EFFECTIVE STRATEGIES TO DEVELOP RURAL HEALTH WORKFORCE IN LOW AND MIDDLE-INCOME COUNTRIES (LMICs)

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PUBLISHED IN: Frontiers in Public Health and Frontiers in Medicine

frontiers Research Topics

frontiers

ISSN 1664-8714
ISBN 978-2-88971-114-7
DOI 10.3389/978-2-88971-114-7

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Citation: O'Sullivan, B. G., Kumar, P., Couper, I., McGrail, M. R., eds. (2021). Effective Strategies To Develop Rural Health Workforce In Low and Middle-Income Countries (LMICs). Lausanne: Frontiers Media SA. doi: 10.3389/978-2-88971-114-7

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frontiers in Public Health

EDITORIAL
published: 04 June 2021
doi: 10.3389/fpubh.2021.702362

Editorial: Effective Strategies to Develop Rural Health Workforce in Low and Middle-Income Countries (LMICs)

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Keywords: LMICs, rural workforce, training, education, recruitment, retention, rural pathways, grow your own

Editorial on the Research Topic

Effective Strategies to Develop Rural Health Workforce in Low and Middle-Income Countries (LMICs)

Around the world, rural communities are facing similar challenges related to accessing the healthcare that they need. These challenges are most noticeable in low- and middle-income countries (LMICs) where the highest proportion of people lives in rural and remote under-resourced communities. The best way to access affordable care in these areas is to focus on building enough skilled health workers in these communities. This relies on LMICs rural communities adopting "grow your own" approaches, involving training local health workers to the scope of skills needed in the community and fostering their connection to the community through support, mentoring and good working conditions (O'Sullivan et al.). The steps involved in "grow your own" strategies are called "rural pathways" and the World Health Organization recommends that rural pathways are critical as part of a suite of strategies to improve health workforce retention (1, 2). For rural LMICs, investing in rural-based training for health workers, adds to the progress toward health, social, and economic progress in line with the Sustainable Development Goals (3). This is because this investment can dramatically lift local educational opportunities and increase access to jobs in locations where they are most needed (4).

However, despite the rich evidence from high income countries, there is a shortage of published evidence about rural pathways strategies in LMICs settings (1, 2). This special call was an attempt to foster exemplars of these, as a means of promoting cross-learning and reflection about the unique LMICs rural context. By sharing information about rural pathways, it is possible for effective approaches in one community to be adopted and scaled up elsewhere, for improving rural workforce capacity.

With this background in mind, this special call brings together a collection of examples of education and training strategies, tools, and resources, from LIMICs of different world regions. We are pleased to have attracted a diverse representation of rural pathways strategies fit to a wide range of LMICs rural contexts as we know that every region has unique experiences to share.

The first article describes a WHO sponsored rural pathways checklist designed to assist LMICs to apply evidence-informed approaches to plan and benchmark rural pathways to achieve community health goals (O'Sullivan et al.). The checklist includes eight holistic steps involved in rural pathways action and a range of prompts to encourage LMICs stakeholders to consider the potential of

Edited and reviewed by:
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Specialty section:
This article was submitted to Family Medicine and Primary Care, a section of the journal Frontiers in Public Health

Received: *29 April 2021*
Accepted: *10 May 2021*
Published: *04 June 2021*

Citation:
O'Sullivan BG, Couper I, Kumar P and McGrail MR (2021) Editorial: Effective Strategies to Develop Rural Health Workforce in Low and Middle-Income Countries (LMICs). Front. Public Health 9:702362. doi: 10.3389/fpubh.2021.702362

people already in rural and remote communities to be trained in health roles in their community, considerations in fostering local training, and ensuring the right professional support to retain health staff (O'Sullivan et al.).

Fonken et al. extended on this work, by applying the checklist to review Kyrgyzstan's current pathway to develop the rural primary care workforce and prioritize the next steps. Using the checklist prompts, his team identified shared goals for strengthening recruitment by addressing working conditions and improving the efficiency of clinics.

Amin et al. further drew from the rural pathways philosophy to evaluate nurses' performance for their central role in delivering primary healthcare in rural tribal areas of Rajasthan, India. The research identified that most nurses were sourced from rural and tribal communities that the clinics serve; nurses from these communities were likely to have a higher retention than those from urban areas. Sourcing from rural and tribal communities, providing on-going training in clinical and social skills, and using a non-hierarchical work environment, coupled with individualized mentoring assisted with health worker motivation.

In the Asia Pacific region, Putri et al. did a pivotal national cross-sectional survey about how to foster early career doctors to work more remotely. Dr. Putri's work provides objective evidence that selecting doctors with a remote background, giving them remote work experience and providing financial incentives, can increase the uptake of work in remote Indonesian areas.

The Philippines has a strong track record in "grow your own" rural workforce training strategies (5, 6) and a new study led by Guignona et al. describes the degree to which a rural education program has impacted on local rural health services and communities in this country. Research about Training for Health Equity Network (THEnet) programs (7), also showed that training that is structured to deliver on the needs of the community produces a health workforce with strong intent to practice rurally and in generalist or primary care disciplines (Johnston et al.).

Several other case studies included in this special topic, delve into how to deliver training in the LMICs context, including in areas like the Pacific Islands and Lesotho (Bryden et al. and McIver et al.). McIvor et al. describe the establishment of new postgraduate training programmes in family, community, and rural hospital medicine in Timor-Leste, Tonga, Solomon Islands, and Vanuatu which have been crucial in building a health workforce in the Pacific region of an adequate size, distribution, and skill level necessary to meet the needs of rural communities across the "Blue Continent" (McIver et al.). Bryden et al., describe the development of the first family medicine speciality training program in the small mountainous kingdom of Lesotho, in southern Africa, which is the first accredited postgraduate medical training program in that country (Bryden et al.).

Larkins et al. describes real-world training in public health investigations, targeted at rural/provincial and regional health and biosecurity workers and managers from Fiji, Indonesia, Papua New Guinea (PNG), Solomon Islands, and Timor-Leste. By mentoring and teaching skills to investigate real-world problems, over 50 projects were done by health workers aiding the analysis and mapping of surveillance data, infection control, and outbreak management. This is incredibly valuable for preparing rural LMICs for local pandemic responses.

Rural pathways are often complemented by regulatory strategies to enhance workforce supply. Mahat et al. discuss strategies to overcome the critical shortage of rural physicians in Nepal using a national medical scholarship program targeting rural public hospital service of 2 years. Of 1,226 scholarships only 12–57% of the first 4 cohorts completed their service, increasing to 86–98% in the most recent three cohorts. Overall, 78% of service days were completed in rural hospitals.

Across other health disciplines, Müller and Couper evaluated the success of the Collaborative Care Project (CCP), which exposes rural clinical school participants in one South African training program, to interprofessional home visits (Müller and Couper). They found students had increased understanding of how a team approach to primary health care contributes to improved patient care, job satisfaction, better discharge planning and continuity of care. In particular, students gained understanding of these issues within low resourced rural contexts and also what limitations the context places on ideal patient care, with issues of power and hierarchy being critical in this.

Finally, rural pathways only work if rural workers are supported once they have been trained. Wheatley et al. describes supporting doctors in isolated rural postings, *via* the Rural Family Medicine Café (RFMC) social media project. The project effectively engaged and supported those interested in rural family medicine thus decreasing occupational isolation.

Overall, the range of high-quality contributions to this special call provides impetus to continue the process of fostering LMICs rural pathways evidence and we commend Frontiers for leading such opportunities. We are also grateful for the ongoing support and encouragement of the WONCA working party on rural practice (rural WONCA) and similar agencies who continue to promote the agenda of global equity of access to healthcare.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Public Health

ORIGINAL RESEARCH
published: 28 August 2020
doi: 10.3389/fpubh.2020.00447

Keys to Expanding the Rural Healthcare Workforce in Kyrgyzstan

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Objective/Background: This study assessed Kyrgyzstan's progress with developing its rural primary care workforce and prioritized next steps to build on its current momentum. Kyrgyzstan has improved rural health care since 1997 through the implementation of family medicine, retraining of rural doctors and nurses, and other efforts. Attrition, emigration, urbanization, and population growth are threatening these hard-won advances. In response, Kyrgyzstan is now educating family medicine residents at rural sites and improving salaries. This study explores other steps to strengthen its rural health care, especially its rural generalists.

Methods: This was an observational study using a two-phase survey process. To access the current status of Kyrgyzstan's rural health care system, we surveyed key stakeholders within that system using a draft version of the new World Health Organization Rural Pathways Checklist. To prioritize next steps, we asked rural FM residents to rank the relative importance of 31 possible future actions to support Kyrgyzstan's rural primary care workers.

Results: Doctors and nurses involved in teaching rural health workers identified that Kyrgyzstan has made good progress with rural professional support and upskilling of existing health workers through education. They saw the least progress with selection of health workers and monitoring. The rural family medicine residents' top ten suggestions for rural recruitment and retention all involved improving working conditions (providing housing, internet, basic medical equipment, protected time off, better salaries, and more respect) and improving clinic efficiency (switching clinic scheduling from walk-in based to appointment based, optimizing the roles of clinical team members, and decreasing low-value clinic visits).

Conclusions: The WHO Rural Pathways Checklist helped to evaluate Kyrgyzstan's current efforts to promote rural primary care. The priorities listed above from the next generation of potential rural family doctors could help guide future steps to promote rural health in Kyrgyzstan and the Former Soviet Union.

Keywords: rural training, rural education, professional support, rural retention, primary care, family medicine, rural generalist, former soviet union

OPEN ACCESS

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Specialty section:
This article was submitted to Family Medicine and Primary Care, a section of the journal Frontiers in Public Health

Received: *04 May 2020*
Accepted: *20 July 2020*
Published: *28 August 2020*

Citation:
Fonken P, Bolotskikh I, Pirnazarova GF, Sulaimanova G, Talapbek kyzy S and Toktogulova A (2020) Keys to Expanding the Rural Healthcare Workforce in Kyrgyzstan. Front. Public Health 8:447. doi: 10.3389/fpubh.2020.00447

INTRODUCTION

History of Family Medicine (FM) in Kyrgyzstan

After independence from the former Soviet Union in 1992, Kyrgyzstan adapted its health care system to meet some daunting challenges. At that time, they suffered a dramatic decline in funding and physician quantity, and they inherited a top-heavy health care system with relatively weak primary care. Like many other former Soviet States, Kyrgyzstan introduced FM to strengthen primary care (1). Many of the strengths of FM resulting from its evolution promised to address their specialty-driven fragmentation (2). Unfortunately, rural primary care outcomes research from this transitional time is sparse from these nations (3), especially from the Central Asian Republics. In 1997 The Kyrgyz State Medical Institute for Retraining and Continuing Education (KSMIRCE) introduced FM by establishing a FM training center in each of the seven oblasts (states) and trained a total of 63 FM trainers to staff these relatively rural centers. From 1999 until 2004 these KSMIRCE trainers retrained over 95% (2,691) of the country's outpatient physicians of various specialties to become "family group practice" doctors using a four-month curriculum (4, 5). During that same period, a similar parallel KSMIRCE program trained nurse trainers, who then retrained 85% (3,890) of the county's outpatient nurses to become FM nurses using a two-month curriculum. This retraining process is still active for doctors and nurses, and to date 6,212 nurses have been retrained as FM nurses (Pirnazarova G. Personal Correspondence). The KSMIRCE has also provide these nurses and doctors with many continuing education programs in every oblast over the years. Outside of the urban areas, these retrained doctors began practicing as generalists, caring for patients of all ages and both sexes with the help of the FM nurses. In the urban areas, however, these doctors did not significantly change their scope of practice, and health care delivery continued to be specialty driven. Initially, care significantly improved in the rural areas. In fact, in the 1990s, the infant mortality rate became lower in the rural areas than in the urban areas with a growing separation between the two rates at least through 2010 (6).

Other Related Health System Projects

The Ministry of Health (MOH) is just starting its fourth national project to improve Kyrgyzstan's health care system: "Healthy Person—Prosperous Country (2019-2030) (7, 8). It emphasizes many primary care goals that will require a robust rural health care system. This emphasis on development of the regions outside of Bishkek is consistent with the National Development Strategy of the Kyrgyz Republic for 2018-2040 (9). Most of these national projects have had some input from international donors. The Swiss Development and Cooperation (SDC) has a long continuing history of projects to improve primary care in Kyrgyzstan (10). From 1997 through 2009, the United States Agency for International Development was very actively involved in broad longitudinal health system reform projects in Kyrgyzstan which included an emphasis on rural health (4).

Rural FM Workforce Crisis in Kyrgyzstan

Unfortunately, the loss of health manpower through emigration and attrition and the lack of new rural family physicians have jeopardized the gains from these projects. Since 1998, Kyrgyzstan has trained over 500 new family doctors (4, 11) in the two main two-year residency programs based in the capital of Bishkek. Of these graduates, only ten ever practiced outside of the country's two major cities and only one is currently working rurally as family doctor (5). Rural primary care depends entirely on the retrained "family group practice" (FGP) physicians and over half of these doctors have emigrated or retired. The resulting rural physician shortage is complicated by a rapidly growing population. According to the head of the Association of Family Physicians and Family Nurses, Suyumjan Mukaeva, approximately half the population now lack reasonable access to a primary care doctor (12). In 2005 nationwide there was an average of 1,888 people per FGP doctor compared to 3,902 per FGP doctor in 2019 (4, 12). This ratio is uniformly worse in rural areas, reaching as high are 18,000 citizens per FGP doctor in some rayons (counties). To complicate this matter, in 2019 61% of the country's FGP doctors were beyond retirement age with 19% nearing retirement age (12). Fortunately, the supply of nurses is much better, even in rural areas.

Ongoing Efforts to Promote Rural Primary Care

In response to this rural health manpower shortage, the MOH and other institutions are working hard to train more primary care workers and to make their work more attractive. From 2014 through the present, the Kyrgyz State Medical Academy (KSMA) has been reforming its curriculum to be more primary care oriented, with the help of the SDC (10). They admit medical students from many rural areas and have greatly expanded their annual number of FM residents from two in 2014 to 56 in 2018 (11). Since 2017, the MOH mandated that all medical school graduates complete 1-year of basic clinical training (general practice) in a rural hospital, which is included as part of the 2-year family medicine residency or the 3-year residencies for narrow specialties. Those interested in becoming FM specialists can continue to serve at that rural site for a second year. Currently, all 40 of the KSMIRCE FM residents and many from KSMA are training primarily in rural settings. These residents also function officially as part-time family doctors caring for attributed populations of 1,000–2,000 people. Their salary for this plus their monthly residency stipend totals <$80 per month. They may also work night shifts in the hospital or emergency departments for additional income. In contrast, residents in other specialties must pay a significant amount for their residency education. The first 24 FM residents who trained primarily in rural settings graduated in the summer of 2019. Unfortunately, many of these graduates have already been lost to follow up, and

Abbreviations: FM, family medicine; ICAP, International Center for AIDS Programs—Columbia University; KSMA, Kyrgyz State Medical Academy; KSMIRCE, Kyrgyz State Medical Institute for Retraining and Continuing Education; MOH, Ministry of Health of the Kyrgyz Republic; PEPFAR, President's Emergency Plan for AIDS Relief; SDC, Switzerland Agency for Development and Cooperation; STLI, Scientific Technology and Language Institute; WHO, World Health Organization.

TABLE 1 | Recipient selection for survey 1 (WHO rural pathways checklist).

Institution	Kyrgyz State Med. Inst. For Retraining & Continuing Education			K. State. Med. Acad.
	Academic FM Physician Faculty Members	Academic FM Nursing Faculty Members	Rural FM Residency Clinical Supervisors	Rural FM Residency Clinical Supervisors
# of survey recipients from this job category	20	12	7	32
Total # of professional in this job category	20	12	16	32
% of professionals surveyed in this category	100%	100%	44%	100%
Comments about the selection process	KSMIRCE is the only national institution tasked with continuing educaton for Kyrgyzstan's FM doctors and nurses		Convenience sample. KSMIRCE trains about 1/3 of the country's FM residents	KSMA trains about 2/3 of the country's FM residents

we were only able to locate three of these graduates who were still practicing in rural areas after their graduation.

Study's Goals

This study gathered and analyzed opinions from rural FM graduates, current rural FM residents, and teachers of FM doctors and nurses to help policymakers more successfully recruit, prepare, and retain rural primary care workers.

METHODS

Overview

This was an observational study using a two-phase survey process to first assess the current progress in developing a rural workforce and then identify priorities for further action.

Survey 1

To assess current progress, we surveyed a total of 71 national and regional level FM teachers (doctors and nurses) and rural clinical supervisors using the draft version of a new WHO self-assessment tool called the Rural Pathways Checklist (13) (https://www.globalfamilydoctor.com/site/DefaultSite/filesystem/documents/Groups/Rural%20Practice/19%20implementing%20rural%20pathways.pdf). **Table 1** summarizes the selection process for our study's participants. This Rural Pathways Checklist self-assessment tool was developed by authors from Monash University in Australia in conjunction with the World Organization of Family Doctors (WONCA) at the request of the WHO, and it was ratified by the University of Queensland. We agreed to help the tool's authors to evaluate the usefulness of this new tool in a Russian-speaking area of Central Asia. The Rural Pathways Checklist consolidates evidence-based approaches for expanding rural health workforces in low and middle-income countries (14). It is based on the premise that successful placement and retention of rural healthcare workers depends on many different factors that should ideally be addressed in parallel. This tool uses a five-point Likert scale to evaluate progress with 30 steps along the pathway toward a robust rural healthcare workforce. These steps are organized into eight key domains, and the tool calculates a percentage grade for each domain, with 100% being full implementation of that domain within health care system. The draft tool includes five questions from the authors of the Rural Pathways Checklist to gather feedback about the draft checklist itself. We used a paper version in Russian to collect seven surveys, then converted this checklist to a Google Form in Russian, with the author's permission, sending it via "WhatsApp" (15, 16).

Survey 2

To prioritize potential next steps for recruiting and retaining the next generation of rural primary care workers, we created a list of 31 practical next steps using the eight main categories from the WHO Rural Pathways Checklist as a framework. We created another Google Form in Russian using a four-point Likert scale to assess the relative importance of these potential next steps: 0 = should not be done, 1 = low priority, 2 = medium priority, 3 = high priority (17). We then surveyed (via WhatsApp) all 24 of doctors who graduated in 2019 as the first class of rural FM residents and all 106 current rural FM residents. We ranked the potential future actions according to the average score from the participants and reviewed their free text comments to identify patterns.

RESULTS

Response Rates

The overall response rate for survey 1 was 41% (29/71), with details summarized in **Table 2**. The response rate for survey 2 was 38% (40/106) for all current FM residents and 17% (4/24) for all rural FM residency graduates.

Evaluation of the Draft WHO Rural Pathways Checklist

62% (18/29) of those who did respond to survey one answered at least one of the five questions designed to evaluate the WHO checklist itself. Seventy-eight percent (14/18) thought the Checklist was applicable to their situation. **Table 3** summarizes the evaluation results. Only 57% (4/7) people given the paper version of the survey successfully completed all the ranking questions, compared to all those who completed the electronic version. One person took the survey twice, 2 months apart with very consistent results, so we counted that as a single response, using the data from first survey.

TABLE 2 | Response rates for survey 1 (WHO rural pathways checklist).

Institution	Kyrgyz State Med. Inst. for Retraining & Continuing Education			K. State. Med. Acad.	Totals
	Academic FM physician faculty member	Academic FM nursing faculty member	Rural FM residency clinical supervisor	Rural FM residency clinical supervisor	
# of participants surveyed	20	12	7	32	71
# of fully completed responses	6	11	4	4	25
# of partially completed responses	1	0	3	0	4
Response rate for fully completed surveys	30%	92%	57%	13%	35%
Overall response rate (fully & partially completed surveys)	35%	92%	100%	13%	41%

TABLE 3 | Opinions of 18 teachers who responded to the feedback questions about the WHO rural pathways checklist.

Question	Summary of responses
How well did the Checklist apply for your situation?	1 very applicable, 13 moderately applicable, 4 slightly applicable
What do you plan to work on now that you have assessed your rural pathway?	11 listed plans
Did it help to identify the gaps in your rural pathway?	9 stated yes
Did it help to identify the strengths in your rural pathway?	5 states yes
Do you have any feedback about the Checklist?	8 gave additional feedback (see below)
Additional written feedback about the WHO rural pathways checklist	
It is an interesting and useful survey	
Yes, It was difficult for me to understand the scoring system from one to five, which one means good?	
Yes, I did not understand the scoring system from one to five	
Some questions are too complicated	
Maybe the Checklist for nursing teachers should include other questions?	
It is sufficient	
Need to see in place	
It helped to identify almost all the weaknesses	

Opinions of Rural Primary Care Teachers About the Current Situation

About half of the FM teachers who responded live in rural areas and half in Bishkek, but all are involved with the education of rural doctors and nurses. Six of the doctors identified their position as either director or vice-director of their clinics. **Table 2** summarizes response rates. **Figure 1** documents the opinions of these teachers regarding Kyrgyzstan's progress with the eight main categories from the draft WHO Rural Pathways Checklist. They clearly felt the greatest progress has been in the areas of professional support, upskilling, education, and training. **Table 4** summarizes their free text comments regarding the context, barriers, and enablers for each of the eight sections of the WHO Checklist. Thirty-four percent of these teachers (10/29) commented that salaries are too low and need to be improved to recruit and retain more rural health workers.

Rural FM residents' priorities for the future: **Table 5** combines results from both surveys. The first column lists the eight main categories from the Checklist as ranked by the teachers, with the most fully implemented categories at the top and least implemented categories at the bottom. The second column of lists the potential specific actions that Kyrgyzstan could take in the future to strengthen rural health care. The table uses three colors to reflect the relative importance of each action according to the rural FM residents and graduates. These same actions are ranked in **Table 6** according to the average score assigned to each by the residents and graduates. **Table 7** lists the resident's free-text comments. Resident's free-text comments mirrored their numerical opinions with eleven commenting on poor financial support and five residents expressing frustration over the lack of respect from patients. Some noted that patients seem to have more rights than doctors.

DISCUSSION

Professional Support and Upskilling Rural Health Workers

Not surprisingly the FM teachers consider professional support and upskilling of existing rural health workers as the most fully implemented aspect of the country's plan to

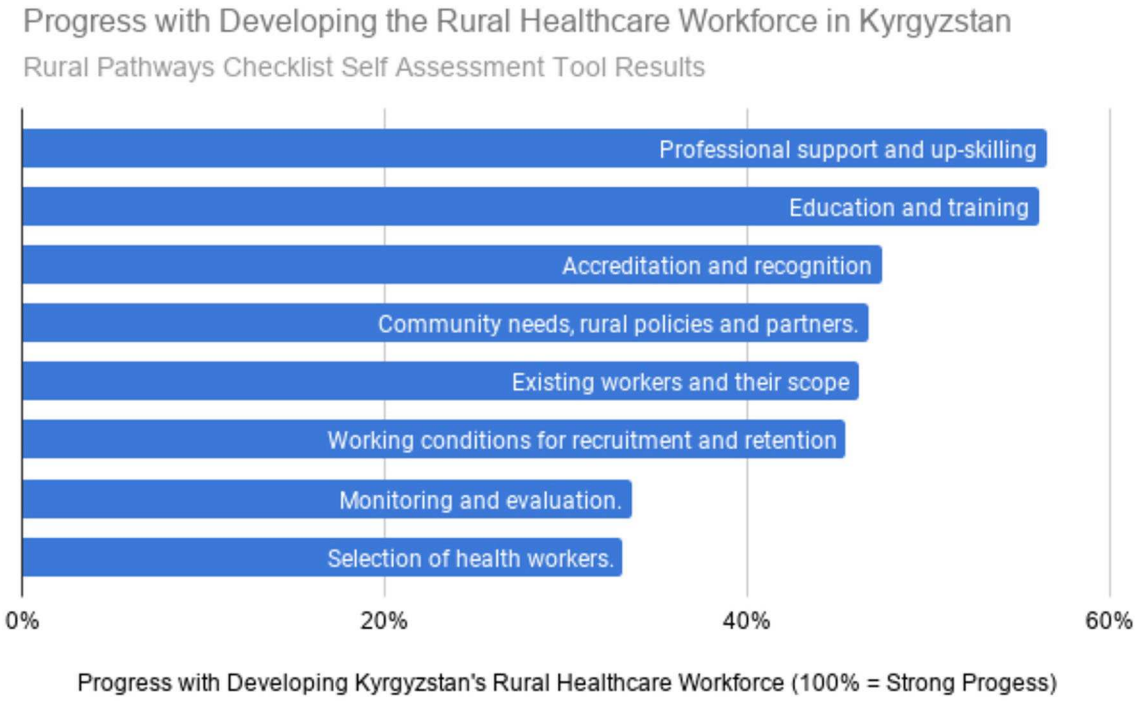

FIGURE 1 | Progress with developing the rural healthcare workforce in Kyrgyzstan. Rural pathways checklist self assessment tool results.

support rural health, since they have accomplished a lot in this area. However, the benefits of the retraining and continuing education programs for FGP doctors and nurses are rapidly eroding as these rural FGP doctors and nurses retire and/or emigrate. The FM residents identified the importance of creating a rural faculty development program and providing regular educational opportunities, including educational teleconferencing for peers. These and many additional actions as listed below will be required to successfully develop the next generation of rural health workers and their teachers.

The Power of Urbanization

The residents surveyed ranked rural residency training as the least important of the 31 future next steps to increase the number of rural health workers. Likely, this reflects the strength of the country's tendency toward urbanization. Whereas, the standard of living in the capital (Bishkek) has changed dramatically since independence, it has changed relatively little in the rural areas. The rural economy is very weak, and ∼20% of the country's citizens are currently working outside the country. One of the residents commented, "It's impossible to retain what is flowing. It's not just the doctors who are leaking, but the population, youth, entire families. This question is not for me, but for the politicians." The strength of these demographic trends calls for dramatic interventions to promote the rural healthcare workforce in Kyrgyzstan. Hopefully, the opinions capture in the study will help guide these interventions.

The Importance of Improving Working Conditions

The rural FM residents ranked improving working conditions as the most important next step in potentially recruiting them to serve in rural areas after graduation. They placed the highest priority on housing with Internet access and better equipment in the hospitals and clinics. As of 2019, none of the 30 rural FM residents visited by Dr. Fonken around the country had their own otoscope, and most did not have easy access to an otoscope. Most of the sites did not provide housing for residents. The residents' next highest priority was improving the salary. Although monthly salaries for family doctors have risen from about $20 in 1997 to $200–400 in 2019, they are still inadequate to provide a reasonable lifestyle. The government is also providing a monthly bonus (about $14) to doctors who work above a certain altitude (80% of the country is mountainous) and a quarterly bonus (about $400) for young doctors who remain in the most underserved areas for up to 3 years (18). Respondents ranked expanding this bonus program as seventeenth in importance out of 31. The residents also highly valued some relatively inexpensive solutions: decreasing the charting/reporting burden, providing protected time off, decreasing the number of low-value visits, changing monitoring from an intrusive punitive process to a more efficient supportive process, and implementing an appointment system. The MOH is currently implementing an electronic appointment system (19), but most patients still prefer to walk in, even when an appointment system is available. This is one of many areas that will require behavioral change on the part of the

TABLE 4 | Free-text comments about each section of the WHO checklist.

WHO checklist categories ranked from most to least implemented	From doctors and nurses involved with teaching rural primary care	Number of similar comments	
	All respondents help with rural education: half live in the capital and half live rurally	**Rural**	**Urban**
Professional support and up-skilling	Once we get direction from the MOH, we will begin upskilling nurses	2	
	Practitioners do not apply the newest clinical protocols and guidelines		1
	Theoretical knowledge is not always applied correctly in practice		1
	We are successfully training nurses nationally via internet about HIV care		1
Education and training	Lack of support for health ed.: infrastructure, supplies, safety, & steady work	3	1
	Local gov. & comm. are not always supportive of rural training. Trainees busy	1	2
	Our hosp./clinic uses an infant manikin, otoscope, AED& US to teach residents	3	
	Regional training centers provide good access to training		3
	We are doing distance ed and have plans for practical skills training		2
	Rural supervisors for residents: busy, poorly paid, lack experience as teachers		2
	Use more electronic distance education. Barriers: internet, computer literacy	1	1
	Rural residents get more clinical experience & may work after-hours for pay	1	
	Limit access to good clinical supervision & quality clinical medical references	1	
	The level of training during medical school is poor		1
	Rural FM supervisors are always available for the residents they supervise		1
	Regional training centers will need new teachers in the future	1	
Accreditation & recognition	Low prestige for family doctors. More prestige for narrow specialitsts	4	
	Graduates can practice their qualification in every medical facility	1	2
	Young doctors in rural areas need options for career growth & more training		1
	Not every facility can employ graduates or enable them to use all their skills		1
	Young doctors are often not recognized as professionals	1	
	Not all graduates are formally recognized by a qualification	1	
Community needs, rural policies and partners	Hosp./clinic is working with community regarding housing for residents	3	
	Government needs to set the plans for nursing, then we can implement them	1	2
	Health promotion & village health committees link clinics and the community	1	1
	There is little cooperation and communication with the rural communities	1	1
	Hosp/clinic is working with community council but it is not too effective	1	
	MOH policy needs to include 10x increase in rural worker salaries + benefits		1
	Urban teachers are limited in how often they can travel to teach rurally		1
	We have no external partners	1	
Existing workers and their scope:	Shortage of rural medical teachers & workers. They are too busy and quite old	2	3
	It is possible to attract young doctors by providing housing & med. Equipment	3	
	Important to continue to support retrained doctors since we have a shortage		1
Working conditions forrecruitment and retention	Low salaries for medical workers. This must be improved to retain them	6	4
	The work load is excessive for rural family doctors. Lack of protected time off	2	2
	Progress in these areas has been geographically spotty, affecting recruitment	2	1
	Lots of charting now (in electronic format)	1	
	Lack of medical equipment, tools for training and internet access		1
	Lack of free housing for residents is a barrier	1	
	Health professionals not safe within the system	1	
	Lack of kindergartens limits retension of young doctors in rural communities		1
Monitoring	Monitoring/supervision improves the quality of care. Helps young doctors	5	
	Barriers: lack of personel, time, money, training, equipment, & organization		3
	Monitoring does not lead to meaningful improvements		1
	Almost daily inspections from national, regional and district level agencies	1	
Selection of health workers	Important to choose active students from rural areas who want to return	3	1
	Rural residents training in their home towns now won't stay (low salaries)	1	

TABLE 5 | Potential specific future actions to improve the kyrgyzstan's rural health workforce.

WHO checklist categories ranked by teachers from most to least implemented	Ranked by rural family medicine residents by color		
	Yellow = High Priority (10 highest ranking future actions per rural FM residents)	Green = Medium Priority	Brown = Low Priority (10 lowest ranking future actions according to rural FM residents)
Professional support and up-skilling	Incentivize ongoing training		
	Reward all care team members for improving their patient populations health outcomes		
	Provide regular tele-conferencing opportunities with peers regionally and/or nationally		
	Provide telemedicine support from key specialists		
	Improve access to evidence-based medical references in Russian		
Education and training	Improve training of medical students in primary care skills		
	Continue to train FM residents at rural sites		
	Improve the clinical training of FM residents so they are better prepared for their roles		
	Improve the clinical training of nurses to prepare them for their expanding roles		
	Create an on-site salaried program to train rural FM residency graduates as teachers		
Accreditation & recognition	Recognize and honor rural health workers for their valuable role in the health care system		
Community needs, rural policies, and partners	Train rural health workers and administrators more about existing rural healthcare policies		
	Increase the involvement of rural health workers and administrators in national policymaking		
	Shift national and regional governmental policies to be more favorable for the rural health care system		
	Increase community engagement with their health and the health care system		
Existing workers and their scope:	Expand the roles for family medicine nurses and feldchers		
	Better define the roles for rural FM doctors, specialists, nurses and pharmacists		
	Strengthen the roles of social workers		
	Strengthen the roles of village health committees		
Working conditions for recruitment and retention	Improve salaries for residents, family medicine doctors and nurses in rural areas		
	Extend the rural doctor's deposit program, which currently rewards after 3 years of service		
	Provide quality housing and internet access for rural FM residents and doctors		
	Decrease the charting and reporting burden for doctors		
	Change policies that result in low-value clinic visits		
	Provide adequate time off		
	Protect doctors from afterhours responsibilities		
	Create an appointment system for clinic visits		
	Provide adequate basic equipment in every clinic		
Monitoring	Shift monitoring from an intrusive punitive process to an efficient supportive process		
Selection of health workers	Continue to admit significant numbers of nursing and medical students from rural areas		
	Strengthen rural secondary school education to better prepare students for medical careers		

patient population, to improve the lives of rural health workers. Overall, the residents' priorities are in line with the goals of the current MOH-SDC project on non-communicable diseases, which stated that the primary care system in Kyrgyzstan must be able to "offer better salaries and career prospects to medical personnel to reduce migration to Russia and Kazakhstan and to provide incentives for family doctors to settle in rural areas": (20).

Task-Shifting in Primary Care

These residents also desire better defining the roles of various types of rural health care workers (seventh most important step). The independent Association of Family Physicians and Family Nurses has been working hard with the MOH to do this. The residents were more in favor of expanding the role of nurses rather than shifting tasks to social workers and village health committees. This may stem from the fact that the residents work more closely with the nurses, and do not interact much with social workers, public health nurses, or village health committees, despite them being well-established as part of the rural health care system. In rural Kyrgyzstan, nurses are providing an increasing proportion of the care as the number of physicians continue to decrease. Almost half of the respondents to our WHO survey were nursing teachers from around the country. They felt that there has been less overall progress with promoting rural primary care than their physician colleagues. The nurses ranked average overall progress along the Rural Health Pathway as only 36%, compared to a 57% ranking from the doctors. The nursing teachers' comments confirmed many of the same problems, needs, and priorities as the physicians. Several of the nursing teachers expressed that they are anxiously awaiting direction from the MOH. Fortunately, the MOH is

TABLE 6 | Potential specific future actions to improve the kyrgyzstan's rural health workforce.

Average Rating on 0-3 Scale	Ranked by Rural Family Medicine Residents and Recent Graduates
2.62	Provide quality housing and internet access for rural FM residents and doctors
2.62	Provide adequate basic equipment in every clinic
2.61	Improve salaries for residents, family medicine doctors and nurses in rural areas
2.59	Protect doctors from after-hours responsibilities
2.57	Create an appointment system for clinic visits
2.50	Better define the roles for rural FM doctors, specialists, nurses and pharmacists and how they can work together
2.46	Recognize and honor rural health workers for their valuable role in the health care system
2.41	Change policies that result in low-value clinic visits
2.41	Provide adequate time off
2.38	Improve access to evidence-based medical references in Russian
2.27	Strengthen rural secondary school education to better prepare students for medical training programs
2.27	Provide regular tele-conferencing opportunities with peers regionally and/or nationally
2.24	Create an on-site salaried program to train rural FM residency graduates as teachers
2.24	Reward all care team members for improvements in the health outcomes of their patient population
2.24	Provide telemedicine support from key specialists
2.24	Incentivize ongoing training
2.22	Extend the rural doctor's deposit program, which currently rewards them after 3 years of service
2.19	Shift monitoring from an intrusive punitive process to an efficient supportive process
2.16	Improve the clinical training of FM residents so they are better prepared for their roles
2.15	Expand the roles for family medicine nurses and feldchers
2.14	Improve the clinical training of nurses to prepare them for their expanding roles
2.13	Strengthen the roles of social workers
2.08	Strengthen the roles of village health committees
2.08	Improve training of medical students in primary care skills
2.00	Decrease the charting and reporting burden for doctors
1.95	Increase community engagement with their health and the health care system
1.92	Continue to admit significant numbers of nursing and medical students from rural areas
1.89	Increase the knowledge of existing rural healthcare policies among rural health workers and administrators
1.84	Shift national and regional governmental policies to be more favorable for the rural health care system
1.68	Increase the involvement of rural health workers and administrators in national policymaking
1.55	Continue to train FM residents at rural sites

about to finalize a plan to expand nursing education and roles. The nurses were also appreciative of an ongoing ICAP/PEPFAR project to train rural nurses about HIV care (21) and efforts by the SDC/MOH to revise the national curricula for nursing training (10). The need for shifting tasks from doctors to nurses and improving working conditions in rural primary care was confirmed by a recent WHO report. It listed the following two policy considerations among their eleven suggestions for improving health services delivery in Kyrgyzstan: (1) "Revisiting the capacity of FM doctors and nurses" and (2) "Improving the attractiveness of FM practice through financial and institutional incentives" (22).

Coordinating With Communities and Other Partners

FM teachers expressed that Kyrgyzstan's health care system should improve coordination with rural communities and other partners. Kyrgyzstan has benefited from many partnerships to strengthen rural primary care. The interface between large projects and community-based initiatives has accomplished some of the tasks that are most valued by rural FM residents, such as supplying free housing and internet. The hospital and clinic in the small town of Kyzyl-suu (Issyk-kul oblast) used a community grant to remodel a building into a dormitory for rural FM residents. They also linked to a project involving the SDC and MOH to better equip the hospital and clinic, including adding medical equipment, upgrading their internet and implementing an electronic medical record (10). In the fall of 2019, Dr. Fonken spent 5 weeks there exchanging professional experience with their four rural FM residents and their local clinical supervisors and administrators. Such professional exchanges are a central part of a longstanding cooperative arrangement between the KSMA, the KSMIRCE and Scientific Technology and Language Institute (STLI), a non-governmental humanitarian organization. Dr. Fonken found the medical team in Kyzyl-suu working effectively with enthusiasm. The residents seemed pleased to have free housing and internet access. Their morale

TABLE 7 | Rural family medicine resident's free-text comments.

WHO checklist categories		Number of similar comments
Education and training	Virtual professional networking would helpful	3
	Virtual professional networking would not be helpful or practical	3
	Need more easy accessible medical literature in family medicine	2
	Need for more respect	1
	There are few well-educated managers	1
	Improve the quality of education in nursing schools	1
	Qualified teachers and doctors do not stay in the countryside	1
	Need continuous medical education	1
	Resident motivation would improve with better salaries	1
Community needs, rural policies and partners	Barriers: Corruption among government officials	1
	Rural communities are not motivated to cooperate	1
	Need to inform the population about the work of the family doctor	1
	Low awareness of officials	1
	Villagers are poorly educated	1
	Rural health care is very important	1
	It is important to educate the population about chronic diseases	1
Working conditions for recruitment and retention	Lack of financial support, poor salary	11
	Lack of respect for doctors and their rights and opinions	4
	Ungrateful and demanding population	3
	Poor working conditions	3
	Poor facilities and equipment	2
	Poor internet access	2
	High workload	2
	Money is not the only tool to retain our young specialists	1
	Unsafe working environment	1
	The government should provide affordable housing for medical workers	1
	Lack of quality education for children of rural medical workers	1
	Important to provide a good living and training conditions for residents	1
Monitoring	Monitoring is important and improves rural health care	3
	Monitoring does not improve rural health care	2
Selection of health workers	Encourage rural secondary school students to pursure medical careers	1
	Provide more scholarships to rural students for medical education	1
	Be of use in the country where you were born	1
	Entrance requirements to medical schools must be equal for everyone	1

was good, and they liked having ample clinical experience and responsibility. There are similar examples of health facilities providing housing to residents in the Narin and Batken oblasts through creative partnerships with the community and other partners. These are good examples for other communities to follow.

Selection of Health Workers

The WHO Rural Pathways survey participants identified the selection of health workers as a current area of weakness. Surprisingly, the residents ranked this as a low priority for future efforts, even though many of the current residents are from the rural area they are now serving. Certainly, in the US literature, recruiting medical students with a rural background is a key predictor of future rural medical practice (23). In personal interviews Dr. Fonken found that many rural residents with children were pleased to be serving their small home communities, where they had family available to help with housing and childcare. The residents in our survey felt that improving secondary education in the rural areas is a moderate priority, and some expressed that the quality of rural schools and lack of kindergartens is a barrier to choosing a career in rural FM.

Suggestions Regarding the Draft WHO Rural Pathways Checklist

We were able to use this new WHO tool to identify Kyrgyzstan's relative progress with various steps along a pathway toward a more robust rural healthcare system. The Rural Pathways Checklist seemed to help participants to think broadly about their situation in Kyrgyzstan. Most of the respondents found the tool applicable and many found it helpful in identifying gaps in their approach to strengthening rural health care. The Google Forms

version was more effective than the paper version. Almost half of the participants who used the paper version of the checklist failed to complete all the ranking questions, and many of them expressed confusion about whether the tool pertained only to that person or to the healthcare system more broadly. We clarify this in the electronic version by adding the phrase "how Kyrgyzstan's health care system is performing in these areas." This tool is likely to be useful in other similar countries. However, if Russian is a second language for recipients, the translation should be simplified. We used the free-test questions from the WHO tool in survey two, however, several of the residents complained that the Russian language used was hard to understand. Two of the Kyrgyz authors also expressed a concern that the translation was in "high academic Russian." Finally, we recommend simplifying the scoring method by dropping the use of percentages and by switching to a zero to three scale (no progress, weak progress, moderate progress, and strong progress), since it fits better on a phone screen.

Limitations

Conclusions from this observational study are limited due to the demographics of the sample groups and to the relatively low response rate. Although we did survey most of Kyrgyzstan's teachers of family medicine doctors and nurses, we failed to include any high-level health system policy makers, who would likely have expressed a different perspective. The inconsistency of telecommunications in rural Kyrgyzstan and linguistic challenges probably adversely influenced the response rate. The response rates do not allow us to make any statistically significant conclusions, however, the observations collected are still valuable. The residents' priorities regarding recruitment and retention are generally in-line with other similar studies (23). Our hope is that these qualitative observations will lead to more rigorous quantitative studies regarding rural workforce issues in the Former Soviet Union.

CONCLUSION

The WHO's Rural Pathways Checklist helped primary care teachers in Kyrgyzstan to evaluate how Kyrgyzstan is supporting its rural health care system. They have progressed the most in the areas of professional support and upskilling/education of rural health workers. They have made the least progress with working conditions, monitor, and section of rural health workers. Current and recent rural FM residents emphasized the importance of improving working conditions (providing housing, Internet, basic medical equipment, protected time off, better salaries, and more respect) and improving clinic efficiency (switching clinic scheduling from walk-in-based to appointment-based, optimizing the roles of clinical team members and decreasing low-value clinic visits). These observations can help guide policymakers' responses to the current rural health manpower crisis faced by Kyrgyzstan and neighboring countries.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article. Inquiries can be directed to the corresponding author. The raw data supporting the conclusions of this article will be made available by the corresponding author, without undue reservation, either in English or Russian.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements and written (electronic) informed consent to participate in this study was provided by the participants.

AUTHOR CONTRIBUTIONS

PF design of study and surveys, initial data analysis, and writing initial manuscript draft. IB, GP, GS, ST, and AT selection of survey participants, wording, distribution of surveys, and final review of data and manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

Frontiers provided a 45% waiver. The remainder of the research and publishing costs were covered by STLI, a humanitarian non-governmental organization (www.stli.org).

ACKNOWLEDGMENTS

Prof. Nurlan Brimkulov (KSMA FM department head) initially suggested a joint research project. Prof. Telogen Chubakov directed the KSMIRCE throughout the development of FM in Kyrgyzstan until April 2019. Suimjan Mukaeva has led the Independent Association of Family Physicians and Family Nurses since it's beginning in 1996. Irina Zelitchenko translated all the materials and the article (Eng/Rus). STLI's Rural Health Project team members and friends helped lay the groundwork for this research and proofed the final text (Graham and Beth Harden, Amanda Merritt, Dan Johnston, and Drs. Inis Bardella, Stephen Chui, Dan Gilbert, Charles Hardison, Chris Hinton, Rebecca Torry, Barton Smith, and Calvin Wilson).

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Public Health

ORIGINAL RESEARCH
published: 16 September 2020
doi: 10.3389/fpubh.2020.00507

From the Frontline: Strengthening Surveillance and Response Capacities of the Rural Workforce in the Asia-Pacific Region. How Can Grass-Roots Implementation Research Help?

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OPEN ACCESS

Edited by:
Belinda Gabrielle O'Sullivan, University of Queensland, Australia

Reviewed by:
Souheila AliHassan, United Arab Emirates University, United Arab Emirates
Larry Kenith Olsen, Logan University, United States

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Specialty section:
This article was submitted to Public Health Education and Promotion, a section of the journal Frontiers in Public Health

Received: 06 July 2020
Accepted: 07 August 2020
Published: 16 September 2020

Citation:
Larkins S, Carlisle K, Harrington H, MacLaren D, Lovo E, Harrington R, Fernandes Alves L, Rafai E, Delai M and Whittaker M (2020) From the Frontline: Strengthening Surveillance and Response Capacities of the Rural Workforce in the Asia-Pacific Region. How Can Grass-Roots Implementation Research Help? Front. Public Health 8:507. doi: 10.3389/fpubh.2020.00507

Health systems in the Asia-Pacific region are poorly prepared for pandemic threats, particularly in rural/provincial areas. Yet future emerging infectious diseases are highly likely to emerge in these rural/provincial areas, due to high levels of contact between animals and humans (domestically and through agricultural activities), over-stretched and under-resourced health systems, notably within the health workforce, and a diverse array of socio-cultural determinants of health. In order to optimally implement health security measures at the frontline of health services where the people are served, it is vital to build capacity at the local district and facility level to adapt national and global guidelines to local contexts, including health systems, and community and socio-cultural realities. During 2017/18 James Cook University (JCU) facilitated an implementation research training program (funded by Australian Department of Foreign Affairs and Trade) for rural/provincial and regional health and biosecurity workers and managers from Fiji, Indonesia, Papua New Guinea (PNG), Solomon Islands and Timor-Leste. This training was designed so frontline health workers could learn research in their workplace, with no funding other than workplace resources, on topics relevant to health security in their local setting. The program, based upon the WHO-TDR Structured Operational Research and Training IniTiative (SORT-IT) consists of three blocks of teaching and a small, workplace-based research project. Over 50 projects by health workers including surveillance staff, laboratory managers, disease control officers, and border security staff included: analysis and mapping of surveillance data, infection control, IHR readiness, prevention/response and outbreak investigation. Policy briefs written by participants have informed local, provincial and national health managers, policy makers and development partners and provided on-the-ground recommendations for improved practice and training. These policy briefs reflected the socio-cultural, health

system and disease-specific realities of each context. The information in the policy briefs can be used collectively to assess and strengthen health workforce capacity in rural/provincial areas. The capacity to use robust but simple research tools for formative and evaluative purposes provides sustainable capacity in the health system, particularly the rural health workforce. This capacity improves responses to infectious diseases threats and builds resilience into fragile health systems.

Keywords: surveillance and response, communicable disease, implementation research, training, capacity strengthening, disease outbreak, Asia Pacific

INTRODUCTION

Emerging infectious diseases (EID) pose a serious threat in the Asia-Pacific Region, as do locally endemic communicable diseases (1, 2). Strong, resilient health systems and the ability of the local health and biosecurity workforce to recognize and respond to EIDs are key components of EID preparedness. This has been amply illustrated in recent months through the responses of low and middle income countries (LMICs) with already stretched and challenged health systems to the COVID-19 pandemic (3). A fit-for-purpose public health workforce, appropriately distributed, networked and with the required skill-sets is an essential part of detecting and responding to emerging and existing infectious diseases in the Asia-Pacific Region, while minimizing indirect deaths due to vaccine-preventable and other illnesses that tend to increase in a pandemic (3). Historically, however, insufficient investment has been made in the development and maintenance of skills-sets within the public health workforce, particularly those at the frontline in rural areas. Mobilizing frontline workers is a vital strategy for strengthening long-term capacity and responsiveness to detect and respond to EID threats while maintaining essential rural health services in the health systems of the Asia-Pacific Region.

Regions with a well-trained and fit-for-purpose health workforce enjoy both health and economic benefits (4). All too often, however, these benefits are concentrated in major urban centers, where there is access to further training, continuing professional development and other forms of support not extended to health and biosecurity workers outside major urban centers. In South Pacific countries most of the population live outside major urban centers (5). It is in rural areas where the risks of communicable disease outbreaks are highest, due to less access to health care, closer contact with animals (domestically and through agriculturally-based industries), population movement and personal contact patterns (for example, communal kava drinking in Fiji) and fewer personal protective resources (6). Delivery of services and surveillance and detection of outbreaks in small dispersed populations is more challenging and complicated to address due to maldistribution of health system resources, in particular the health workforce (7). Furthermore, the consequences of communicable disease spread are often greater in rural and regional areas, due to older and more vulnerable populations and less access to services (8).

Health and biosecurity workers in rural and remote contexts in LMICs are often extremely well-informed about local challenges to surveillance and response and local priorities for strategies to address these challenges. Many of these workers are involved in producing surveillance data such as Pacific Syndromic Surveillance System (PSSS) reports, but are not trained or supported to purposefully analyze the data or advocate for local solutions (9). Furthermore, there is a paradox that often less-experienced health and biosecurity workers are deployed to rural settings, which are viewed as less desirable, and these new graduates are provided with limited ongoing support or mentoring. For these reasons, supporting workers in rural and regional areas in the Asia Pacific Region to be active and empowered to improve primary health care systems and responses in their local context is likely to produce benefits and spin-off effects in terms of local health security as well as rural health workforce satisfaction and professionalization (and possibly retention).

One way to "activate" health and biosecurity workers with the skills and knowledge to respond to local surveillance and response challenges is through training in and conduct of implementation research projects. Implementation research (previously often called operational research) is the scientific study of the processes used to implement initiatives, and the contextual factors that may influence these processes (10). In the context of health, implementation research focuses on clinical and public health policies, programs, and practices, with the aim of identifying what does and does not work, and how and why this is the case in particular contexts. It also provides a structure through which to test implementation approaches.

In order to strengthen the research capacity of frontline surveillance and response staff, a series of implementation research workshops augmented with on-the-job work and mentoring was delivered to public health and biosecurity workers in Fiji, Solomon Islands, PNG, Timor-Leste and Eastern Indonesia in 2017–2018. These countries share common features of being island nations with widely distributed populations and extremely limited human resources for health (HRH). For example, Solomon Islands is classified as one of 57 countries deemed to have a critical shortage of health workers with a health worker density (physicians, nurses and midwives) of only 1.90 health workers per 1,000 population, well below the minimum WHO guidelines (of 2.3 per 1,000 population). In this country, there are only 87 doctors for the entire population of 550,000 (11, 12). Furthermore, few members of the stretched formal health workforce have any prior training in research or quality improvement (11).

In light of these contextual factors, the implementation research workshops adopted a "learning by doing" model whereby participants undertook a workplace-linked project on a surveillance and response priority issue identified in collaboration with local policy makers and in-country stakeholders (13, 14). Over 50 public health workers participated in the research training and conducted workplace-based projects, involving creating a protocol, obtaining ethics approval, and engaging in data analysis and dissemination of results. Projects covered a wide range of local priority areas including TB/Bovine TB, vaccine preventable diseases, vector-borne diseases and evaluation of surveillance and response systems.

Ongoing engagement with key stakeholders in the project countries was prioritized throughout the project. This engagement included Ministries of Health, local universities, and non-government organizations (NGO), ensuring ongoing support and sustainability of this capacity-strengthening initiative. The implementation research training was part of a broader program of collaborative research projects based on surveillance and response in the Indo-Pacific region—the "Partners in Tropical Health" project. The program logic informing the capacity strengthening component of the project is presented below (**Figure 1**).

In this manuscript, we briefly report about the process and systems-wide outcomes of implementation research training for rural health and biosecurity workers in the Asia-Pacific, focused on surveillance and response to communicable disease threats. We then analyze the topics and health system components of completed projects to explore how interconnected outcomes can have an additive effect in supporting the rural health workforce in LMICs and strengthening health systems to provide both ongoing essential health care and responses necessary for health security. A companion paper has been developed wherein we explain the quantitative and qualitative changes in knowledge and confidence around implementation research among fellows in LMICs (Carlisle et al. under review). Lessons from this region may be of use to other LMICs as they consider strategies to strengthen the rural workforce to enhance preparedness for inevitable future novel infectious disease outbreaks.

METHODS

Development of Local Partnerships to Agree on Priorities and Selection of Fellows

In-country meetings with stakeholders were held to develop surveillance and response-based priorities for research projects, and identify target participants and in-country mentors. The program was targeted at participants with at least 5 years of health workforce experience, although no previous research experience was expected or required. Following submission of an expression of interest, the selected frontline health workers (referred in this paper as Research Fellows) participated in three in-country workshops. Projects conducted by Research Fellows were designed to ensure that most research could be conducted in the workplace, complementing existing daily activities and ensuring that they were not lost to service delivery while conducting their projects. Forging relationships and fostering communication between health, biosecurity and agricultural surveillance and response staff within regions was an important secondary goal of the work.

Customization and Delivery of the Implementation Research Training Program

The implementation research curriculum was based on the successful Structured Operational Research and Training IniTiative (SORT-IT) model (15). The SORT-IT model is designed to help low- and middle-income countries to improve their health systems through capacity-building and priority-driven research. Participants come from the health workforce and learn practical research skills through mentor-supported training and undertaking their own research projects.

We customized the SORT-IT materials to ensure that the curriculum was regionally relevant based on in-country discussions with the partner countries, limited prior research exposure and the Tropical Partners focus on policy-relevant surveillance and response research (**Figure 2**). The delivered training consisted of a series of three face-to-face workshops, lasting 7, 4, and 5 days, respectively over a period of ∼12 months, interspersed with periods of independent work supported by mentors. This training was repeated for cohorts based in Fiji, the Solomon Islands and eastern Indonesia.

The main modifications included: (a) expanding the focus on qualitative and mixed methods implementation research, (b) increasing the focus on the policy brief as a key research output, (c) changing the software used for quantitative analysis from Epi-data to Excel, and (d) reducing the expectation of prior research experience for selection into the training. This meant changing the original pre-requisite of Masters level qualifications, to no expectation of previous research experience or educational qualification. This opened eligibility to many frontline rural/provincial health workers who would otherwise be systematically excluded from such programs.

The participatory workshops ensured that Research Fellows (RFs) could fully develop their research experience and skills, with formal presentations, practical activities, small group discussions, time for writing, and presentations from the RFs themselves on their research proposals and results. Each RF was paired with in-country and international mentors for their project, in addition to ongoing support from the four project facilitators.

After the projects were completed (but before manuscripts had been completed), country-specific policy translation workshops were held. These sessions were well-attended by a wide range of intersectoral stakeholders, policy makers and leaders from government, health, higher education, biosecurity, animal health and livestock sectors. All RFs gave an oral presentation about their work and findings and lively cross-sectoral solution-focused discussions ensued.

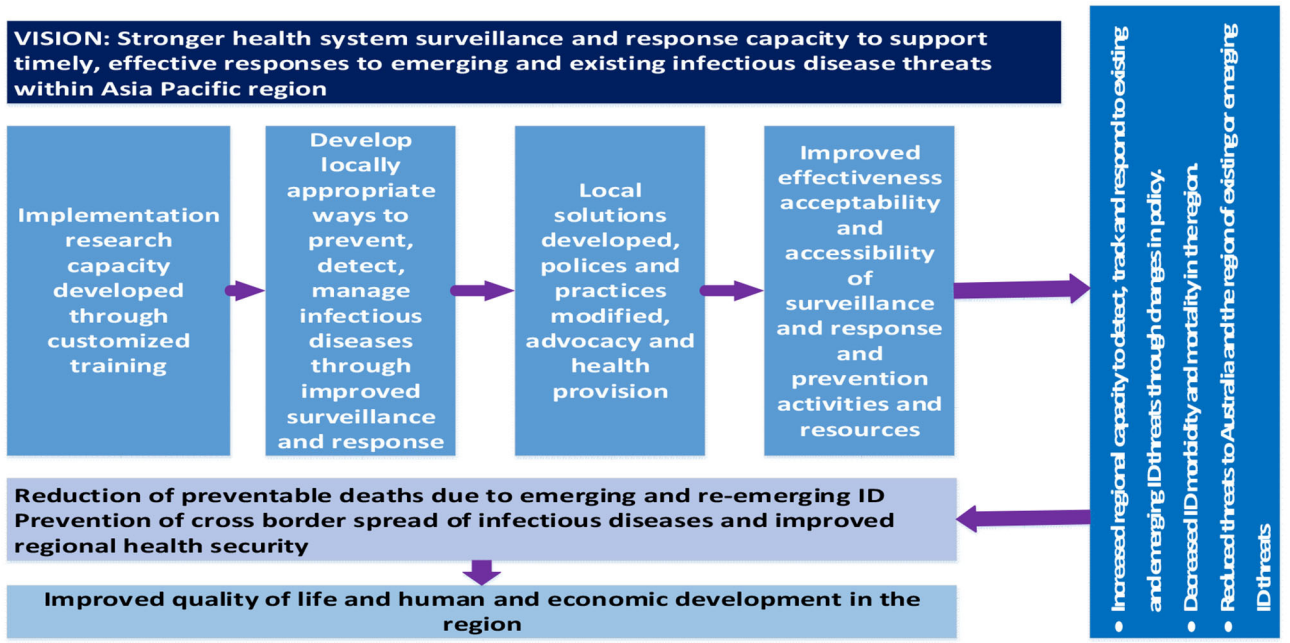

FIGURE 1 | Program logic guiding capacity-strengthening activities of the Partners in Tropical Health project.

Evaluation of Outcomes

Evaluation of outcomes from the perspective of individual RFs in terms of changes in knowledge and confidence and satisfaction with the process was undertaken with pre and post-workshop questionnaires collecting quantitative and qualitative data. Findings were positive and statistically significant (Carlisle et al. under review). Evaluation of outcomes and effects is ongoing as RFs continue to finalize publications from their work. However, all RFs completed policy briefs and shared these with key decision-makers within their countries, leading to local and regional cross-sectoral knowledge exchange and awareness. To understand the broader outcomes and effect of the project findings, we undertook a process of mapping the thematic findings and then identified barriers and enablers to surveillance and response capacity identified by RFs against the six WHO health system building blocks (16), with the accepted addition of working with community. Initially undertaken by one facilitator (MW), this was then broadened to include all facilitators and the broader authorship.

From discussions following this mapping process, an explanatory framework was developed. This framework is designed to explore the associations between the rural health workforce, the community, and other health system components. Understanding these associations is a critical step to strengthen the capacity of the rural and remote health workforce to respond to communicable disease threats, and capitalize on the potential for context-aware priority research to inform policy and practice.

RESULTS

Fifty-three public health workers across five countries completed the implementation research training and conducted workforce-based projects (**Table 1**). Most of the participants were rural/provincial public health and biosecurity workers, but participants included primary health care and district health staff, laboratory staff, animal health officers, district hospital staff and provincial or national hospital staff as well as central health advisors. Overall 34 (64.2%) of RFs who completed the workshops were female. **Table 1** includes a summary of prior educational attainment and occupational background of the RFs.

Projects covered a wide range of local priority areas, including tuberculosis (TB) and bovine TB, vaccine preventable diseases, evaluation of surveillance and response systems, outbreak preparedness, and vector-borne diseases. The projects included analysis and mapping of surveillance data; infection control; readiness for implementation of the International Health Regulations (IHR); prevention and response and outbreak investigation.

Foci of Studies From a Health Systems Perspective

Pleasingly, there was a high degree of correlation between the topics and foci chosen by RFs for their completed implementation research projects and the research and health system priorities that had been previously identified in meetings and workshops with health ministry, education and health sector stakeholders in each country. There was an extremely high level of satisfaction and knowledge-gain amongst participants (Carlisle et al. under review). The vast majority of RFs produced a policy brief and some have published their work, while others continue working toward publications for inclusion in the *Western Pacific Surveillance and Response Journal* and *Fiji Journal of Public Health*.

MODIFIED SORT-IT TRAINING PROGRAM
Workshop 1: (7 days; Developing a research proposal)
Infectious diseases: surveillance and response refresher
Contextualizing implementation research
Developing an implementation research proposal
Milestone 1 (due two weeks after completion of Workshop 1): Completion of draft research proposal and ethics application submitted to local ethics committees (if required)
Workshop 2: (4 days; Data analysis)
Planning and conducting an implementation research project: ethics submission
Planning data analysis and presentations
Milestone 2 (due two weeks after completion of Workshop 2): Completion of data collection and analysis plan
Undertake small work-based implementation research project with support from local and international mentor
Milestone 3 (due one week before start of Workshop 3): Evidence of data collection
Workshop 3: (5 days; Dissemination and translation)
Data analysis
Writing and publishing
Disseminating the findings (Dissemination Event)
Milestone 4 (due two months after completion of Workshop 3): Policy brief and/or draft manuscript

FIGURE 2 | Structure and milestones of the modified SORT-IT program used in the Indo-Pacific for the Partners in Tropical Health project.

To synthesize project findings and extract the implications for rural health workers in LMICs, key barriers and enablers reported from the implementation research studies conducted by the RFs were mapped against the WHO health system building blocks (**Table 2**). The majority of projects had a focus on health information systems for surveillance and response, supporting the health workforce, community responses, service delivery and medical products and infrastructure. Smaller numbers of projects focused on health system governance and financing (**Table 2**).

The factors affecting health system capacity as identified by these implementation research projects were synthesized (**Table 2**). Key health systems factors identified by RFs were a lack of support for the rural health and biosecurity workforce, including poor quality training in priority areas, with inadequate knowledge and supervision. In turn, this reduced motivation and adherence to best practices. Inadequate staff numbers resulting in exhaustion and burn-out of the workforce also contributed, as did planning and information problems such as a lack of connection between identifying a problem and being able to produce a response. Limited surge capacity was an issue in terms of both workforce and supplies, and projects identified the important role of a volunteer workforce in filling gaps and assisting with service delivery, but also some challenges inherent in training, supporting and integrating this additional workforce. Recommendations to address workforce challenges included building training, support and career pathways for rural health professionals and strengthening engagement and support with capable volunteer members from rural villages to reinforce prevention strategies for infectious diseases at village level.

This synthesis of projects, findings and recommendations from RFs of our Partners in Tropical Health implementation research training was then used to develop an explanatory framework exploring the associations between the rural health workforce, the community, and other health system components that are vital to strengthen the capacity of the rural and remote health workforce to respond to communicable disease threats (**Figure 3**).

DISCUSSION

This Partners in Tropical Health implementation research training program successfully worked with rural health and biosecurity workers from five countries in the Asia-Pacific region, delivering a range of small but policy-relevant local research projects, and demonstrating successful rural health workforce development. The modified SORT-IT program appeared to be

TABLE 1 | Demographic characteristics of completed Research Fellows.

		Number of participants ($N = 53$) *n* (%)
Country of residence		
	Fiji	17 (32.1%)
	Solomon Islands	19 (36.4%)
	Papua New Guinea	5 (9.4%)
	Eastern Indonesia	11 (20.8%)
	Timor-Leste	1 (1.9%)
Sex	Female	34 (64.2%)
	Male	19 (35.8%)
Highest educational qualification	Doctoral degree	1 (1.9%)
	Master's degree	13 (24.5%)
	Bachelor degree	28 (52.8%)
	Diploma	11 (20.8%)
Occupational group	Surveillance and response worker (field/rural)	15 (28.3%)
	Nurse	13 (24.5%)
	Doctor	2 (3.8%)
	Biosecurity worker	3 (5.7%)
	Surveillance and response worker (provincial)	9 (17.0%)
	Lecturer/teacher	6 (11.3%)
	Laboratory Scientist	4 (7.5%)

successful and well-received by participants, with significant gains in self-reported knowledge and confidence across a range of research skills (Carlisle et al. under review). The project topic areas, while organically developed, reflected local health sector priorities and covered a wide range of problematic local communicable diseases and health system building blocks. The individual project findings are being disseminated through in-country knowledge translation seminars, collections of policy briefs presented to local Ministries of Health, and peer-reviewed publications and presentations in locally-relevant journals. Whilst a limitation of this approach is the focus on small and simple research projects, perhaps limiting generalizability, this is far outweighed by the strength of generating locally relevant, contextually-informed solutions.

The explanatory framework synthesized from the analysis of these 53 projects reveals the strong inter-relationships between health system factors—primarily a competent, well-distributed health workforce, with individual and community drivers of good health, strong governance and inter-sectoral communication and information systems (**Figure 3**). These interconnected factors, so vital for health security are regularly being tested when responding to local/regional outbreaks of known infectious disease such as measles, polio, cholera, and dengue. Despite some success with the local outbreak detection of known infectious disease [aided in the Pacific by the embedded PSSS; (9)], retrospective analyses of responses to the International Health Regulations (IHR) indicate that many countries (notably in the WHO Africa and Western Pacific regions) have relatively low preparedness and operational readiness for responding to a global pandemic caused by a novel infectious agent. The current COVID-19 pandemic illustrates the additive burden for already stretched health systems dealing with outbreaks (e.g., dengue, measles) on an ongoing basis. The added threat of COVID-19 (or other EIDs) has the potential to overwhelm health systems (including the workforce) in parts of Asia and the Pacific (17).

There is a strong interconnection between health security (including the ability to respond to infectious disease threats) and overall health system capacity and resilience (18, 19). For example, responses to the Ebola-virus outbreak in East Africa showed the variability in responses and effectiveness depending on the underlying state of the health system and governance, and highlighted the inadequacy of existing health and medical research systems to understand and respond (20). Health systems need to have sufficient reserve to be able to recover after the shock of an infectious disease outbreak and still be able to provide ongoing care for people with chronic diseases, acute care for endemic infectious diseases and deliver appropriate preventive care (21).

What is striking are the parallels between our inductively-derived explanatory framework and those deductive frameworks used by the WHO and other large organizations to illustrate issues of pandemic preparedness and response more broadly (6, 22). Small, locally conducted implementation projects, conducted by locally embedded health and biosecurity workers with guidance in research methods (from international and local mentors) are able to deliver strong insights to local health sector leaders and ministry officials, while providing skills and confidence to distributed health workers, and at the same time linking with the local socio-cultural context and local determinants of health in this hyper-diverse region.

All of these issues are particularly critical in rural areas and low-income settings, where wide population dispersion and a scant health workforce add to the logistical difficulties in the delivery of health services (12). Health workforce challenges that are currently particular issues in the Asia-Pacific Region include: (a) absolute shortages; (b) maldistribution; (c) issues with governance, planning and support for the health workforce; (d) public sector working conditions; and (e) increasing global mobility of workers (19). However, there are many capable people in the rural settings who can be engaged—at village levels (e.g., unemployed youths with tertiary education achievements)—to strengthen data collection, and preparedness for the prevention of infectious diseases. These people communicate on a daily basis with other villagers to enforce prevention strategies for ID at village levels. During COVID-19, village women and young men were involved in training their own village members in hand washing, distancing, no sharing of cups in kava parties and other ways of contributing to prevention and preparedness. They do not have to be paid wages; they just do this work for the general good of the people of their village.

The rural and remote health and biosecurity workforce in LMICs is an underused and fragile resource in terms of preparedness and response to emerging infectious diseases and health security. The health workforce sits squarely at the intersection between delivering universal health coverage, having strong and resilient health systems, and global health security (18). Interventions focused on improving capacity to detect

TABLE 2 | Project areas, health system building blocks, factors affecting health system capacity, and recommendations from Research Fellows.

Building blocks (no. of projects)	Project areas of focus (CD including TB, malaria, dengue, zika, measles, diarrhea, leptospirosis, and meningococcal disease)	Factors affecting surveillance and response capacity	Synthesized fellow recommendations
Health information systems (19 projects)	• Use of data for prediction, response, evaluation • Quality of data and adherence to protocols • Linked data (climate, geography, diseases)	• Under-reporting and double counting • Not using data for response/decision making/preparedness	• Strengthen surveillance and response systems, especially capacity of health workers to document and respond • Training for health and biosecurity workforce on recording, interpreting and sharing data
Workforce (11 projects)	• Clinical practices • Quality of training (and evaluation) • Surge capacity; barriers and enablers for workforce response • Knowledge and motivation • Health workforce numbers	• Inadequate knowledge and supervision • Motivation and adherence issues • Poor quality training • Inadequate staff numbers and exhaustion	• Invest in adequate health staff to respond to outbreaks (incl. surge) • Provide high quality ongoing training and professional development (incl. data recording) • Career pathways and support • Support training and PD in professionalism at all levels • QI processes around training and supervision
Community (8 projects)	• Health seeking behavior • Causes for delay • Lived experiences • Knowledge and behaviors re prevention (animal and human health)	• Limited health seeking behavior (related to knowledge and stigma) • Socio-economic and cultural determinants affecting ability to modify risk	• Target community education and health promotion to reduce stigma • Improve cultural safety of services • Consider role of community volunteers in surge capacity for education/health promotion
Medical products and infrastructure (6 projects)	• Antimicrobial resistance • Water, sanitation and waste disposal facilities • Supplies at health facilities	• Laboratory and health facilities ill–equipped with unreliable supplies • Lack of water and sanitation facilities at health facilities • Poor antibiotic stewardship • Limited surge capacity	• Review inventory and restocking systems • Ensure access to infrastructure required for safe care e.g., handwashing, waste management • Provision of basic equipment and maintenance
Service delivery (6 projects)	• Home based care • Community volunteers for dengue control • Improving immunization coverage • TB-DOTS • Net distribution	• Accessibility, affordability and acceptability issues • Inadequate health promotion • Underperforming community volunteers • Integration of volunteers with mainstream workforce	• Training and recognition of volunteers as important HRH • Budget to train family as partners in TB-DOTS • Free to user, distributed service provision • Mass immunization catch-up program
Governance (2 projects)	• Intersectoral collaboration (One Health) • International Health Regulations assessment	• Missing defined roles responsibilities, protocols, policies • Poor communications and inter-sectoral collaboration	• Standard operating procedures and policies for preparedness and response • Mechanisms for information sharing across sectors and levels of health system • Respond to feedback from HRH
Financing (1 project)	• Development assistance	• Important role of development assistance financing • Withdrawal/decline in financing leading to outbreak potentials	• Stable, ongoing programs of development assistance

CD, Communicable Diseases; TB-DOTS, Tuberculosis - Directly Observed Treatment- Short-course; PD, Professional Development; QI, Quality Improvement; HRH, Human Resources for Health.

and respond to existing diseases that are locally prevalent and relevant can in addition help strengthen preparedness for a possible future EID pandemic (23). While the mechanism for this is as yet unclear, a plausible explanation is that a focus on local ongoing disease threats strengthens local engagement, recognizes the broader social and cultural determinants of health, and strengthens "soft" organizational capacity, such as communication and trust (24). The specificity of how this progresses in different locations needs to be guided by an openness to doing things in different ways in different contexts across the region. Adequate training, supplies, professional development and support are all important, as well as retention and recruitment initiatives. An additional benefit may follow in terms of synergies with several sustainable development goals (SDGs).

An additional factor that is less often mentioned is the importance of "activation" of the rural and remote health workforce. This can be thought of as analogous to empowerment,

FIGURE 3 | Interconnections for a stronger rural health workforce and better health security.

and is a vital factor in building health sector resilience (25). Developing an adequate knowledge and skills base to identify a problem, and design, implement and evaluate locally relevant and appropriate solutions to that health service problem is a critical competency–this is what this kind of IR training in a distributed style can deliver (26, 27).

CONCLUSION

Policy briefs written by participants outlining results and recommendations from workplace-based projects have informed local, provincial and national health managers, policy makers and development partners. Recommendations have guided the development of improved health care practice and training. The capacity to use robust but simple research tools and processes for formative and evaluative purposes provides sustainable capacity to a distributed rural and remote health workforce for responding to infectious diseases threats. Scale-up of this approach may be warranted to strengthen surveillance and response. Strengthening the activation and motivation of these health professionals is an important element of this success.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by James Cook University Human Research Ethics Committee. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SL, MW, DM, and KC conceived this work and facilitated the workshop program together with HH and MD. MW conducted the initial synthesis of themes for **Table 2**, which was then reviewed and extended by other authors. SL wrote the first draft of this manuscript. All authors revised and commented on subsequent drafts, viewed and approved the final manuscript, and were involved with the program as facilitators, in-country industry partners, mentors or Fellows.

FUNDING

This program of work was funded through the Australian Department of Foreign Affairs and Trade (DFAT) through a Center for Indo-Pacific Health Security grant: the Partners in Tropical Health Project and Complex Grant Agreement number 73050.

ACKNOWLEDGMENTS

The authors are very grateful to the Ministries of Health and Medical Services in each of the countries, our in-country university partners (Fiji National University, Udayana University, Bali, and Solomon Islands National University), local and international mentors and the Research Fellows. We extend our thanks to the broader project team from the Partners in Tropical Health Project.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Public Health

ORIGINAL RESEARCH
published: 19 October 2020
doi: 10.3389/fpubh.2020.582464

Training a Fit-For-Purpose Rural Health Workforce for Low- and Middle-Income Countries (LMICs): How Do Drivers and Enablers of Rural Practice Intention Differ Between Learners From LMICs and High Income Countries?

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Equity in health outcomes for rural and remote populations in low- and middle-income countries (LMICs) is limited by a range of socio-economic, cultural and environmental determinants of health. Health professional education that is sensitive to local population needs and that attends to all elements of the rural pathway is vital to increase the proportion of the health workforce that practices in underserved rural and remote areas. The Training for Health Equity Network (THEnet) is a community-of-practice of 13 health professional education institutions with a focus on delivering socially accountable education to produce a fit-for-purpose health workforce. The THEnet Graduate Outcome Study is an international prospective cohort study with more than 6,000 learners from nine health professional schools in seven countries (including four LMICs; the Philippines, Sudan, South Africa and Nepal). Surveys of learners are administered at entry to and exit from medical school, and at years 1, 4, 7, and 10 thereafter. The association of learners' intention to practice in rural and other underserved areas, and a range of individual and institutional level variables at two time points—entry to and exit from the medical program, are examined and compared between country income settings. These findings are then triangulated with a sociocultural exploration of the structural relationships between educational and health service delivery ministries in each setting, status of postgraduate training for primary care, and current policy settings. This analysis confirmed the association of rural background with intention to practice in rural areas at both entry and exit. Intention to work abroad was greater for learners at entry, with a

OPEN ACCESS

Edited by:
Matthew Richard McGrail, The University of Queensland, Australia

Reviewed by:
Colleen Cheek, Tasmanian Government, Australia
Marietjie De Villiers, Stellenbosch University, South Africa

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Specialty section:
This article was submitted to Public Health Education and Promotion, a section of the journal Frontiers in Public Health

Received: *14 July 2020*
Accepted: *14 September 2020*
Published: *19 October 2020*

Citation:
Johnston K, Guingona M, Elsanousi S, Mbokazi J, Labarda C, Cristobal FL, Upadhyay S, Othman A-B, Woolley T, Acharya B, Hogenbirk JC, Ketheesan S, Craig JC, Neusy A-J and Larkins S (2020) Training a Fit-For-Purpose Rural Health Workforce for Low- and Middle-Income Countries (LMICs): How Do Drivers and Enablers of Rural Practice Intention Differ Between Learners From LMICs and High Income Countries? Front. Public Health 8:582464. doi: 10.3389/fpubh.2020.582464

significant shift to an intention to work in-country for learners with entry and exit data. Learners at exit were more likely to intend a career in generalist disciplines than those at entry however lack of health policy and unclear career pathways limits the effectiveness of educational strategies in LMICs. This multi-national study of learners from medical schools with a social accountability mandate confirms that it is possible to produce a health workforce with a strong intent to practice in rural areas through attention to all aspects of the rural pathway.

Keywords: rural practice intention, rural medical practice, barriers and enablers, rural practice, human resources for health (HRH), LMIC = low- and middle-income countries, practice intentions, social accountability

INTRODUCTION

Equity in health outcomes for rural and remote populations in low- and middle-income countries (LMICs) is limited by a range of socio-economic, cultural and environmental determinants of health. Access to comprehensive primary health care services provided by a well-trained and fit-for-purpose health workforce in rural and remote areas is one important strategy to address health disparities (1, 2). LMICs are grappling with overall shortages of human resources for health (HRH), with the World Health Organization calculating a global shortage of 17.4 million in 2013, projected to decrease to 14.5 million by 2030 [based on an indicative aggregate density threshold of doctors, nurses and midwives of 4.45 per 1,000 population; (3)]. These shortages are in turn inequitably distributed, with the most pronounced shortages in countries with the least resources. In many LMICs there is a long-term, embedded underinvestment in education and training of the health workforce, despite evidence of the economic benefits of this investment (4). This issue is exacerbated by limited communication between the education and training sector and the health sector, in terms of ensuring that the competencies of graduating health workers are appropriate to meet the needs of the population they serve (3).

In addition to these absolute shortages in HRH, in almost all parts of the world, the health workforce is geographically and vocationally mal-distributed, with a relative over-supply in the urban centers, and health workforce shortages in rural and remote areas, especially in areas that rate lower on livability scales (3). There are many reasons for this mal-distribution. For example, rural and primary care practice are often perceived as "second class" options—a misperception that is inadvertently and perhaps deliberately reinforced because, particularly in medicine, most health professional students are the children of the urban elite, most training takes place in large urban institutions, and the most visible role models during this training are city-based specialists (5). In addition, especially in medicine, the "hidden curriculum" and remuneration structures within health care reward sub-specialization and procedural work over generalism. Together with often under-developed and under-resourced postgraduate training programs for primary care, this may make primary care or general practice unnecessarily challenging and unjustly unpopular as a career option for medical graduates (2).

Health professional education that is sensitive to local population needs and that attends to all elements of the rural pathway is vital to increase the proportion of the health workforce that practices in underserved rural and remote areas (6). In practice, this means paying close attention to: (i) rurally-oriented selection processes; (ii) rural and primary health care-oriented curriculum delivered largely in rural and remote locations; (iii) rural and regional postgraduate training pathways and support; and (iv) ensuring exposure to a wide range of appropriate rural and remote mentors and teachers (6–8).

The Training for Health Equity Network (THEnet; www.thenetcommunity.org), is a community-of-practice of 13 health professional education institutions from 10 countries in high, middle and low income settings, with a clear, self-identified mandate to deliver socially accountable education to produce a fit-for-purpose health workforce and contribute to Universal Health Care (UHC). One of the earliest tasks of the THEnet Evidence Group was to collaboratively develop and test a common Evaluation Framework to be used by health professional schools to critically self-evaluate the degree to which they were achieving their own social accountability goals (9). Part of this work is holding ourselves, as educators, responsible for where our graduates go, what they do, and the degree to which practice location and skill set match need. Since 2010, THEnet has been coordinating an international graduate outcome study, to look at the associations between learner characteristics, intentions to practice and actual practice location and discipline in these differing contexts and now has data on more than 6,000 learners from both LMICs and high income countries (HICs).

This study is part of a series of multi-institutional collaborative research supported by THEnet and its institutional partners to gather evidence on the outcomes and impact of socially accountable health professional education(SAHPE), using the THEnet's Framework for Socially Accountable Health Workforce Education as a logicmodel [https://thenetcommunity.org/the-framework/; (9–11)]. Collaborative research between THEnet partner schools is helping to demonstrate the success of a socially accountable approach (7, 12–14). This manuscript considers learner characteristics, considers learner characteristics and country contextual factors associated with: (i) intention to practice in rural and underserved areas; (ii) intended discipline of practice; and (iii) intention to emigrate at graduation, and analyses how these associations vary between LMICs and HICs.

METHODS

The THEnet Graduate Outcome Study (GOS) is an international prospective cohort study, now with more than 6,000 learners from nine health professional schools in seven countries [included in these analyses four LMICs; the Philippines (two schools), Sudan, South Africa and Nepal, and two HIC; Australia and Canada]. Surveys of learners are administered at entry to medical school, at exit from medical school and at years 1, 4, 7, and 10 thereafter. Underserved populations are defined in terms of three dimensions: (i) geographic factors; (ii) socioeconomic factors; and (iii) socio-cultural disadvantage (due to religion, caste, minority ethnicity or status as a refugee or recent immigrant). Rurality is defined contextually in terms of quintiles for each country that mirror population quintiles as closely as possible. Further details of the methodology are available elsewhere (12, 13). Longitudinal matching of entry and exit surveys is now possible for increasing numbers of learners and we are building up the longitudinal cohort into the postgraduate years which allows correlation with actual practice in time, and the inclusion of data about clinical placements. Different schools have commenced data collection for the GOS in different calendar years according to when ethical approval was granted.

Building on earlier work, in this analysis we consider the association of intention to practice in rural and other underserved areas and a range of individual and institutional level variables at two time points—entry to and exit from the medical program; that is cross-sectional data at two time-points. At each point, Pearson χ^2 tests and binary adjusted logistic regression are used to examine the individual and institutional factors associated with: (i) intention to practice in rural areas; (ii) intention to practice in generalist disciplines; and (iii) intention to emigrate. Longitudinal paired data analysis used McNemar's test. These findings are then triangulated with a sociocultural exploration of the structural relationships between educational and health service delivery ministries in each setting, status of postgraduate training for primary care, current policy settings with regard to HRH planning and support, and other relevant factors that may influence support. This concurrent, mixed methods design (15) was constructed to optimize our understanding of the factors that influence HRH outcomes in medical school settings. Data to inform this analysis come from document review of publicly available sources and websites, supplemented by direct communication between authors; all embedded experts in health professional education in their own contexts. To further the trustworthiness of our results we also triangulated findings with those from complementary research from within the THEnet community, to understand the factors contributing to these strong drivers (14, 16).

Ethics approval was received from the ethics review committees of each participating school. Individual informed written consent was obtained from all participants.

RESULTS

Of the 6,000 learners enrolled in the study, findings presented here include data from 3,849 learners at entry and 1,229 learners at exit. Of these learners, 149 provided data at entry and exit with 45% of learners with such matching data having attended school in a LMIC. The analyses involve survey data from medical schools in LMICs, including 864 learners from Gezira University in Sudan, and 665 learners from Walter Sisulu University in South Africa, both specifically established to meet the needs of the rural and impoverished regions in their respective countries. We also have data from 382 learners across two medical schools in the Philippines. Ateneo de Zamboanga University in Mindanao, which is founded on a strong social mission to meet the needs of rural and underserved populations across Mindanao in Southern Philippines; and the School of Health Sciences, University of the Philippines, Leyte, which provides a stepladder curriculum to meet the needs of populations in the Philippines archipelago. Entry level data from two cohorts of students from Patan Academy of Health Sciences in Nepal, established with a specific mission to meet the health needs of the dispersed rural populations of Nepal are also available. Comparison data for rural practice intention are available for HIC schools in Australia (James Cook University and Flinders University; both with a social mandate to meet the needs of rural and remote populations, and Australian Aboriginal and Torres Strait Islander populations) and Canada (Northern Ontario School of Medicine; established to meet the health needs of rural, Indigenous, Francophone and the general population of Northern Ontario).

The demographics of learners at these schools differ from those of most medical schools, with higher proportions of students from rural and remote backgrounds (40.4%), from low socioeconomic and educational backgrounds (28.9% from low income background, 34.4% neither parent completed university, 29.4% spent more than 4 years in public schooling), and from underserved population groups (23.9%; **Table 1**).

Contextual information about these health professional courses, their structure and setting and their relationships with local health services and training programs in the region are summarized in **Table 2**. The schools have all clearly evolved to serve underserved populations in their regions. Notable contextual features include the differences between LMICs and HICs in terms of recognition and strength of training programs for family medicine/general practice as a specialty. Australia and Canada both have strong, certified training programs for general practice/family medicine, with recognition of the important role played by these practitioners in providing first contact, comprehensive continuing care and acting as a gatekeeper for access to the specialist system. Despite the efforts of THEnet partners and a family practice program delivered by PAHS, both Nepal and the Philippines have comparatively limited recognition, training or support for primary care and patients are able to self-refer for specialist care (**Table 2**). To some extent, this is still the case in Sudan, though progress in training for primary care has been made through establishment of a community-oriented postgraduate training program in family medicine in 2010. South Africa has a strong training program for family medicine, but lack of clarity in policy about the role of primary care providers within the health system has limited their effectiveness in working as

TABLE 1 | Demographic profile and background characteristics for participating THEnet schools.

Mean age (SD)		Female *n/N* (%)	Lowest two quintiles of income (background) *n/N* (%)	Identify as underserved population *n/N* (%)	Neither parent attended university *n/N* (%)	Years of public schooling (>4 years) *n/N* (%)	Rural background 1-3[a] *n/N* (%)
Entry $n = 3,851$	Exit $n = 1,187$	2,917/4,915	863/2,987	984/4,121	1,555/4521	1,336/4,538	1,613/3,989
21.14 (4.34)	26.33 (4.12)	(59.3)	(28.9)	(23.9)	(34.4)	(29.4)	(40.4)

[a] *Rural quintiles (1, remote village; 2, small rural town; 3, large rural town) vs. Urban quintiles (4, major regional center and 5, major city or capital city). Learners with primary school background in a country other than the country where they attended medical school were excluded from this variable. Most schools used population size to define quintiles; NOSM and UPSHS based quintiles on government socioeconomic classifications.*

part of a team in the community to deliver primary health care services.

Intention to Practice in Rural Areas

At entry to medical school, a high proportion of learners intended to practice in rural areas (defined as a remote, small rural or large rural town; quintiles 1–3) after completing postgraduate training (1,864/3,598; 51.8%). In these cross-sectional samples across all these schools, a significantly smaller proportion of learners intended to practice in rural areas at exit than at entry (502/1,135, 44.2%; OR 0.74, 95% CI 0.65–0.84, $p < 0.001$). Importantly, there was no significant change in the proportion of learners intending to practice in rural areas between entry and exit for the 144 learners with matching data ($p = 0.644$).

Binary logistic regression analyses adjusting for confounders showed that learner characteristics and school being located in a LMIC were significantly associated with intention to practice in a rural area, and these differed at entry and exit (**Tables 3**, **4**). Learners with a rural background (where the majority of primary schooling was completed in a remote, small rural or large rural town; quintiles 1–3) were 3.3 times more likely to intend to practice in rural areas at entry ($p < 0.001$; **Table 3**). Similarly, learners with a lower income background (defined as parental income in the bottom two quintiles) and those who identified as a sociocultural underserved group were 1.7 times ($p < 0.001$) and 1.3 times ($p = 0.04$) more likely to intend to practice in rural areas at entry, respectively (**Table 3**). In comparison, at exit, a higher likelihood of intention to practice in a rural area was associated with attending medical school in a LMIC (AOR 2.01, $p < 0.001$), being female (AOR 1.80, $p = 0.001$) and having a rural background (AOR 1.89, $p < 0.001$), with a weak association with age (**Table 4**).

The rural quintile of learners' background was strongly associated with intent to practice in rural areas, at entry and exit (Pearson's χ^2 for trend; 281.920, df = 4, $p < 0.001$; 43.035, df = 4, $p < 0.001$, respectively). This trend was observed even after adjusting for age, school's country income setting, gender, family income and sociocultural underserved group. Compared with learners with a metropolitan background, learners from small rural towns had the highest likelihood of intention to practice in rural areas at entry (AOR 6.32, $p < 0.001$) and exit (AOR 3.82, $p < 0.001$), followed by learners from remote towns, then regional centers, then major urban centers (**Supplementary Materials 1**, **2**).

Learners with an international background (who completed the majority of primary schooling in a different country to their medical school) were less likely than learners with a domestic background to have rural practice intentions at entry ($N = 3,500$; Pearson χ^2 60.217, df = 1, $p < 0.001$) and exit ($N = 516$; Pearson χ^2 10.849, df = 1, $p = 0.001$).

Intended Discipline of Practice

For the cross-sectional data, learners were twice as likely to intend to practice in family medicine/general practice at exit (282/1,093, 25.8%) compared with entry (412/2,892, 14.2%; OR 2.09, 95% CI 1.76–2.48, $p < 0.001$; **Figure 1**). Learners were also significantly less likely to have practice intentions in the discipline of surgery at exit (134/1,093, 12.3%) than at entry (1,033/2,892, 35.7%; OR 0.25, 95% CI 0.21–0.31, $p < 0.001$). For the learners with paired data, there was no significant change in the proportion of learners who intended to work in family medicine/general practice between entry and exit ($p = 0.664$). There was, however, a significant change in the proportion intending to practice in surgery with 23/31 (74.2%) changing away from surgical intent between entry and exit ($p < 0.001$).

Binary logistic regression analyses showed that age, gender, high income setting and rural background were associated with learners' intention to practice in family medicine/general practice (**Supplementary Material 3**). Females were twice as likely as males to have practice intentions in generalist disciplines at exit, but not at entry (exit AOR 2.10, $p = 0.002$; entry AOR 0.93, $p = 0.667$). Learners with a rural background were twice as likely to intend generalist practice as learners with an urban background, at entry (AOR 2.05. $p < 0.001$), but not at exit (AOR 1.51, $p = 0.063$). At entry and exit, learners from schools in LMIC were much less likely to intend to practice in generalist disciplines than learners in HIC (entry AOR 0.19, $p < 0.001$; exit AOR 0.15, $p < 0.001$).

Intention to Work Abroad

A significantly smaller proportion of learners at exit reported an intention to practice abroad than at entry (exit 376/778, 48.3%; entry 1,591/2,459, 64.7%; OR 0.51, 95% CI 0.43–0.60, $p < 0.001$). Interestingly, the proportion of learners with matching entry and exit data who changed their intention from working abroad to an intention to stay in their country (18/31, 58.0%) was significantly greater than the proportion of learners who changed their intention to instead work abroad (7/47, 14.9%; $p = 0.043$).

TABLE 2 | Contextual information about these health professional courses, their structure and setting and their relationships with local health services.

Country	Medical education context*	Relationship between health system and educational planning	Health professional school, foundation year, (year of joining graduate outcome study)	Training structure (size of entry cohort of medical students in 2013)	Priority population	Participants *n* (response rate, %)
The Philippines	Population density 358 people/km^2 Gross national income per capita $7290 (2012) 40 medical schools Physician density 1.3/1,000 (2010) Poor recognition of general practice/primary care as a specialty, but many graduate with public health qualifications. Weak US-style family medicine training and certification	Historically poor coordination between health professional education and health systems Patients can self-refer to specialists, bypassing primary care. Strong and largely unregulated influence of pharmaceutical sector Largely privatized higher education system, and large wage disparities between public and private systems for healthcare workers Maldistribution - <10% of graduates serve rural areas Health training as an export industry - high rates of medical and nursing emigration	Ateneo de Zamboanga University School of Medicine, (AdZU) Zamboanga City, Mindanao. 1993 (2013) School of Health Sciences, University of the Philippines, (SHS) Palo, Leyte. 1976 (2013)	Four-year graduate MD training, about 50% community based. One year internship, 50% in rural health units, emergency and district hospitals (48 students) Five-year graduate MD program. Multilevel entry stepladder curriculum. Six months in Year 2 and all of Year 5 in rural community practice setting Also trains community workers/midwives and nurses)(15 students)	Rural underserved areas of Mindanao, especially Zamboanga peninsular and outlying islands Rural underserved populations in the central Philippines Indigenous peoples	Entry 216 (87.4) Exit 150 (84.7) Entry 33 (89.2) Exit 50 (72.5)
Sudan	Population density 25 people/km^2 Gross national income per capita $3220 (2012) 29 medical schools (8 private) Physician density 0.3/1000 (2017) Role of primary care in health system underdeveloped and undervalued in health system Two year community-oriented postgraduate training in family medicine developed in partnership with Gezira Ministry of Health	Four older medical schools, then rapid proliferation of new schools mostly in Khartoum. Perceived decline in training standards Widespread emigration of health professionals for social and economic reasons In last decade partnerships between education institutions, Ministry of Health and Education to progress training for primary health care, including an initiative through U Gezira (17) Feminisation of medical workforce caused issues in rural coverage and workforce (18)	University of Gezira Faculty of Medicine, Gezira State. 1975 (2013)	Five-year undergraduate training program Twenty percent of time allocated for community-based education (270 students)	Rural underserved areas in Gezira region	Entry 805 (66.6) Exit 59 (29.6%)
South Africa	Population density 48 people/km^2 Gross national income per capita $11,970 (2012) Nine medical schools Physician density 0.9/1,000 (2017) Four year postgraduate community-based training program (UK/Aust style) for family medicine—specialist recognition	Previously limited coordination between HRH training and deployment with no integrated data source for HRH planning, despite HRH making up almost 2/3 of public health expenditure. Previous planning efforts not implemented Absolute shortages in HRH, especially beyond urban centers, and in public sector, with high professional emigration	Walter Sisulu University Faculty of Health Sciences (WSU) Mthatha, South Africa. 1985 (2013)	Six year undergraduate program, rural experiences in Years 1–3 and 6 months in Year 5 Also trains Clinical Associates (PAs) (120 students)	Rural underserved areas of Eastern Cape and KwaZulu Natal provinces	Entry 563 (91.4%) Exit 102 (58%)

(Continued)

TABLE 2 | Continued

Country	Medical education context*	Relationship between health system and educational planning	Health professional school, foundation year, (year of joining graduate outcome study)	Training structure (size of entry cohort of medical students in 2013)	Priority population	Participants *n* (response rate, %)
	Tension between health policy focused on public PHC (without a clear role for family physicians) and health system with strong specialist and hospitalist focus	Introduction of National Health Insurance has spurred more coordinated efforts and integrated planning through the NHI Fund, although still in its infancy (19, 20)				
Nepal	Population density 196 people/km^2 Gross national income per capita $2,170 (2012) 19 medical schools (15 private) Physician density 0.75/1,000 (2018) Three year postgraduate medical training program in general practice to address rural doctor shortage Lack of well-defined career pathway for general practice with limited ability to serve the rural population or strengthen PHC approach due to health system factors that favor speciality practice (21)	Poor staff performance in terms of productivity, quality, availability, and competency Fragmented approach to HRH planning, management, and development Imbalance between supply and demand, and narrow skill mix Limited HRH financing Low attraction/retention in public service, and "brain drain" largely due to the migration of health workers (22)	Patan Academy of Health Sciences (PAHS) Patan, Nepal 2008 (2019)	Five year undergraduate problem-based learning curriculum. Not-for-profit institution. Adapted for local priority issues and priorities. Selective recruitment prioritizing rural students and extensive rural community placements (65 students; 2019)	Rural underserved areas, the poor and diverse ethnic groups, particularly those in northern and Western Nepal	Entry 130 (100%)
Australia	Population density 3 people/km^2 Gross national income per capita $41,590 22 medical schools Physician density 3.7/1,000 (2017) Strong postgraduate training program (3–4 years) for general practice with independent certification exams General practitioners and "rural generalists" have well-recognized role as gatekeepers and work in private practices, community health centers, rural hospitals and community-controlled health services	Well supplied in terms of numbers of doctors and nurses but ongoing problems with vocational (insufficient generalist) and geographical maldistribution Various incentives and policies introduced to address these with variable success Separate Ministry for Health and Education, but relatively cohesive and functional mechanisms to create joint planning—e.g., Medical Training Review Panel (23) Reducing earlier reliance on international medical graduates Attention to entire rural pathway demonstrated to produce successful outcomes	James Cook University College of Medicine and Dentistry (JCU) Townsville, Queensland 2000 (2013) College of Medicine and Public Health (FU) Adelaide, South Australia. 1995 (2013)	Six year undergraduate MBBS program, entirely regional, including 20 weeks in small rural and remote settings Also trains dentists and Physician Assistants (238 students) Four year graduate program based in Adelaide or in Darwin. Option for 1 year Parallel Rural Curriculum (30 students) (160 students)	Rural, remote, Aboriginal and Torres Strait Islander populations, and others in tropical Australia Rural, remote and Aboriginal and Torres Strait Islander populations	Entry 1,367 (83.1%) Exit 509 (42.0%) Entry 480 (74.2) Exit 167 (57.5)

(Continued)

TABLE 2 | Continued

Country	Medical education context*	Relationship between health system and educational planning	Health professional school, foundation year, (year of joining graduate outcome study)	Training structure (size of entry cohort of medical students in 2013)	Priority population	Participants *n* (response rate, %)
Canada	Population density 4 people/km^2 Gross national income per capita $41,170 (2012) 17 medical schools Physician density 2.3/1,000 (2016) Family medicine is a strong, recognized specialty and gatekeeper to specialist care School based family medicine programs with defined curriculum and an end-point examination	HRH comprise a large part of health expenditure Strong system of universal access and coverage through family practice, rural hospitals and regional/urban hospitals Parallel private health system Limited processes to track predicted actual and predicted health workforce over time at national level (although some local initiatives) and some national descriptive data.	Northern Ontario School of Medicine (NOSM) Thunder Bay and Sudbury, Canada. 2005 (2016)	Four year graduate program. Entirely regional. Twelve weeks Indigenous and rural community placements plus 8 month community longitudinal integrated clerkship (64 students)	Rural, Indigenous, Francophone and general population of Northern Ontario	Entry 255 (99.2%) Exit 192 (98.5)

*From World Health Organization Global Health Observatory (http://apps.who.int/gho/data/node.country) and World Bank (https://data.worldbank.org/indicator/). Most recent available data point used.

Learners with an international background were significantly more likely than learners with a domestic background to have intentions of working abroad at entry (both $p < 0.001$). After adjusting for age, school's country income setting, gender, family income background and sociocultural underserved group, learners with an international background were 4.4 times more likely to intend to work abroad at exit, than learners with a domestic background (95%CI 2.01–9.55, $p < 0.001$). However, reasons for emigration vary; of the 76 learners at exit with an international background, 20 intended to work abroad because their country needs doctors ($n = 6$) or to stay close to home ($n = 14$).

Binary logistic regression analyses of learners with a domestic background showed that decreasing age, not identifying as an underserved group and having an urban background were associated with an intent to practice abroad at entry (AOR 0.90, $p < 0.001$; AOR 2.31, $p < 0.001$; AOR 1.44, $p = 0.007$; respectively; **Supplementary Material 4**). At exit, decreasing age was associated with higher intent to work abroad (AOR 0.85, <0.001; **Supplementary Material 5**).

When restricting the analysis to learners from LMIC, where emigration of trained HRH is a major concern, the proportion of learners with an intention to practice abroad was significantly smaller at exit (75/256, 29.3%), than at entry (745/1,203, 61.9%; OR 0.25, 95% CI 0.19–0.34, $p < 0.001$). The proportion of learners who intended to work abroad for more than 10 years was also significantly smaller at exit, than at entry (exit 4/50, 8.0%; entry 109/413, 26.4%; OR 0.24, 95% CI 0.09–0.69, $p = 0.005^{\text{FET}}$). After adjusting for confounding variables, decreasing age was the only learner characteristic that was significantly associated with intention to practice abroad at entry and exit (entry AOR 0.81, $p < 0.001$; exit AOR 0.53, $p < 0.001$; **Table 5**).

For all learners combined, the main motivation to work abroad, at entry and exit, was to gain experience (entry 783/1,513, 51.8%; exit 174/360 48.3%). A much higher proportion of learners in LMIC were motivated to work abroad for this reason at exit, compared with learners in HIC (LMIC 50/72, 69.4%; HIC 124/288, 43.1%). In LMIC, an intention to stay at home rather than work abroad at exit was motivated by a desire to respond to the need for doctors in their home country (91/165, 55.2%) or a preference to stay close to home or family (66/165, 40.0%).

DISCUSSION

This multi-national study of learners from medical schools with a social accountability mandate confirms that it is possible to produce a health workforce with a strong intent to practice in rural areas, in both LMIC and HIC settings through attention to all aspects of the rural pathway. These same learners express a strong (and increasing) intention to practice in generalist disciplines or primary care, and a decreasing intention to work abroad following graduation. These trends are particularly strong for learners from rural and low socio-economic backgrounds, and in contexts where there are clear roles for primary care providers in the rural health system, with a strong training program and postgraduate support. It follows, that to strengthen

TABLE 3 | Predictors of intention to work in a rural location where binary variable is rural vs. urban location at entry[a].

	Number in unadjusted analysis	Unadjusted odds ratios (95% CI; *p*-value)	Adjusted odds ratios (95% CI; *p*-value) *N* = 1,574
Increasing age	3,573	1.03 (1.01–1.04; 0.001)	1.01 (0.98–1.04; 0.48)
LMIC school	3,598	0.87 (0.76–0.99; 0.033)	0.80 (0.63–1.00; 0.051)
Female	3,592	1.26 (1.10–1.44; 0.001)	1.22 (0.82–1.51; 0.073)
Income bottom two deciles	2,169	1.86 (1.54–2.26; <0.001)	1.66 (1.29–2.13; <0.001)
Identify as underserved group	3,063	1.90 (1.61–2.25; <0.001)	1.32 (1.02–1.72; 0.04)
Rural background (Quintiles 1, 2 and 3)	2,895	3.45 (2.94–4.04; <0.001)	3.29 (2.63–4.11; <0.001)

[a]*Rural quintiles (1, remote village; 2, small rural town; 3, large rural town) vs. Urban quintiles (4, major regional center and 5, major city or capital city). Excludes learners with an international background. CI, confidence interval.*

TABLE 4 | Predictors of intention to work in a rural location where binary variable is rural vs. urban location at exit[a].

	Number in unadjusted analysis	Unadjusted odds ratios (95% CI; *p*-value)	Adjusted odds ratios (95% CI; *p*-value) *N* = 597
Increasing age	1,102	1.07 (1.04–1.10; <0.001)	1.09 (1.04–1.14; 0.001)
LMIC school	1,135	1.50 (1.16–1.93; 0.002)	2.01 (1.47–3.00; <0.001)
Female	1,132	1.51 (1.18–1.93; 0.001)	1.80 (1.26–2.55; 0.001)
Income bottom two deciles	790	1.09 (0.80–1.50; 0.576)	0.85 (0.57–1.25; 0.407)
Identify as underserved group	974	1.15 (0.83–1.58; 0.407)	0.80 (0.51–1.25; 0.335)
Rural background (Quintiles 1, 2 and 3)	958	1.76 (1.36–2.29; <0.001)	1.89 (1.33–2.68; <0.001)

[a]*Rural quintiles (1, remote village; 2, small rural town; 3, large rural town) vs. Urban quintiles (4, major regional center and 5, major city or capital city). Excludes learners with an international background. CI, confidence interval.*

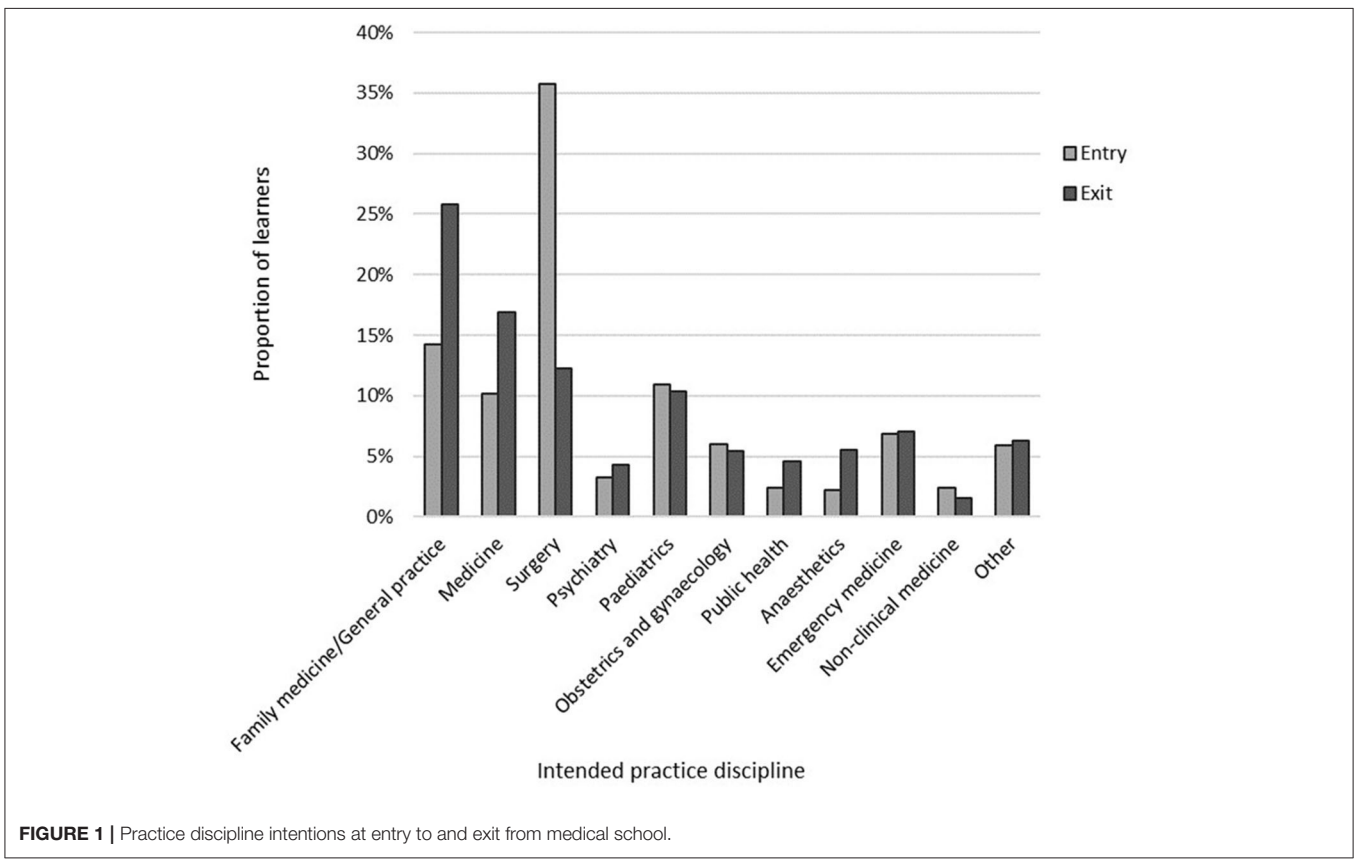

FIGURE 1 | Practice discipline intentions at entry to and exit from medical school.

TABLE 5 | Predictors of intention to work abroad where binary variable is "yes—intend to work abroad" and "No—don't intend to work abroad" at entry and exit for schools in LMIC.

	Entry	Exit
	Adjusted odds ratios (95% CI; *p*-value) (*N* = 560)	**Adjusted odds ratios (95% CI; *p*-value) (*N* = 176)**
Increasing age	0.81 (0.77–0.86; <0.001)	0.53 (0.41–0.70; <0.001)
Female	0.69 (0.48–1.01; 0.055)	1.45 (0.60–3.54; 0.413)
Income top two deciles	2.31 (1.36–3.93; 0.002)	2.74 (0.95–7.90; 0.063)
Does not identify as underserved group	1.82 (1.23–2.69; 0.003)	1.37 (0.49–3.84; 0.547)
Urban background (Quintiles 4 and 5)	1.85 (1.26–2.73; 0.002)	1.78 (0.68–4.64; 0.240)

Excludes learners with an international background. CI, confidence interval. Unsure option removed from analysis.

the rural health workforce in LMICs, it is important to increase the number of health professional education institutions with a social mission that are located in regional and rural areas, that recruit learners from rural backgrounds, and deliver primary health care focused curricula largely in regional, rural and community settings. As Strasser and Neusy (6) point out, training future health professionals in the contexts in which they will later be needed to serve is essential. In addition, it is vital to use policy levers to clarify the role of primary care providers/family physicians in the health system, and work to increase the prestige and recognition of these roles within the health system (24). Building postgraduate training programs with certification exams in family medicine/general practice, so that it can be recognized as a specialty in its own right, is an important step along that journey (17, 25).

Previous published analyses (based on smaller numbers of learners) demonstrated an association between students' intent to practice in a rural location after completing postgraduate training, and the drivers of: (i) coming from a rural and/or low income background; and (ii) their medical school being located in a regional area (13). This analysis confirmed the association of rural background with an intention to practice in rural areas at both entry and exit, and furthermore, found a consistent trend of higher odds of rural practice intention associated with increasing remoteness of learners' background. Compared with learners in HICs, learners in LMIC were less likely to have rural practice intentions at entry, but more likely at exit, suggesting that the power of these levers to strengthen the rural health workforce in LMICs might be even greater than in HICs (where the majority of studies to date have taken place). This is confirmed by other work coming from our partner schools in the Philippines (14) and Sudan (16). Further exploration of the cultural expectations of service and triangulation with placement experiences across settings may help to explore how these intentions change over the period of training and how strengthening the role of primary care within health systems could synergistically provide pathways and support for emerging health professionals.

Learners at exit were considerably more likely to intend a career in generalist disciplines, such as family medicine/general practice, than those at entry to their medical programs. Importantly, being female was associated with intention to practice in generalist disciplines and also with intention to practice in rural areas at exit, after adjusting for other learner characteristics and country income setting. These findings emphasize why community-based primary care focused training provided by these schools is so important to provide appropriate role models and inculcate the idea of service amongst their students (26). In the absence of these programs, it is difficult to have intentions to work in a discipline and geographic area to which there is no (positive) exposure, and with no clear profile or training pathway in the health system.

Many LMICs are experiencing challenges in implementing a primary health care approach as the role of family medicine, and training strategies and pathways are developed. Challenges include a low profile of family medicine, strengthening governance of primary care, unclear roles and responsibility for family medicine physicians, public mistrust in rural and primary health care providers, provision of appropriate training for the local context, limited infrastructure and supplies, and lack of evidence to inform policy makers (27, 28). While learners from LMICs in our study showed a high intent to practice in rural areas, a lack of policy support may pose significant challenges in realizing a rural workforce. Training in competencies and skills specifically for rural general practice has been incorporated into postgraduate training pathways for health professionals in HIC settings, and established to varying extents in LMIC settings. In Nepal and the Philippines for instance, efforts to support a PHC approach through postgraduate training programs in general practice/family medicine (21) have been challenging due to a lack of recognition of the value of primary health care in health policy, resulting in unclear career pathways and roles for general practitioners, and an overall effect of discouraging graduates from pursuing a generalist discipline. The Faculty of Medicine University of Gezira pioneered postgraduate training in family medicine in Sudan and is producing positive outcomes in rural practice. The program's first cohort of 207 candidates provided health services for 158 primary health care centers, most of them located in rural areas in Gezira State, of which 84 centers had never been served by a doctor (17). Recruitment of candidates to this program has been high reflecting the role of local universities in developing their communities however retention of the program's graduates in rural areas will become clearer in the future.

Interestingly, intention to work abroad was greater for learners at entry to the course than at exit (and although numbers are small at this stage of the prospective study, there was a significant shift to an intention to work in-country for learners with entry and exit data). This indicates a strong influence of educational experiences, both explicit and "hidden," in strengthening a desire to serve the local region. High levels of emigration of doctors is an issue for LMICs however this downward trend in intention to work abroad was apparent for schools in both LMIC and HIC settings. A desire to gain experience motivated the majority of learners in LMICs who

intended to work abroad at exit. Adding to this, a smaller proportion of learners in schools located in LMICs intended to work abroad for more than 10 years at exit, than at entry, suggesting that learners plan to return to the country of their medical school. These findings are particularly significant for LMIC countries, many of which have high rates of health worker emigration, few rural practitioners, and a privatized system that favors the wealthy. In addition, HICs have a responsibility to train an adequate workforce for their own rural areas, reducing dependence on international graduates (13).

This manuscript extends previous findings with a much larger cohort and matched data, allowing comparison between LMICs and HICs schools to assess the influence of the sociopolitical context of each school and the HRH planning context in the regions where the training takes place. There is increasing recognition that strengthening primary health care across LMICs is a critical component of strengthening health systems, particularly in rural areas where the population is dispersed, usually socio-economically disadvantaged and often more vulnerable to both communicable and non-communicable disease (2).

The strengths of this study are the inclusion of a large number of learners from a wide range of countries and contexts across five continents, collection of intention information at several time points, and the triangulation of contextual information about health systems and curricula with the survey data. Limitations however, include the fact that the majority of this data is still essentially two sets of cross-sectional data, with only 149 learners for whom matched entry and exit data is available to date and for whom true longitudinal information is available. In addition, given the many factors associated with choice of practice location, strong rural intent may not always result in later rural practice. Although early studies from some schools are encouraging (16), longitudinal studies with longer follow-up periods are important, especially given implications for future funding for rural initiatives (29). Furthermore, this study focused on learners' background characteristics and rural practice intent. It is the goal of socially accountable education to produce a workforce with a desire to serve the health needs of all underserved populations, including the urban underserved and those subsets of populations of lower socioeconomic status. Puddey et al. (30) found that graduates with a lower socioeconomic background were 1.63 times more likely to be practicing in areas of lower socioeconomic disadvantage, adding to the evidence for the need to select a diverse student body to meet the needs of underserved populations. Data from Ghent University were available but excluded for this analysis as rural practice was not considered to be sufficiently distinct from urban practice in Belgium.

CONCLUSION

Understanding the drivers to serve rural and underserved regions amongst medical students and junior doctors is critical in producing a fit-for-purpose health workforce to provide universal coverage to primary health care and strengthened health equity in low and middle income countries. Understanding impacts across all levels in the rural training pathway is vital to optimize the chances of achieving this goal.

DATA AVAILABILITY STATEMENT

The datasets generated for this article are not readily available because access to the de-identified data is considered on request by all participating schools. Requests to access the datasets should be directed to Sarah Larkins, sarah.larkins@jcu.edu.au.

ETHICS STATEMENT

This project has received ethical approval from the following bodies: James Cook University Human Research Ethics Committee, 4th November 2015, H6398 and then H7600. Ateneo De Zamboanga University Ethics Board Review, 2015. Flinders University, Social and Behavioral Research Ethics Committee (SBREC), 12th June 2014, Project Number 6387. Faculty of Medicine University of Gezira Ethical Committee. Lakehead University Research Ethics Board number 1465183, 20 May 2016, and Laurentian University Research Ethics Board number 6009708, 11 July 2016. Walter Sisulu University Faculty of Health Sciences Postgraduate, Training, Research and Ethics Unit, Human Research Committee, 3rd June 2014, Clearance 006/2014. Ethics Review Board, University of the Philippines, Manila. IRC, Patan Academy of Health Sciences. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SL, A-JN, and FC conceived of the study with later input from SE, TW, JCH, and CL. KJ has been responsible for data storage and management and much of the analysis reported here. SL, KJ, MG, SE, CL, FC, SU, A-BO, TW, JCH, SK, and SL played major roles in driving local data collection in their settings and contributing to local data analysis. KJ and SL drafted the initial manuscript with input from all authors. All authors contributed to the article and approved the submitted version.

FUNDING

THEnet has received support from Atlantic Philanthropies and the Arcadia Foundation. GOS research on NOSM students builds on tracking studies funded by the Ministry of Health and Long-Term Care, Ontario, Canada. All participating schools provided in-kind support for the study.

ACKNOWLEDGMENTS

We also acknowledge Sara Willems, Kaat Van Roy, Jennene Greenhill and Mary Mammen for their input into the conception and administration of the study. The authors would like to acknowledge all the learners and staff from THEnet partner schools in the community-of-practice who have contributed data to the THEnet graduate outcome study. The research team would like to thank medical students who completed the surveys. We also thank the deans of our schools who facilitated the conduct of this study. We thank our medical school administrators for their support of our study and the researchers who provided

assistance, in particular Margaret French. We extend our thanks to Professor Jehu Iputo (past dean of WSU) and Professor Ali Babiker Habour (past dean of FMUG) for huge efforts in reviewing this manuscript and unlimited support to THEnet Office activities.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2020.582464/full#supplementary-material

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Public Health

POLICY AND PRACTICE REVIEWS
published: 26 October 2020
doi: 10.3389/fpubh.2020.546382

Medical Scholarships Linked to Mandatory Service: The Nepal Experience

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Introduction: Nepal has one of the world's lowest physician to population ratios, with a critical shortage of rural physicians. The Nepal Government uses the private sector to address this shortage of rural physicians. All private medical colleges must offer total scholarships, free of cost, to a proportion of their annual MBBS student intake. These scholarships come with a compulsory two-year service contract, which must be completed at public hospitals post-graduation. The mandatory service requirement was implemented in 2005/2006 and this paper evaluates the first decade of this scholarship program, with particular attention to the mandatory service requirement.

Methods: We collected data on MBBS scholarship awardees from the Scholarship Section at the Ministry of Education, Department of Health Services, and the Ministry of Health and evaluated trends, service completion, and location.

Results: Initially, because of poor monitoring, the mandatory service completion rate was low. Rates increased to 74–98% when strict rules tied service completion certificates to obtaining medical registration. In the past 4 years, three cohorts of scholarship doctors who completed their service requirements served 78% of their service-days in rural hospitals (primary healthcare centers and district hospitals). Yet, geographic inequities in physician distribution persist. Only 51% of district hospitals had at least one scholarship doctor, 31% of the district hospitals had more than 1.5 scholarship doctors, while 7% had none. The district hospitals in the Central region, which includes the capital city, had twice the number of scholarship doctors compared to the Mid-western region, which includes some of the country's most remote areas.

Conclusion: The scholarship program has partially succeeded in reducing the physician shortage in Nepal's rural hospitals. To address the remaining inequities in physician distribution, efficient management systems, appropriate medical training, and support for rural practice are vital.

Keywords: medical education, medical scholarships, rural physicians, private sector, health policy

OPEN ACCESS

Edited by:
Matthew Richard McGrail, The University of Queensland, Australia

Reviewed by:
Tarun SenGupta, James Cook University, Australia
Jitendra Kumar Singh, Tribhuvan University, Nepal

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Specialty section:
This article was submitted to Family Medicine and Primary Care, a section of the journal Frontiers in Public Health

Received: *28 March 2020*
Accepted: *28 September 2020*
Published: *26 October 2020*

Citation:
Mahat A, Zimmerman M, Shakya R and Gerzoff RB (2020) Medical Scholarships Linked to Mandatory Service: The Nepal Experience. Front. Public Health 8:546382. doi: 10.3389/fpubh.2020.546382

INTRODUCTION

The World Health Organization recommends medical scholarships "with enforceable agreements of return of service in rural or remote areas to increase the recruitment of health workers in those areas" (1). Although conditions, incentives, and duration of mandatory service differ, a compulsory service strategy has been used in over 70 countries to recruit physicians to underserved areas

(2). For example, compulsory service strategies ensured that all districts in Mozambique and all municipalities in Puerto Rico had at least one doctor (2, 3), staffing improved in rural hospitals of South Africa (4), and physicians were more equitably distributed Thailand's district hospitals (5). However, compulsory service in five Indian states did not effectively place doctors in underserved areas (6).

Nepal is a low-income country with one of the world's lowest physician to population ratios of 2.1: 10,000 (7). This low ratio is coupled with inequities in physician distribution. Eighty-five percent of specialists and 56% of MBBS (Bachelors in Medicine Bachelors in Surgery) public sector doctors work in the Central region that includes the capital, Kathmandu (8).

The recruitment and retention of physicians in rural areas, where 83% of the population resides, has been a persistent challenge. In 2013, over half of the positions for doctors in rural public hospitals (77% of primary healthcare centers and 53% of district hospitals) were reported to be vacant (9). National health policies since 1991 have aimed to increase access of the rural population to a doctor through strategies including scaling up the production of different categories of health workers through the private sector, increasing the quality of pre-service education, and encouraging the deployment of graduates to rural areas (10–13).

This paper reviews government policy to use training scholarships to leverage the private medical education sector and improve physician placement in rural areas through mandatory 2-year service in public hospitals. It highlights that the successful enforcement of such a policy is dependent on the government's capacity to fund, regulate, coordinate, plan and provide adequate support and training for physicians.

In the early 1990s, the Nepal government allowed the private sector to offer medical education within the country. Consequently, ∼2,000 new MBBS doctors now graduate from Nepal's medical colleges every year. The private sector produces the largest number of physicians. Seventeen of the 20 medical colleges that currently offer an MBBS program are private. A 5.5-year MBBS program at a private institution costs about $40,000 USD. At a public institution, it can be as little as $2,500 USD.

In Nepal, the government requires that all private medical colleges offer complete scholarships, which offer free admission and tuition to a proportion of their annual student intake (10% for Nepali-owned, 20% for foreign-owned for-profit institutions). The number of scholarships differs each year depending on the number of students approved for intake by the Nepal Medical Council (NMC). These scholarships include a mandatory, post-graduation, 2-year work contract in government health facilities. These private institutions fund medical education, and the government pays the recipients' salaries during the mandatory service period.

The medical scholarship funding from the private sector has relieved the government of expenses otherwise required to produce doctors for its rural hospitals. However, the mandatory service requirement has only been enforced since 2005 (for the scholarship cohort of 2000). Until then, the government did not have the resources to pay the salaries of the scholarship doctors after graduation.

The MBBS Scholarship Program

The Ministry of Education (MoE) selects the scholarship awardees based on their performance in a competitive exam. This complies with the government directive, *Scholarship Rules 2060 (2003) (2002/2003 AD)* (14). According to these rules, 55% of the scholarship awards are open category, meaning that they are entirely based on merit while 45% of the awards are reserved for under-represented groups such as women, indigenous, socially/economically excluded groups, and people from remote areas (**Table 1**).

Under-represented groups can compete in both open and reserved categories. If a candidate from a reserved-population group who graduated from a community school does not pass the MoE exam, someone from the same population group graduating from other types of schools (e.g., private, non-profit, missionary, or public-private.) becomes eligible for the scholarship award. If candidates of the under-represented groups fail to pass the minimum requirements to fill the quota for the reserved category, the scholarships are awarded to candidates in the open category.

Within 3 months of graduation from medical college, scholarship doctors are required to report to the MoE and then to the Department of Health Services (DoHS) under the Ministry of Health (MoH) for posting at a public hospital. Late reporting results in a financial penalty. The DoHS places scholarship doctors in public hospitals based on vacant hospital positions at the time of reporting. The scholarship doctors are posted to a health facility for 2 years unless they have received a transfer letter. They may request a transfer themselves or be transferred by the DoHS to another hospital at any time.

During their mandatory service period, scholarship doctors are eligible to apply for permanent government service positions. If accepted in the Ministry of Health or any of the public security agencies (Nepal Army, Nepal Police, and Nepal Armed Police

TABLE 1 | Reservation category for Ministry of Education scholarships [adapted from Government of Nepal (14)].

Reserved category	Proportion of reserved category	Proportion of total scholarship
Women	33%	14.85%
Janajatis (indigenous group)	27%	12.15%
Economically or socially excluded	25%	11.25%
Dalit	9%	4.05%
Citizens from remote areas (*Accham, Kalikot, Jajarkot, Jumla, Dolpa, Bajhang, Bajura, Mugu, and Humla* districts)	4%	1.8%
Disabled	2%	0.9%
Total	100%	45%

Abbreviations: DoHS, Department of Health Services; HF, Health facility; MoE, Ministry of Education; MoH, Ministry of Health; MBBS, Bachelor in Medicine Bachelor in Surgery; NMC, Nepal Medical Council; PHC, Primary healthcare center.

Force), they can complete their mandatory service period as permanent government employees.

After 2 years of service, DoHS issues the scholarship doctors a certificate of service completion. Scholarship doctors who do not complete their service requirements are required to pay the government a financial penalty. If they do not complete their service nor pay the financial penalty, the NMC will not issue them a permanent registration nor will MoE issue a *Letter of no objection*. The NMC registration is required to practice medicine in Nepal, and the *Letter of no objection* is required for immigration clearance to leave the country on a student visa.

Nepal's Public Health Care System

Nepal's healthcare system follows a hierarchical hospital referral structure (**Figure 1**). Primary healthcare centers (PHCs) and District hospitals provide healthcare services to the rural population. District hospitals provide lifesaving emergency surgical services. Zonal, Sub-Regional, and Regional hospitals receive referral cases from their respective areas. The Central hospitals located in Kathmandu valley provide tertiary care and super-specialized services.

All districts have at least one district hospital or a referral hospital (zonal, sub-regional, regional, or central hospital). Sixty-three out of 75 districts have a district hospital. Some districts have more than one district hospital because a PHC was upgraded.

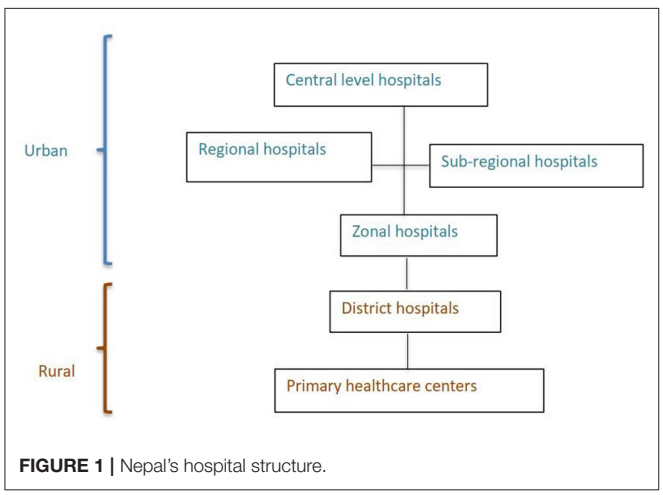

FIGURE 1 | Nepal's hospital structure.

Objective

This paper evaluated the first decade of Nepal's MBBS scholarship program. Specifically, it sought to answer the following:

- In the past 10 years, how many citizens were awarded MBBS scholarships to Nepal's private colleges?
- What percentage of the scholarship awardees completed their mandatory service?
- Where did the awardees serve their mandatory service and for how long?

METHODS

We collected the number and place of MBBS scholarship awards, the mandatory post-graduate service duration, and the completion status of the scholarship doctors. We merged data obtained from the DoHS, MoH, and the Scholarship Section of the MoE. Our study was limited to awardees at Nepal's private medical colleges.

We examined scholarship trends, service completion rates and service location.

Data on the category selected for the scholarship were often missing. The data on sub-categories (under the reservation category) for scholarship doctors was not available. Mandatory service data was also often incomplete. While for some years

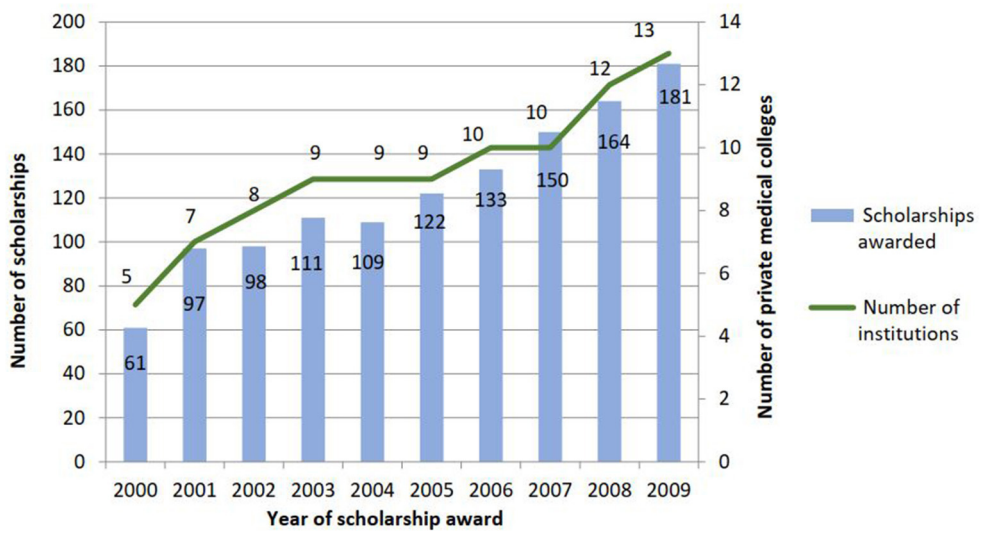

FIGURE 2 | Number of private medical colleges and scholarships awarded (2000–2009).

the scholarship doctors' documents were complete, other years did not have data on the location and duration of service during the bonded contract period. Furthermore, data on the location and duration of scholarship doctors' service were available only for the most recent three cohorts that completed their mandatory service (scholarship cohorts of 2005–2007). Therefore, we limited our service completion data analysis to these three cohorts only. The duration of service was calculated from the start date and end date per facility in the service completion certificates.

RESULTS

From 2000 to 2009, the MoE awarded 1,226 MBBS scholarships (**Figure 2**). The number of scholarships increased an average of 14% each year. The largest increase was in the first year (59% between scholarship cohorts 2000 and 2001) after which the number of scholarships increased by 8% per year. In 2009, 181 citizens were awarded MBBS scholarships in 13 private institutions compared to 60 scholarships in 5 institutions in 2000. This is a 197% increase in the number of scholarships and a 160% increase in the number of private medical colleges in 10 years.

Since the introduction of the reservation category in 2003 up until 2009, 58% of the scholarship awardees have been from the open category and 36% from the reservation category (with 6% missing data) (**Table 2**). This is less than the target ratio of 55:45. In 2009, 43% of the scholarships were awarded to the reserved category.

The vast majority (81%) of the scholarship recipients are male (**Table 3**). Before the reservation category for under-represented groups, only 3–11% of scholarship recipients were women. Since 2003, because they can also compete under both open and reserved categories, the proportion of female scholarship awardees has increased and is consistently more than the reserved 15% of the total scholarships. In 2004, 30% of the scholarships were awarded to women.

The scholarship awardees' service completion rate has increased over the past decade (**Figure 3**). Only 12–57% of the first four cohorts of scholarship awardees, between 2000 and 2003, completed their service, but 74% of the fifth cohort in 2004 completed their mandatory service. The service completion rate for the next three cohorts between 2005 and 2007 then ranged from 86 to 98%. The scholarship cohorts of 2008 and 2009 were in service at the time we collected data.

Over half of the scholarship doctors served in the same health facility for 2 years, 28% in two facilities, and 15% in three (**Table 4**). Among the 6% of doctors who served in more than 3 health facilities, most are those who, during their mandatory service period, joined the Ministry of Health as permanent employees.

We calculated the scholarship doctors' service-days from their DoHS certificate of service completion. Of the 374 doctors of the three cohorts who completed their service, details were available for all but one. The 373 doctors provided 271,067 service-days (**Table 5**) an average of 726.7 days of service (1.99 years) per scholarship doctor.

Considered together, the scholarship doctors completed three-quarters of their service-days in district hospitals (46%) and PHCs (32%), which serve rural populations. They completed 2% of the service-days in zonal hospitals, 3% each at sub-regional and regional hospitals, and the remainder at central hospitals of public security agencies, Ministry of Health, and District Health Offices.

Combining the last three cohorts that completed the mandatory service requirements, **Figure 4** shows the average number of scholarship doctors in district hospitals. In total, the doctors provided 124,726 service-days at district hospitals in the past 4 years. Had they been equitably distributed across the 70

TABLE 2 | Categories of medical scholarship recipients (2000–2009).

Scholarship year	Open category	Reserved category	Missing data	Total
2000	61(100%)	–		61
2001	105 (100%)	–		105
2002	98 (100%)	–		98
Total (2000 –2002)	**264 (100%)**			**264**
2003	68 (61%)	39 (35%)	4 (4%)	111
2004	65 (60%)	44 (40%)	0	109
2005	76 (62%)	44 (36%)	2 (2%)	122
2006	75 (56%)	45 (34%)	13 (10%)	133
2007	83 (55%)	44 (29%)	23 (15%)	150
2008	94 (57%)	59 (36%)	11 (7%)	164
2009	98 (54%)	77 (43%)	6 (3%)	181
Total (2003–2009)	**559 (58%)**	**352 (36%)**	**59 (6%)**	**970**

TABLE 3 | Sex disaggregation of scholarship awardees in private medical colleges (2000–2009).

Scholarship cohort	Female (%)	Male (%)	Remarks
2000	2 (3%)	59 (97%)	
2001	6 (6%)	91 (94%)	
2002	11 (11%)	87 (89%)	
2003	27 (24%)	84 (76%)	Reservation
2004	33 (30%)	76 (70%)	category enforced
2005	31 (25%)	91 (75%)	(14.85% of total
2006	33 (25%)	100 (75%)	scholarships for
2007	32 (21%)	118 (79%)	women)
2008	26 (16%)	138 (84%)	
2009	37 (20%)	144 (80%)	
Total	**238 (19%)**	**988 (81%)**	

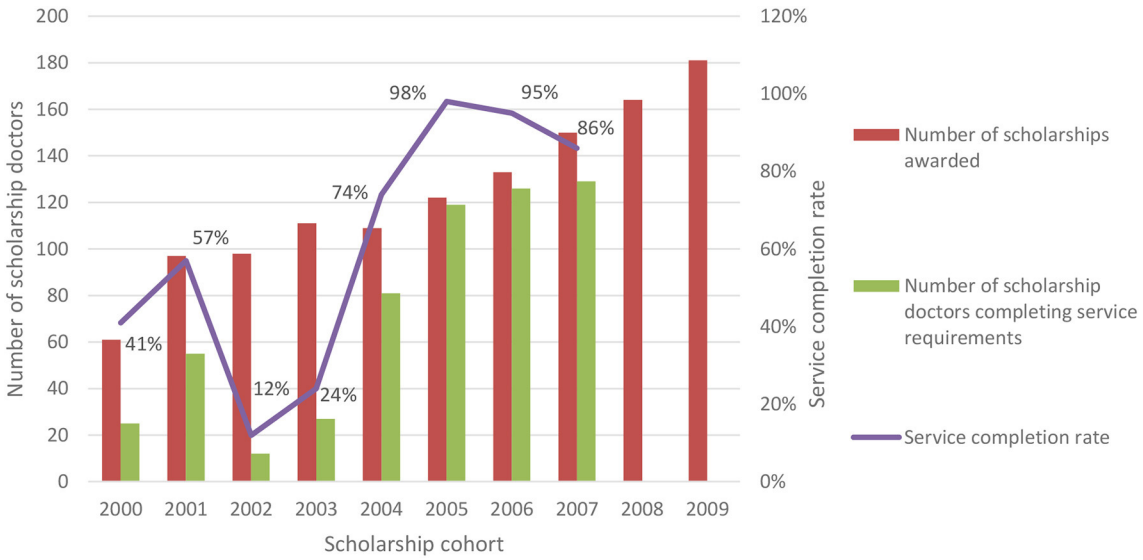

FIGURE 3 | Number of scholarships awarded and service completion rate of the scholarship cohorts.

TABLE 4 | Number of healthcare facilities in which the scholarship doctors were posted (scholarship cohorts 2005–2007).

Number of healthcare facilities served	Number of doctors	Percent
1	192	51%
2	104	28%
3	54	15%
4	19	5%
5	4	1%
Total	**373**	**100%**

TABLE 5 | Service days of scholarship doctors in different health facility types.

Types of health facility	Number of HFs served (total HFs)	Service-days	Percent of service days in different health facility types
Ministry of Health		3,525	1%
Central Hospital	3	3,533	1%
Regional Hospital*	3 (3)	7,466	3%
Sub Regional Hospital	3 (3)	8,622	3%
Zonal Hospital	11 (11)	33,752	12%
District (public) Health Office		1,716	1%
District (level) Hospital	66 (71)	124,726	46%
Primary Healthcare Center	118 (205)	87,727	32%
Total		**271,067**	**99%**

Includes Regional Tuberculosis center.

district hospitals, each hospital would have had 1.22[1] scholarship doctors, i.e., at least one scholarship doctor would be present in all district hospitals.

Between 2012 and 2015 (the mandatory service period of the scholarship cohorts 2005–2007), up to five scholarship doctors worked in a district hospital at a time. Thirty-six district hospitals (51%) had one or more scholarship doctors while 34 hospitals (49%) had less than one. Twenty-two district hospitals (31%) had more than 1.5 doctors, of which 3 hospitals (4%) had more than 3 scholarship doctors. In contrast, no scholarship doctor served in five district hospitals (7%).

The number of scholarship doctors in district hospitals varied by the development region (**Figure 5**). The Central, Western, and Eastern development regions had more than one scholarship doctor per hospital while the Mid-western and Far-western regions had fewer. Compared to the Mid-western region, hospitals in the Central region had twice the number of scholarship doctors (1.6 vs. 0.74).

DISCUSSION

In the early years of the mandatory service enforcement in Nepal, the scholarship doctors' service completion rate was low (scholarship cohorts of 2000–2003) because of weak program monitoring. To resolve this, the government enforced new rules that tied the service completion certificate to the *MoE Letter of No Objection* and the NMC registration. These rules required the doctors to present official letters and attendance sheets from the hospitals as evidence of their service. Consequently, the service completion rate increased

[1]Number of scholarship doctor per district hospital = (Total number of service-days in district hospital)/(number of district hospitals*number of years*number of days in a year).

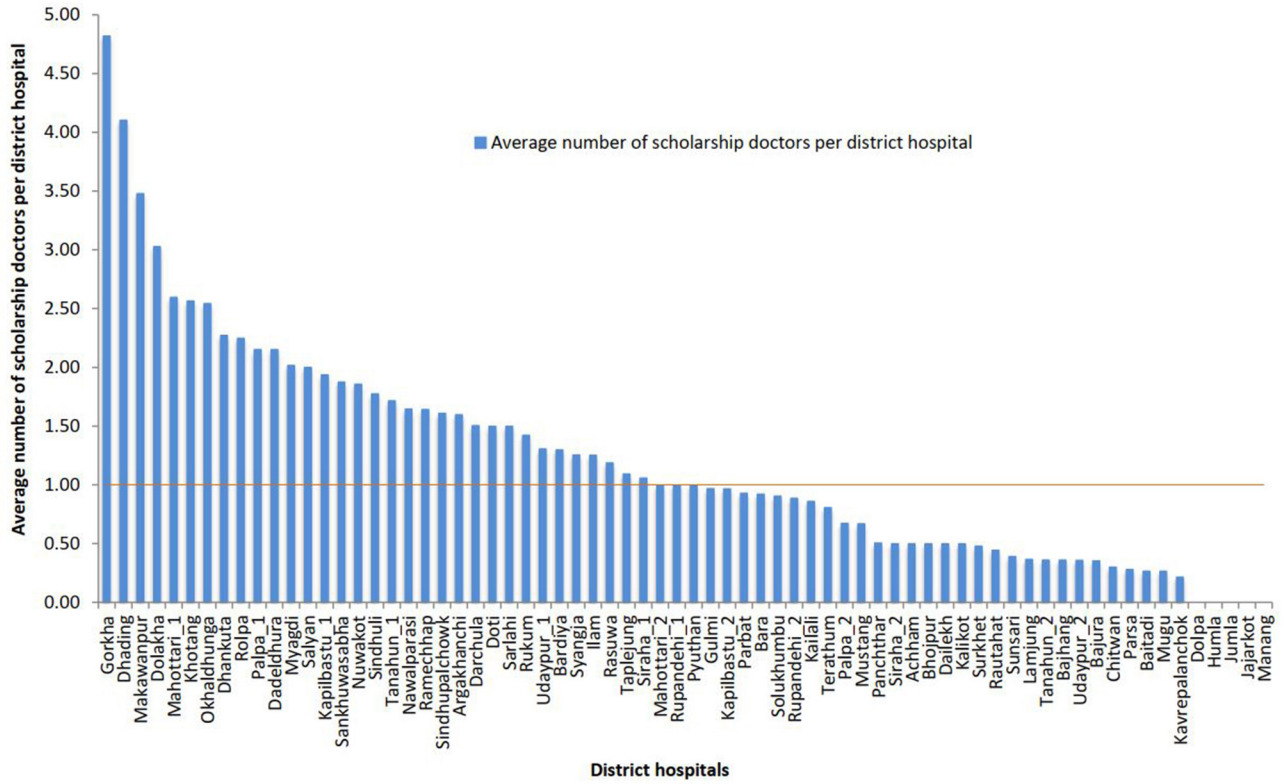

FIGURE 4 | Average number of scholarship doctors per district hospital in the past 4 years.

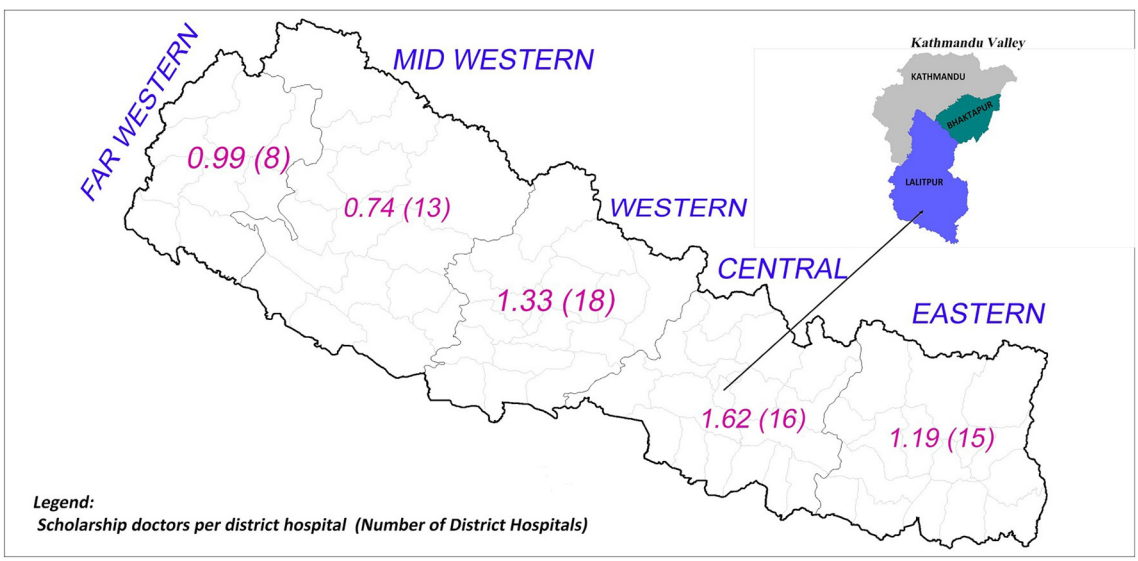

FIGURE 5 | Average number of scholarship doctors per district hospital across development regions in the past 4 years.

from 24 to 74%. It also provided detailed data to the agencies at the MoH and MoE on the duration of service at each hospital. In the last three scholarship cohorts, the annual mandatory service completion rate has consistently been over 85%.

Government regulations appear to ensure a high service completion rate for those intending to practice medicine in Nepal. However, loopholes exist for defaulters who leave the country on a non-student visa or who quit the medical practice. Vietnam, Mongolia, and Ethiopia have used stricter

measures such as withholding degrees until mandatory service is completed (2).

The proportion of medical scholarships selected entirely on merit dropped from 100% in 2001 to 54% in 2009. During this period, the proportion of women increased from 3% in 2001 to 30% in 2004. The reservation category for scholarships has given people from under-represented and excluded population groups the opportunity for medical education free of cost which would otherwise not be possible.

Nepal's scholarship program provides a regular supply of physicians for rural public hospitals. Of the 1,447 approved positions for doctors in the public sector in 2011, 335 (23%) were for those coming through the scholarship program (15). Before enforcing mandatory service obligations, doctors were less likely to work in rural areas. For instance, of the first 22 cohorts of Nepal's oldest medical college, only 27% of MBBS graduates worked outside the Kathmandu valley (16). In the public sector, only 32% of the generalist medical doctors work in rural areas (8). In contrast, the past three cohorts of scholarship doctors spent 98% of their first 2 years of practice outside of the Kathmandu valley and 78% in district hospitals and primary healthcare centers.

Despite these promising figures, geographic inequities in physician distribution remain. In the past 4 years, an overwhelming majority of scholarship doctors served in district hospitals in the Central, Western, and Eastern development regions. The Mid-western and Far-western regions, where the scholarship doctors served the least, are furthest from Kathmandu and include some of the most remote areas of the country. These findings are similar to the distribution of medical specialists, 85% of whom are based in the Central region (543), with only 5% in the Mid-western ($n = 22$) and Far-western ($n = 4$) regions. In the private sector, 68% of the specialists ($n = 894$) work in the Central region compared to 4% in the Mid-western ($n = 29$) and Far-western ($n = 19$) regions (8).

The scholarship program has been unable to place doctors in some areas with the greatest need. Although over three-quarters of the service-days of the scholarship doctors were spent in rural areas (either district hospitals or primary healthcare centers), their distribution varied according to their proximity to urban centers. The Mid-western region has the highest human poverty index in the country (17). Half of the children under five are mal-nourished (17) and the diarrheal mortality rate is twice the national average (18). The average life expectancy in the five districts where no scholarship doctors were posted (Dolpa, Humla, Jumla, Jajarkot, and Manang) ranges from 61 to 66 years, substantially below the national average of 69 years (13). The US National Health Service Corps, a program that provides loan repayment or medical scholarships for primary care service in underserved areas encountered similar difficulties. Areas with worse population health measures were less likely to benefit from program physician placements (19, 20). The inequity in the geographic distribution of doctors can be attributed to several factors.

Program Management

Several issues concerned with the management of the program contribute to the geographic inequity. The main offices responsible for the MBBS scholarship program, the MoE and the DoHS do not coordinate or communicate about scholarship doctors. Data on the selected category of the scholarship doctors, the expected number of doctors from the mandatory service program, and the availability of physicians in each government facility under different types of contracts at any given time are not available in one platform. Hence, planning for appropriate positions is absent.

A transparent and accessible system is required to assign scholarship doctors to different hospitals. For example, in Norway, each graduate is randomly given a number and within 6 h of receiving the number, the graduates are called in numerical order to choose from among the available places (2). In Nepal, since the placement of scholarship doctors is at the discretion of DoHS officials, the doctors can exert influence, avoid the most remote postings, and be assigned to locations near big cities. The *Implementation Guidelines for Nepal Government Scholarship Recipient Doctors and Health-workers 2071* (2015) attempts to prevent doctors concentrating in certain hospitals by specifying the maximum number of scholarship doctors that can be posted at a health facility (21).

The timing and duration of a posting are also important. Although the scholarship doctors should report for service at the DoHS within 3 months of graduation, they are still eligible for posting beyond this period after paying a small financial penalty. This allows them to delay starting work until positions near urban centers become vacant. For the past 4 years, 21% of the scholarship doctors were posted for an average of less than a year in one healthcare facility. This shows the instability of staffing in public hospitals.

Finally, MoE tracks defaulters only after someone from the general public files a petition against a defaulter. The defaulter can still choose to serve the mandatory period after payment of a late fee instead of the larger financial penalty for breaking the terms of the contract. Regular tracking of scholarship recipients is necessary to ensure scholarship doctors fulfill their service obligations within a specified period or pay a bigger penalty. Local governments and/or communities could be utilized for this tracking (19).

Medical Training

There is no evaluation of the scholarship doctors' capacity and motivation to work in Nepal's remote. Such evaluations are important because often, the for-profit private medical colleges are designed to serve the global market rather than the local population's primary health care needs (22).

For new graduates, Nepal's remote public hospitals are extremely challenging workplaces. They often have a high volume of patients, are understaffed, face shortages of hospital equipment and supplies, laboratory, and radiological diagnostic support are limited or absent, and the sites have poor communication facilities. Supportive supervision may be poor or absent. Although the government has implemented a telemedicine program in 30 district hospitals so specialists can provide support in diagnosis and management, it is yet to be fully utilized because of challenges such as inconsistent power supply, inadequate information technology capacity, infrastructure challenges, and funding shortages (23).

Another solution might be to follow the experiences of the scholarship system in South Africa, where the internship period for doctors has increased to 2 years to prepare them for independent practice in district hospitals (24). The first year of mandatory service could be based in larger hospitals to build the capacity of recent graduates' to work in remote areas the second year.

Additional Support

Scholarship doctors are paid a graded salary. Additional rural financial incentives are provided for those working in rural and remote areas. However, financial incentives are not sufficient to ensure quality healthcare services. For Nepal's scholarship doctors, there are no additional advantages to serving in rural postings except for being eligible to apply for openings at government-owned institutions during the mandatory service period.

Mandatory rural service programs work best when combined with additional support such as comfortable housing, central personnel management, security, and a supportive working environment (1, 25, 26). The current program has not considered these factors even as the government enforced mandatory service for MBBS from public medical colleges from 2015 and for all specialists under government scholarships since 2018.

LIMITATIONS

This study depended entirely on the data available at the DoHS and MoE, as no other source was available. MBBS doctors working in public hospitals are recruited through permanent positions at MoH, temporary contracts at some hospitals, and through the MBBS scholarship program. All these doctors are managed through different human resource management systems within different divisions and departments of MoH. We focused solely on the doctors recruited through the MBBS scholarship program for private medical colleges. Without data on non-scholarship doctors, we cannot say what portion of the public sector MBBS positions were filled through this program.

Data on defaulters was not available. The penalty amount is deposited in the Internal Revenue Department, and this information is not recorded in the relevant agencies within the Ministries of Education or Health. We cannot say if those graduates not completing the mandatory service requirements paid the financial penalty, if they dropped out of medical college, or avoided the rural postings after graduation.

The scholarship doctors' service-days have been calculated from their DoHS certificate of service completion. These counts may include holidays and entitled leave. The scholarship doctors are allowed 30 days of leave that cannot be taken together, but we do not have data on how much of the entitled leave was used. Therefore, one must interpret the service-days results with caution.

The inconsistency in data completeness (e.g., details on the category of scholarship, the background of doctors, details on service, data on other graduates) did not allow for a rigorous analysis on the association of the scholarship doctors characteristics with the likelihood of rural service and limited our analysis to service completion status of three cohorts only.

Finally, this study does not consider the quality of medical education, working conditions in rural hospitals, the career paths of the scholarship doctors, and stakeholders' perspectives (e.g., scholarship doctors, hospital managers/supervisors, patients, MoE, and MoH representatives). These are critical factors that determine program effectiveness and must be considered when improvement recommendations are developed.

CONCLUSION AND RECOMMENDATIONS

Nepal's MBBS scholarship program has provided considerable medical education opportunities to the citizens including under-represented groups and communities without using government funds. The program has partially succeeded in addressing the rural physician shortage.

Low- and middle-income countries struggling to place doctors in rural hospitals can learn from Nepal's experience leveraging the private sector to fill the human resource for health gaps in rural public hospitals. To reap the full benefit of the program, along with mandatory rural service contract, the emphasis must also be on (a) the equitable distribution of MBBS physicians during their mandatory service period, (b) the creation of favorable working conditions to deliver high-quality service, and (c) provision of appropriate physician training for practice at remote health facilities to achieve the objectives of the MBBS Scholarship program.

Considering this, we make the following recommendations:

1. *Improve coordination between relevant agencies* to ensure physician production and postings are well-planned, medical training is aligned with population needs, infrastructure and logistical support are available in rural health facilities, defaulters are actively tracked and penalized, and the program meets its objectives through a consolidated health workforce department that hosts accurate data on the health workforce.
2. *Establish information systems* under different ministries that record complete information and are compatible and ensure access, input, and import relevant digital data for regular monitoring, analysis, and evaluation to support planning.
3. *Enforce mandatory rural service contracts* for physicians trained under government scholarships or subsidies. Medical degrees and/or medical council registrations should be conditional upon service fulfillment.
4. *Utilize the private sector for government scholarships* ensuring that under-represented groups and rural populations are included in the scholarships.
5. *Ensure that the quality of medical education* and the training curricula meets the health needs of the local population.
6. *Create a systematic and transparent process for posting scholarship doctors* based on local needs, that avoids cherry-picking postings and taking into account the background, availability, and to some extent, graduates' preferences.
7. *Provide adequate support and bundled incentives to rural physicians* such as comfortable housing, security, communication support including operational telemedicine services, supportive supervision, and mentorship from

senior role models in government hospitals, opportunities for continuing medical education, peer support, reasonable financial bonus, and opportunities for training and promotions.

AUTHOR CONTRIBUTIONS

AM conceived the study and led data collection. AM, RBG, RS, and MZ contributed to data analysis. AM and RBG contributed to writing the manuscript. RS provided coordination and administrative support. MZ supervised the study. All authors contributed to the article and approved the submitted version.

FUNDING

This study was funded by the Nick Simons Institute, a Nepal based organization that works to support rural healthcare (www.nsi.edu.np).

ACKNOWLEDGMENTS

We thank the Department of Health Services, Ministry of Health and Scholarship Division, Ministry of Education of the Government of Nepal. We also thank Dr. Senendra Raj Uprey, Dr. Pushpa Chaudhary, and Dr. Rajendra Pant, former Director Generals at DoHS, and Dr. Anil Shrestha and Dr. Rishav Shrestha at Nick Simons Institute for their support.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Public Health

ORIGINAL RESEARCH
published: 03 November 2020
doi: 10.3389/fpubh.2020.569279

A Situational Mapping Overview of Training Programmes for Community-Based Rehabilitation Workers in Southern Africa: Strategies for Strengthening Accessible Rural Rehabilitation Practice

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OPEN ACCESS

Edited by:
Belinda Gabrielle O'Sullivan, University of Queensland, Australia

Reviewed by:
Krista Mincey, Xavier University of Louisiana, United States
Alice Cairns, James Cook University, Australia

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Specialty section:
This article was submitted to Public Health Education and Promotion, a section of the journal Frontiers in Public Health

Received: 04 June 2020
Accepted: 05 October 2020
Published: 03 November 2020

Citation:
Ned L, Tiwari R, Hess-April L, Lorenzo T and Chikte U (2020) A Situational Mapping Overview of Training Programmes for Community-Based Rehabilitation Workers in Southern Africa: Strategies for Strengthening Accessible Rural Rehabilitation Practice. Front. Public Health 8:569279. doi: 10.3389/fpubh.2020.569279

In 2018, the United Nations global report showed that people with disabilities, who make up 15% of the worlds' population, have poorer health and rehabilitation access (SDG 3). Without improving the needed person-centered health and rehabilitation services at household level, SDG 3 cannot be achieved. This includes addressing human resource shortages through training multi-skilled community based rehabilitation workers (CRWs) to build rural workforce capacity and enhance the lives of people with disabilities, particularly in LMICs where the need is higher but resources are lower. However, to date, there is no documentation and analysis of existing training and its scope for this workforce in LMICs. A situational mapping overview was undertaken to review the current status of rural rehabilitation training programs offered in Southern Africa for CRWs. CRWs are rehabilitation personnel, based in the home/community, who are not professionals (without a bachelor qualification) but render non-institutional rehabilitation and inclusive development in communities, under the supervision of rehabilitation practitioners. Information on these programs was obtained using a two-step process. Firstly, a descriptive list of university courses for rehabilitation workers offered in the Southern African countries was collected via an internet and literature search. Secondly, detailed information about the disability and rural rehabilitation courses was collected from the respective institutions and their designated websites. There are six training courses targeted at CRWs or disability practitioners with a disability focus being offered at universities in Southern Africa, five of these in South Africa and one in Zimbabwe. Additionally, four training courses are offered as online/open resources by global organizations and are self-directed with no accreditation. While other key competencies feature, none of these programmes' learning outcomes make direct reference to the

rural practice context and its complexities in relation to disability and poverty. The situational mapping overview shows limited training targeted at CRWs in Southern Africa, to effectively facilitate rural rehabilitation, poverty reduction and social inclusion. There is a need for an articulated community-orientated rural training to respond to the unmet needs. This may require a different set of competencies and assessment standards for trainees as well as additional competencies for their supervisors and mentors.

Keywords: community-based rehabilitation, community rehabilitation worker, disability, training, rurality

INTRODUCTION

In the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD), disability is defined as "those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others" (1). The World Report on Disability estimates that 15% of the world's population has some form of disability, and of those, 80% live in low-income countries with little or no access to basic health and social services (2). While a higher proportion of people with disabilities live in relative poverty in both high and low-middle-income countries, rural contexts, particularly, tend to have higher prevalence of disability because of the intersection between disability, poverty and rurality which heightens the barriers to health, rehabilitation, education and work (3–9). Recent data from nine countries in Southern Africa suggests that an average of 64% of people with disabilities who need rehabilitation are not able to access these services (10)–this is an ongoing problem in rehabilitation practice and the situation may be dire in rural contexts.

Adequate numbers of available trained workers who deliver rehabilitation services is an important proxy for ensuring the realization of rehabilitation goals within the context of human rights especially in low resource settings. Consistent with literature, the demand and need for rehabilitation is much higher than what can be provided by available services in low- and lower-middle-income countries (LMICs) (11). This is compounded by a low density of well-trained rehabilitation practitioners required for the delivery of adequate services (12–14). The situation remains worse in rural contexts (15, 16). Consequently, human resource analysis shows higher disability prevalence and higher service demands in contexts with shortages of human resources (11). While many human resource national plans and reviews tend to leave out rehabilitation (2), studies in countries like in South Africa (17–19), in Malawi (20) and in Kenya, Tanzania and Uganda (9, 21) indicate this field and its workforce constraints in less resourced settings (22).

Given that shortages of appropriately trained and deployed human resources is one of the bottlenecks for expanding access to rehabilitation services (14), one way of decentralizing and expanding service delivery is a deliberate focus on human resources at home and community levels in order to increase the supply of and access to rehabilitation closer to where people live (14). With the specialized skill and experience of working at household and community level, CRWs are the most cost-effective resource who could play a role in strengthening access and services, particularly in Africa where such workers are already in rural communities and, with training, can provide independent rehabilitation services, over recruiting workers from outside the community (23). However, a recent systematic review on the effectiveness of alternative cadres in community based rehabilitation (CBR) shows that, there is a need for more research on the training, development of these workers (22).

In the context of community based rehabilitation practice, mid-level workers are generally known as community-based rehabilitation workers(CRWs) (24) or community rehabilitation facilitators (CRFs) (12) or community disability workers (CDWs) (25). For the purpose of this paper, the term community-based rehabilitation workers (CRWs) will be used as a generic term to refer to these workers. CRWs are rehabilitation personnel, based in the home and/or community levels, who are not professionals (without a bachelor qualification) but render person-centered and community-based rehabilitation and inclusive development at home under the supervision of rehabilitation practitioners (with a bachelor qualification based in district hospitals), thus compensating professional human resource constraints and improving access to rehabilitation and health services particularly in rural contexts (24, 26). They work across the community non-hospital based health, education, labor, social and development sectors as guided by community based rehabilitation (CBR) Guidelines (27) to ensure effective implementation of community based inclusive development (CBID) (20, 21). CRWs, as key drivers of CBR, were introduced into community based rehabilitation as part of an interdisciplinary rehabilitation team with their role including following-up of clients seen at primary health care (PHC) level services (28, 29). Being primarily community based, CRWs engage and support people with disabilities, their families and communities in a range of rehabilitative, education and advocacy activities, frequently aimed at maximizing inclusion, social integration and participation (30). In addition, their work also puts emphasis on disability on the facilitation of empowerment of people with disabilities and their families for social and economic inclusion of people with disabilities (27).

Against this background, much is already known about the impact of CRWs, inclusive of rural settings. For instance, Chappell and Johannsmeier (12) showed that these workers transcended the result of individual medical rehabilitation in South Africa to include aspects of community development and equalization of opportunities which involved poverty reduction and social inclusion. Another study in three rural communities in

Botswana, South Africa and Malawi found that these workers to be bridging the gap between people with disabilities, their families and services at district level (31). Working at community level, they are also able to assist authorities to identity, screen, build trusting relationships and support people with disabilities and their families (32) thus facilitating the restoration of dignity and a sense of belonging (12). Furthermore, a national study (24, 33) in South Africa demonstrated the role played by CRWs in reducing inequalities in access to health and social services through coordinated actions toward mobilizing resources across different government departments. A common finding on these studies is that, for communities where CRWs were present, people with disabilities had better access to education, healthcare and other social services (24, 33). This ensures that people with disabilities are not left behind. Given the resourcefulness of these workers, what training is available to build the skills of this workforce and strengthen the already under resourced rehabilitation practice? What learning outcomes are targeted by such available training? And can the training improve rural practice?

Training Needs of Community-Based Rehabilitation Workers

The shortage of rehabilitation workers to address rehabilitation needs at a community level underlines the need for the development of education and training programs for community-based rehabilitation workers. Training programmes need to be regularly reviewed to ensure their continued relevance. Given that gaps in service-delivery, as perceived by people with disabilities, include poor identification of needs, not having basic needs met and inadequate community interventions (12), deficiencies in services such as health care, rehabilitation, social support and assistance combined with financial constraints and inadequate and inaccessible transport (8, 34), it would be crucial that training of CRWs prepares them to respond accordingly. For example, as Chappell and Johannsmeier (12) further emphasized, training needs to address development and barriers at the community level rather than solely focusing on impairment needs, more clinically—oriented interventions at home. Supporting this, a recent scoping review on the training needs for CBR workers not only highlights the need for training in clinical, management, and cultural competence skills but also the need for competencies such as empowerment of people with disabilities and community development practice skills to be addressed in training programmes (35). As such, CBR training assumes significance as gaps highlighted toward developing skills for a critical practice of rehabilitation include tenets of disability inclusion, human rights and social justice. Additionally, such training needs to equally address the need for ongoing professional development of CRWs. For example, adopting flexible and blended training approaches could facilitate the needed ongoing development (35) because it moves away from training that is not solely based in urban centers.

The development of these workers also requires that they attain specific relevant competencies. One study which explored the competencies that could strengthen the training of CRWs for disability-inclusive development in rural areas of South Africa, Botswana and Malawi identified a unique set of competencies (36). These competencies included; integrated management of impairment needs with a focus on functionality, advocacy, negotiation, networking, empowerment and capacity building skills (36). The study reiterated that it is imperative for training programmes to build skills in inter-sectoral and inter-disciplinary collaborative practice with specific reference to the complexities that rural contexts pose to the work of CRWs. In a different context, in Australia, the Rural and Remote Allied Health Competencies—Senior Professional (RRAHC-SP) framework suggests 88 competencies under 33 sub-domain and eight overarching domain areas. The eight domains include: service delivery, equity and diversity, professional skills, ethical practice, development and support, quality and safety, clinical management and clinical skills (37). While rural contexts are not homogenous, these competencies relate to the ones identified in the Southern Africa study and are responsive to the needs identified above.

However, there is a dearth of information on what current training of CRWs is available in the Southern region and secondly, how the training addresses needs and competencies required for under-resourced rural settings. Additionally, there remains an unanswered question on whether the training of CRWs should focus on developing generalist or specialist competencies for practice in rural contexts. Therefore, the aim of this study was to conduct a situational mapping overview of the current status of training offered for community based rehabilitation workers in Southern Africa, with a particular focus on advocating for training that capacitates CRWs' understanding of CBR and skills to effectively carry put their roles in response to the needs of people with disabilities in rural contexts. The objectives were to:

- Explore the programmes' admission requirements, mode of learning, course description, length and learning outcomes
- Propose strategies for development of community based rural rehab workforce and practice through training.

MATERIALS AND METHODS

This was a situational mapping overview (38) study aimed at mapping out existing training programmes for community-based rehabilitation workers. Such mapping categorizes literature, examines a situation in order to understand it and helps to identify gaps on a particular topic from which to conduct further research or reviews (38). The data regarding the existing CBR and disability inclusive development courses were obtained using a two-step process and the information was entered into a matrix.

As the first step, we created a list of courses offered in the Southern African countries i.e., Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, and Zimbabwe. We conducted an internet search using the Google search engine. Published literature was utilized to direct us to institutions offering disability and rural rehabilitation programmes and websites of various universities and institutions searched. Only certificate and diploma courses ranging in duration from short-term (3 months) to longer term

(2 years) were included in the analysis. Keywords used for the search included "Community based rehabilitation," "disability inclusive development," "Community based rehabilitation workers," "Southern Africa," "Community-based rehabilitation OR training programme," "Community-based rehabilitation OR training course," "Community-based rehabilitation workers OR training OR education," Community-based rehabilitation OR disability inclusive development course"; Community-based rehabilitation OR disability inclusive development training course" These specific phrases were searched independently and combined using connecting words.

In the second step, detailed information about the disability and rural rehabilitation programmes was collected from the respective institutions and from the designated websites of these institutions. The institutes with limited information were contacted through e-mails to get more information regarding the available programs, eligibility criteria, duration, nature of the program etc. Websites from specific NGOs with information about CBR and disability inclusive development training courses, documents of training manuals/tool-kits, and reports about training were also searched. NGO websites that provided freely accessible on-line manuals/toolkits, which tend to be more generic, focusing on the CBR guidelines or principles of disability and inclusion, and not tied to a specific country, e.g., Light for the World's CBR manual and CBM's Disability and Inclusive Development toolkit were also reviewed.

The collected data or information was incorporated into a matrix and the findings were triangulated wherever possible. Learning outcomes were accessed through each programmes' website, and analyzed through a deductive thematic analysis process. This implies that pre-defined codes (as shown in **Table 3**) were drawn from literature on CBR worker competencies and training needs. Each of the programmes' learning outcomes were assessed against these pre-defined codes. All data was available in the English language. All programmes that were not eligible to this level of workers and training that was toward a professional degree were excluded.

Ethics approval was obtained from the Stellenbosch University Health Research Ethics Committee (HREC Reference No: X19/03/007).

RESULTS

The paper reports the findings of the ten training courses being offered in CBR and disability inclusive development in Southern Africa in the year 2019–2020. **Table 1** displays details of programmes, entry requirements, course information, and learning outcomes. **Table 2** displays open source training resources available.

Course Descriptions

There are 6 formal training retrieved courses targeted at community-based rehabilitation workers or disability practitioners with a disability focus being, offered at universities in Southern Africa. Five of these are offered in South Africa and one in Zimbabwe. While these 6 formal courses require a graduate degree as an entry requirement, they are also open to people who only have relevant years of experience with no qualifications. This implies that those who have a high school level of education and some experience in the field of disability and rehabilitation are also eligible. In the absence of proof of such formal qualifications, course participants are selected based on the recognition of their prior learning (RPL) in their particular field or area of disability and rehabilitation practice.

Additionally, 4 training courses are offered as online/open resources by global organizations. These courses also target community-based rehabilitation workers, people with disabilities and people working for NGO's but do not provide a formal qualification or accreditation as they are less formal, have no eligibility and are self-directed. The less formal training focus more on improving people's practical skills.

Mode of Learning

All the formalized training programmes are offered by institutions of higher learning which are public universities. All the currently existing programmes, offer their courses in blended learning mode. All the formal programmes happens at institutional level. Apart from the informal training by CBM, none of the other programmes take place at community level or in rural contexts. While the higher certificate offers practice learning at community levels of care, this remain limited to urban settings due to the situatedness of the programme. The informal online programmes are self-directed, implying that CRWs within rural contexts could access these programmes as part of continued professional development.

Scope of the Programmes' Learning Outcomes

Competencies that were listed by most courses encompassed an understanding of the concept of disability inclusion and skills related to clinical care or rehabilitation, health promotion, and community participation. Knowledge on disability and diversity as well as disability legislation were also listed by the majority of programmes (See **Table 3**). Fewer programmes listed competencies such as knowledge related to advocacy, cultural awareness, human rights, social justice, disability information and management as well as disability research. Only one programme specified knowledge on the CBR guidelines, while other competencies that were listed by the least number of programmes included monitoring and evaluation, ethical practice and capacity building of people with disabilities. None of these programmes' learning outcomes make direct reference to the rural practice context and its complexities.

DISCUSSION

Our intention with this situational mapping overview was to determine the current status of existing training for CRWs, with a particular focus in rural practice. At the core of decentralizing and expanding rehabilitation services is a deliberate focus on human resources at the community level (14). Additionally, development of a skilled rural workforce through training rural people in rural settings to deliver the services needed in the community is a tenet of rural training pathways (39). Training of

TABLE 1 | Details of formal training currently available.

No	Programme	Admission requirements	Course info	Learning outcomes
1.	Post-graduate Diploma in Disability and Rehabilitation Center for rehabilitation studies, University of Stellenbosch, South Africa	A bachelor's degree or equivalent, qualification at National Qualifications Framework level 7, or Recognition of prior learning (RPL) where in some or other manner attained, in a particular field of study, a standard of competence.	Focuses on strengthening and deepening knowledge and theoretical understanding of disability and rehabilitation, with the aim of promoting the development of current thinking, response and practice in disability and rehabilitation studies. Comprehensive rehabilitation education and training programmes, research and community interaction opportunities for all health sciences and rehabilitation-related professionals at all levels of health services and in the community. Duration: 1 year	• Demonstrate responsible participation in the promotion of the quality of life and full inclusion of all persons with disabilities in the local, South African and global community. • Demonstrate sensitivity to, and strive for a deep understanding of cultural, religious, social and ethnic diversity and its impact on the disabled person. • Identify and find solutions to disability and rehabilitation-related problems through thinking within an outcomes-based approach • Work effectively with persons with disabilities, disabled persons organizations and other community groups; • Demonstrate familiarity with the legislation, policy documents and research literature in the field of disability and rehabilitation, and critically relate relevant literature to individual scope of practice; • Identify and define complex problems within the disability and rehabilitation scope of practice, and apply appropriate knowledge and skills to solve them; • Identify contradictions, challenge orthodox theory and practices, and suggest new approaches in the field of health, disability and rehabilitation; • Demonstrate comprehensive knowledge of the programme delivery principles, concepts and models in the field of disability management and rehabilitation, as well as the various contexts at primary, secondary and tertiary level in which these apply; and • Demonstrate mastery of advanced theory and its application to the specialized field of disability and rehabilitation.
2	Post-graduate Diploma in Disability Studies, Disability Studies division, Department of Health and Rehabilitation Sciences. UCT. South Africa	An undergraduate degree or equivalent in any discipline. Applicants who do not have an undergraduate degree may apply for admission on the basis of Recognition of Prior Learning (RPL) e.g., experience in the field of disability and development;	• The PG Diploma in Disability Studies programme aims to increase awareness and informed participation in disability issues at a teaching, research and community-based programme level. • Duration: 1 year	• Understand disability as an issue of diversity with deep psychological roots that results in social injustice because of power and privilege that favors the non-disabled norm • Be able to critically engage with research in the light of the transformative aims of the disability practitioner • Be familiar with the discourse of the discipline of Disability Studies with conceptual understanding and the ability to communicate understanding, thinking and reasoning in academically rigorous ways • Be able to monitor the capacity of government and development agencies to implement strategies that lead to the equalization of opportunity and social justice for disabled people • Be able to understand theories of development and how disability can be mainstreamed within these processes
3	Higher Certificate in Disability Practice, Disability Studies division, Department of Health and Rehabilitation Sciences. UCT. South Africa	Matric certificate or National Senior Certificate for Adults (NASCA) or HEQSF level 4 equivalent qualification; RPL	The programme creates foundational skills for disability prevention and care. This qualification is to provide students with the basic knowledge, cognitive and conceptual tools and practical techniques for application in the field of disability inclusive development. Duration: 1 year	• Select and screen disabled clients for impairments and provide basic interventions to improve participation in the life areas of living, learning, working and socializing. • Implement health promotion actions, education and strategies. • Promote the rights of people with disabilities and implement strategies and actions to enable participation. • Describe basic information systems and implement communication systems in relation to care pathways of people with disabilities. • Screen, provide basic care, and implement follow up and referral systems, as they relate to the needs of people with disabilities.

(Continued)

TABLE 1 | Continued

No	Programme	Admission requirements	Course info	Learning outcomes
4.	Attendance Certificate: Short Course: The basics of Disability, Center for rehabilitation studies, University of Stellenbosch, South Africa	Grade 12/Matric Certificate	Students are introduced to disability basics Duration 3 days	• How the different disability approaches impacts the nature and experience of disability • The difference between disability, impairments and health conditions • The relationship between poverty and disability • The role of health care in disability
5	Attendance Certificate: Short Course on disability rights in an African context, Center for Human Rights, University of Pretoria	Practitioners working with persons with disabilities, human rights activists. Proficient in English.	The course promotes disability rights in Africa by raising awareness about the United Nations Convention on the Rights of Persons with Disabilities (CPRD) (2006) and the Protocol to the African Charter on Human and People's Rights on the Rights of Persons with Disabilities in Africa (2018). Duration: 1 week	• Understand the development of disability as a global human rights issue • Understand and apply provisions of the CRPD • Apply the CRPD to selected areas • Understand the development of disability as a human rights issue as the African regional and sub-regional levels • Understand and apply the intersection between the human rights and cultural aspects of disability in an African context • Understand and apply disability from a comparative human rights law perspective in other regions, including the European and Latin American regions • Understand and apply the regulation of disability from a comparative law perspective in selected non-African countries • Understand and apply theoretical approaches to equality and non-discrimination in a disability context.
6	Diploma in Disability Studies Zimbabwe open university	A relevant first degree pass Or accreditation of prior learning	Introduction to disability and disability issues Duration: 2 years	• Sensory, physical, motor and intellectual disabilities • Inclusion advocacy and empowerment • Communication with and counseling of people with disabilities • Community Development • Assessment and Rehabilitation • Legal and ethical issues of disability

CRWs is thus recommended and advocated for, as a cost-effective strategy for developing and scaling up rehabilitation workforce for rural practice (18, 23, 25). Against this background, a number of points can be drawn from our findings.

The first is the reiteration of the limited training opportunities for CRWs not only for initial training but also limited opportunities for upskilling. Given that there are limited numbers that could enter through recognition of prior learning per class and that rehabilitation needs remain unmet (10), it may mean that we are not producing enough workforce. It is worth noting that the existing formal programmes accept candidates who have a prior degree but also have an allowance for limited numbers of those who assume entry by recognition of prior learning. It can thus be concluded that the training is limited for Southern Africa. For instance, while five of the programmes are located in South Africa, they are not only accepting South African students but international students. Compounding this issue is the major challenge that Universities often do not recognize certificate programs, as career pathways for CWRs (36) hence they are few. This is because this level of training is usually placed at Technical Vocational Education and Training (TVET) and Universities of Technology levels which offer certificate programs. This policy decision could be the reason as to why universities have been slow in investing on this level of training. In South African specifically, the discipline-specific training of assistants or technicians were similarly terminated and no Higher Education institution (HEI) has taken up this training (18). A compounding factor is that most NGOs that used to train have discontinued training for CRWs in contexts like South Africa due to lack of support and funding constraints (28, 40). Another contributing factor is the way multidisciplinary workers have gained inadequate support from governments in Southern Africa) (41).

Provided that TVET are supported with relevant human resources for training posts and collaborations with the rehabilitation practitioners, they could be best suited to facilitate this community-based training as they are located in rural communities. Currently, universities such as Cape Peninsula University of Technology and Walter Sisulu University in South Africa (SA) already have health promotion qualifications. However, no capacity has been built in other service levels to better support and supervise these workers and for continuity. Additionally, human resources for training remain a challenge as these PHC platforms have fewer rehabilitation practitioners both for service delivery and to do the training of CRWs. Elsewhere, partnerships were noted as central to effective delivery of decentralized training for medicine students (42). The Western Cape province (South Africa), as an example, recognized

TABLE 2 | Other informal open source online training and training resources available.

	Organization	Resource	Description	Learning outcomes
7	CBM (Christian Blind Mission)	CBM Disability Inclusive Development Toolkit	The toolkit is designed as a resource that can be used in a variety of ways: to support staff induction, team meetings, refresher days and training workshops. It can also be used as a tool for personal reflection, self-study and a training resource. Has in-house informal training including supervision. Targets community members living within walking distances of clinic (persons with disabilities, mothers of children with disabilities or a disabled family member).	• Promote and apply disability inclusion, in work place, at home, in the community
8	WHO	INCLUDE Online Learning community (CBR)	An online learning community for community-based rehabilitation (CBR) that aims to inform and support CBR managers and interested stakeholders around the world It is an online programme that guides the user through different information modules based on the CBR guidelines: health, education, livelihood, social and empowerment.	• Learn about Community-based Rehabilitation (CBR) as an inclusive development strategy to realize the rights of people with disabilities at the community level • Discover how other programmes are putting CBR's inclusive development strategy into action • Create your own action plan for inclusive development • Share experiences, thoughts and ideas with a community of other dedicated individuals working in CBR • Reflect on your own experiences and beliefs about inclusive development
9	Light for the World	CBR Training manual	Build on existing basic CBR skills. The training manual covers organizational skills, knowledge and attitudes needed when implementing CBR in accordance with the various components of the CBR guidelines.	• Understand the structure of the guidelines document. • Know how to incorporate the CBR guidelines within the local context of their individual projects. • Use the guidelines as a tool to develop and implement their CBR projects.
10	Online Global Health and Disability Course London School of Hygiene and Tropical Medicine	Anyone with a professional or personal interest in disability as it relates to health, rehabilitation, international development and humanitarian assistance.	The course aims to raise awareness of the importance of the health and well-being of people with disabilities in the context of global development. There is a particular focus on low and middle income countries–both in the content of the course and the target learners. Duration: Minimum 5 weeks (online)	• Describe the links between disability, health and well-being • Discuss challenges to health and well-being amongst people with disabilities • Develop an understanding of what disability is and its relevance to the global development agenda • Reflect on how different types of disabilities affect people's lives in different ways • Identify solutions to improve health and well-being amongst people with disabilities

rehabilitation care workers as an essential resource capable of strengthening PHC and CBR across service platforms (43) and this could be a replicated strategy in other countries. Integral to recognition of this essential resource is an establishment of functioning partnerships between health and rehabilitation sectors, Universities of Technology, TVET and communities to increase uptake of training and successfully implement such decentralized training for CRWs.

This strategy does not mean that the process will be seamless. A succeeding issue would be that of country capacity to create jobs and absorb these CRWs post-training, and ensure continued professional development. This absence of capacity is particularly concerning because there is currently poor career pathing and continuing professional development for community-based rehabilitation workers (10, 11). Consistent with the WHO Rehabilitation 2030, CRWs' training programs in the rest of the African continent are critical avenues for scaling up and building capacity of human resources to meet rehabilitation demands (13). A responsive strategy here could be to mobilize African governments to open up posts for this workforce not only in Ministries of Health but across the sectors playing a role in community-based inclusive development implementation. Integral to this planning strategy, is the need for intersectoral budgeting particularly if we are to effectively implement disability inclusive development as a broad strategy (40).

The second point of discussion relates to the slowly changing mode of rehabilitation training. While programmes are starting to follow blended online modes of learning, we did not find

TABLE 3 | Themes emanating from Programmes' outcomes.

Codes	Programmes
Advocacy	1, 6
Disability inclusion	1, 2, 4, 5, 6, 7, 8
Clinical skills	1, 2, 3, 6
Health promotion	1, 3, 4, 10
Disability and diversity	1, 4, 5
Community participation	1, 7, 8, 6
Cultural awareness	1, 5
Human rights	3, 5
Principles of programme delivery	1
Social justice	2, 7
Capacity building	6
Networking and referral	3
CBR guidelines	9
Disability information and management,	1, 3
Ethical practice	6
Legislation on disability	1, 5, 6
Monitoring and evaluation	2
Disability research	1, 2

programs transitioning toward community-based training on rural sites. This rural training in the community, has worked for medical student training. Increasingly, medicine as well as the allied health professions have been training more students at (peri-urban, urban and rural) sites away from the tertiary academic health center (42). Some studies in South Africa have identified benefits for such a decentralized clinical training for students, the health services and the community. For instance, Van Schalkwyk et al. (44) have argued that rural training of health professionals enhances rural practice preparedness. Additionally, it has a strong workforce imperative as it enhances the likelihood of such student working in these rural contexts (42, 44). This decentralized training happening at the community level could be a possible strategy to explore for training community-based rehabilitation workers through accreditation of higher education institutions. However, this strategy requires consistent commitment of financial and human resources for the training at community level, more trainers and facilities. It would mean that some hospitals or clinics as well as Non-Governmental Organizations (NGOs)/ Disabled People's Organizations (DPOs) become accredited sites for such training in order to build more capacity and professional learning of rehabilitation practitioners to serve as supervisors.

The capacity building of transdisciplinary supervisors requires that there is availability of relevant practitioners in the training communities. It has been common practice for CRWs to be supervised by managers with little or no experience and knowledge of rehabilitation (45). De Villiers et al. (42) found that availability of human resources who are willing, committed and motivated to train in decentralized training plays an integral role. But, for rehabilitation practice in rural contexts, the limited availability of workforce as well as limited knowledge of CBR (11) remain ongoing challenges which influence poor supervision issues and insufficient support of this cadre (12, 46). Gamiet and Rowe (43) argue that, with positive perceptions toward rehab care workers by rehabilitation practitioners related to strengthening CBR and PHC and sufficient training of supervisors, these CRWs could receive appropriate support. It may be that we need to also invest in recruiting and training supervision human resource through train-the-trainer programs as part of continued professional development. Likewise, the post-graduate programs aimed at strengthening skills of rehabilitation practitioners need to foreground rural practice.

The third point of the situational mapping overview results relates to the extent that training programs address competencies required for context specific rural settings with specific reference to the complexities that rural contexts pose to the practice of CRWs. Competency frameworks are an increasingly popular development tool to develop clinical governance, performance management, and professional development in health care. However, to date there is a dearth of information relating to specialist competencies for rehabilitation workers in remote and rural environments (1). While most emphasis on competencies seems to be placed on facilitating functioning, providing basic rehabilitation care and follow-up, less emphasis seems to be placed om understanding community-based rehabilitation as a community inclusive development strategy and facilitating community participation, advocacy and capacity building in the learning outcomes listed by training programs. Competencies for CBR workers in less resourced settings include disability knowledge, basic clinical skills, communication skills, management skills, and cultural competence (14, 35, 36). Being able to facilitate collaborative relationships is an essential skill required by mid-level rehabilitation workers in order for them to build and maintain partnerships necessary for program sustainability (39, 47, 48). These particular competencies are fairly represented in all the training programs included in this overview. Competencies focusing on the implementation of rural and remote service delivery, understanding disability and diversity (25, 30, 49) were however under-represented in programme outcomes.

Booyens et al. (25) argue that the interventions of CRWs need to document, target, measure and monitor the many barriers to inclusion and participation as a result of the complexity of impairments, social issues and power imbalances in rural contexts. However, these authors also ask whether these workers in rural communities necessarily require specialist training, or whether generic workers could be adequately trained and equipped for the complexities of rural contexts (25). This is an important question given that, as literature shows, people with disabilities in rural areas are subjected to institutional and environmental exclusion (25, 50, 51). Therefore, acquiring specific skills which capacitate CRWs to enable empowerment, restore dignity and humanity of people with disabilities as well as facilitate eradication of social, economic and institutional barriers embedded in rurality may require both general and targeted training.

The former is already addressed by the programmes found in this study. We therefore argue that targeted training ought to

specifically speak to the links between disability, poverty, rurality, human rights and inclusion. We suggest that, one way in which the needed targeted training for CRWs in rural communities could address this link is to explicitly facilitate critical reflexivity around the complexities of rurality and disability. This is a significant shortcoming noted in the current learning outcomes and competencies for the various programmes listed in this review. Engaging in critical reflexivity on these complexities may aid CRWs to interrogate their own values and identify nuanced strategies needed to work toward social inclusion (52). Likewise, the training of rehabilitation practitioners/professionals who will be responsible for supervision of CRWs needs to equip these practitioners with critical reflexivity skills, particularly within a rural context, if they are to contribute to developing their practice.

CONCLUSION

Based on this situational mapping overview, there is a need for an articulated process to develop community-based training of CRWs who will address the unmet rehabilitation needs in rural contexts of Southern Africa. This education and training of CRWs needs to be standardized while allowing flexibility for relevance, core specialist competencies for rural contexts and assessment standards to be developed. These rural practice specialist competencies of CRWs must include critical reflexivity, intersectoral collaborative practice and advocacy skills to enable these workers to address the prevailing attitudinal, systemic, environmental and institutional barriers facing people with disabilities and their families in rural settings. Moving to community orientated rural training may also require a different set of competencies for supervisors of these workers, where they may need to manage a team of CRWs who are active in the community. The competencies must include interprofessional practice, an improved understanding of community based rehabilitation as a community based inclusive development strategy as well as advocacy skills to be able to mobilize for resources of these workers at the community level.

As the supervision and mentoring relationship between CRWs and professionals is an important one, it would be necessary for institutions that offer respective training for this cadre of workers i.e., TVET colleges, Universities of Technology and universities, to explore how they could collaborate in fostering partnerships in joint training. This implies that inter-institutional as well as trans-disciplinary training could be facilitated as a key strategy for more training. Through such partnerships, opportunities for fieldwork placement and service-learning experiences as well as professional development to facilitate upskilling of CRWs could also be explored and formalized. These forms of coordinated commitments and actions are significant considerations toward developing training and maintaining a sustainable CBR workforce. This is particularly important for expanding and decentralizing the institutionalized services of rehabilitation to the community level.

Articulation is one strategy of starting this decentralized training. For instance, the first and second years of professional training could include CRWs and be based in the community. This would mean both the professionals and CRWs get an opportunity to develop competencies together and learn collaborative practice. Drawing from the issues that CRWs often have to address, the training has to emphasize on advocacy skills, rural practice and inclusive development skills.

The identified limitations of this overview include the acknowledgment that there may be other CRWs' training programmes available which are either not packaged as formal or not accredited or may be formalized but not accessible via the internet. These programmes may have been left out of this overview but may be helpful to inform the strengthening of accessible rural rehabilitation practice.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary materials, further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

Ethics approval was obtained from the Stellenbosch University Health Research Ethics Committee (HREC Reference No: X19/03/007). The Stellenbosch University Health Research Ethics Committee provided a waiver for written informed consent for this study, as the study was a desktop review and did not involve dealing with any human subjects.

AUTHOR CONTRIBUTIONS

LN and LH-A led the conceptualization and writing of the various drafts of the manuscript. RT, LN, and LH-A conducted the search. All authors assisted with editorial and conceptualization of the paper. All authors contributed to the article and approved the submitted version.

ACKNOWLEDGMENTS

LN acknowledges NRF-BAAP programme for funding to cover dedicated time for writing and research (Grant No. 120640).

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Public Health

ORIGINAL RESEARCH
published: 19 November 2020
doi: 10.3389/fpubh.2020.595255

The Rural Family Medicine Café Project: A Social Media Strategy to Reduce Occupational Isolation and Improve Support for Rural Healthcare Professionals

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OPEN ACCESS

Edited by:
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Eron Grant Manusov, The University of Texas Rio Grande Valley, United States

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Specialty section:
This article was submitted to Family Medicine and Primary Care, a section of the journal Frontiers in Public Health

Received: *15 August 2020*
Accepted: *22 October 2020*
Published: *19 November 2020*

Citation:
Wheatley A, Floss M, Bakola M, Kampouraki M, Silveira B and Scott-Jones J (2020) The Rural Family Medicine Café Project: A Social Media Strategy to Reduce Occupational Isolation and Improve Support for Rural Healthcare Professionals. Front. Public Health 8:595255. doi: 10.3389/fpubh.2020.595255

Background: Globally rural medicine is currently suffering from staff shortages. Social and professional isolation are identified as significant pressures on health professionals working in rural areas. Social media (SOME) has created new methods of social engagement where conventional forms have failed. The Rural Family Medicine Café (RFMC) is a SOME project created to engage and support those interested in rural family medicine thus decreasing occupational isolation.

Methods: A quantitative analysis of SOME activity associated with the RFMC was done by measuring the frequency of #ruralcafe, #ruralwomenGP, #ruralGP, #ruralstories, and #ruralmedicine from October 2015 to October 2016 along with the number of Facebook page likes and YouTube views. A time series and regression analysis were done to assess the correlation between the frequencies of hashtag use and the number of new likes or views. A qualitative analysis of the content of tweets using the associated hashtags and comments on the RFMC YouTube videos was then done to assess participants' response to the RFMC. To add context to the data collected, regularly attending participants were invited for a semi-structured interview.

Results: There was a positive trend in the number of Facebook page likes (+273%) and Twitter hashtag use (+2,458%) but a negative trend (−92%) in the number of RFMC YouTube views. There was no statistically significant relationship between the number of views on the RFMC YouTube and RFMC associated SOME activity ($p = 0.141$). A significant relationship was shown between the number of Facebook page likes and the number of views on the RFMC YouTube ($p = 0.037$). Participants felt positively about the RFMC with recurring themes of; promotion, advocacy, public health, engagement, inspire, sharing, spreading information, feeling connected and general positive comments such as "enjoying tweets," "great discussion." Participants shared anecdotes, useful links, and book recommendations.

Conclusion: The RFMC has seen an increase in the amount of associated SOME activity despite having less viewers. This is most likely due to the few participants of the RFMC continuing the café discussions on SOME, particularly Twitter, and engaging outside of the RFMC. The RFMC has developed into a virtual community which is reducing occupational isolation for its participants.

Keywords: occupational isolation, rural, social media, family medicine, rural training, rural education

INTRODUCTION

Although approximately half of the global population lives in rural areas, less than a quarter of the total physicians' workforce work in rural areas (1). Demanding working conditions, substandard medical equipment and facilities, inadequate financial remuneration, inadequate opportunities for personal and professional growth, safety concerns, and lack of job opportunities for spouses and educational opportunities for children all contribute to the maldistribution of health professionals across the rural: urban divide (2). The provision of a stable and rewarding personal and professional environment has been cited as being key to a country's ability to recruit and retain health professionals in underserved areas (3). Social and professional isolation of rural healthcare professionals contributes to the perception that rural practice is difficult for professionals working in small rural communities, and to those students who aspire to a rural career (4).

Social media (SOME) provides healthcare professionals with tools to share information, to debate health care policy and practice issues, to promote health behaviors, to engage with the public, and to educate and interact with patients, caregivers, students, and colleagues (5). SOME refers to a variety of web-based applications which allow users to create and share content (6). This includes blogs/microblogs such as Twitter, internet forums such as Google groups, content communities such as YouTube, Flickr, and TikTok, and social networking sites such as Facebook or LinkedIn (7). The use of SOME is becoming increasingly prevalent in society particularly among individuals aged 45–54 (8).

A survey of more than 4,000 physicians conducted by the SoMesite QuantiaMD found that more than 90% of physicians use some form of SOME for personal activities, whereas only 65% use these sites for professional reasons (6, 9). SOME sites such as Facebook, Twitter, and YouTube are powerful symbols of a new generation of online tools and applications that foster user-generated content, social interaction, and real-time collaboration (10). There are manifold opportunities for professionals to use vast social networks to improve the wellbeing of patients and contribute to public health through the provision of high quality health information (10). The standards expected of doctors do not change because they are communicating through SOME rather than face-to-face or through other traditional media. However, using SOME creates new circumstances in which the established principles apply (11).

In response to a recognized need for increased communication between rural providers, the Rural Family Medicine Café (RFMC) was created. The RFMC is a SOME project created, originally on the Google Hangouts platform, in October 2015 to support and network doctors, students, and professors from around the world, interested in rural family medicine. The concept was first developed during the European Rural Conference in Croatia in 2015. Attending conferences gives rural professionals a sense of connection with likeminded colleagues however, this is in stark contrast to the realities of isolation they face when they return to rural communities or medical education which lacks a rural focus. The RFMC was developed to maintain this feeling of connectedness outside of the conference setting. With time, the concept spread to Facebook and Twitter using the hashtag "#ruralcafe" and the RFMC developed into an informal community for learning about rural medicine. It is a virtual place where people can meet together and share ideas, similar in setup to a coffee shop. The format is described in the Rural Cafe Manual; 15 steps to create a rural cafe, creating the opportunity for people to organize cafes locally (12). The RFMC was held monthly and usually included an international panel that discussed a topical issue in rural medicine. The café is then livestreamed to YouTube and others can join in the discussion by using #ruralcafe on Facebook and Twitter. Participants in the RFMC supported the creation of the World Rural Medicine Student Network, or Rural Seeds, which supports the engagements of healthcare students and communities with a rural background (13). In April 2016 "Rural Health Success Stories" was created as a result of networking between the founders of the RFMC and WONCA Rural South Asia [WoRSA (14)] (15). This led to the development of the hashtag "#ruralstories" with the aim to inspire, support, and reduce feelings of isolation among rural healthcare professionals. Similarly, the hashtag "#ruralwomenGP" was created to bring awareness of gender inequality in rural medicine.

This study aimed to investigate the impact of the RFMC on rural healthcare professionals and medical students interested in rural health. This study sought to quantify SOME activity associated with the RFMC and qualitatively analyse responses and discussions on the RFMC on Facebook, YouTube, and Twitter. It is hypothesized that the RFMC will be associated with qualitative evidence that it is seen as a good educational

opportunity and a way to reduce feelings of professional and social isolation.

METHODS

Ethical approval for this study was granted by the Swansea University College of Human and Health Sciences and College of Medicine Research Ethics Committee reference #020117.

To assess the frequency of use of the hashtags associated with the RFMC, Twitter and Facebook searches were used to count the use of "#ruralcafe," "#ruralwomenGP," "#ruralGP," "#ruralstories," "#ruralmedicine" in each month from October 2015 when the RFMC started to October 2016. The topic of the RFMC in each month was also noted to investigate the correlation between the use of a particular hashtag and the topic. To establish a baseline measurement, the frequency of use in September 2015 of each hashtag was also measured. The number of followers on the RFMC Facebook page and the number of views of the RFMC YouTube videos in each month was also measured. With the data collected, a time series analysis was performed to compare the SOME activity in each month to the baseline measurement.

To qualitatively analyse the effect of the RFMC on feelings of isolation and lack of support, the content of tweets and Facebook posts using #ruralcafe, #ruralstories, and #ruralwomenGP were analyzed. Similarly, the comments on the RFMC YouTube videos were also analyzed. Comments were broadly classed as either positive or negative. Further data were collected by conducting a survey among RFMC participants. The survey was done using GoogleForms and the invitation was sent through the RFMC mailing list. Researchers did not know which participants responded to the survey thus the responses were randomized. The survey was opened from December 2016 to February 2017 and 54 responses were obtained. To account for participant bias, a question on whether the participant had viewed or participated in a RFMC was included in the survey but no participant answered this question. As a result, investigators do not know the level of experience each participant had with the RFMC. To supplement the information gathered from the survey, willing participants of the RFMC were invited for a semi-structured interview. Ten interviews were conducted with participants with the high engagement with the RFMC. The interview questions delved further into the participants' reasons and perceived benefits for participating, and issues that had been encountered. Questions used for the survey and semi-structured interview can be found in the **Supplementary Material**. Informed consent was obtained for participants who answered the survey and interview participants prior to collecting data.

Inclusion Criteria

To be included in the study participants needed to have an interest in rural medicine, access to a computer and internet. Participants also needed to have an SOME account on FaceBook, Twitter, or Google+ and be able to communicate in English.

Exclusion Criteria

Participants who were unable to communicate in English were not included in the study.

Limitations

This study was limited by the necessity of internet access for the RFMC. The study involved the use of SOME platforms which may not be user friendly to all participants. The RFMC operates solely in English so participants who were unable to communicate in English could not participate. The hashtags #ruralmedicine, #ruralgp, #ruralwomenGP, and #ruralstories are general hashtags that are not specific to the RFMC. This may give a positive biased result which limits the reliability of study.

RESULTS

Data Analysis

Of the hashtags concerning the RFMC, #ruralcafe was used most frequently. Use of #ruralcafe took off in the month of October 2015 when the RFMC started, and remained relatively high with a spike in May 2016 and again October 2016 as shown in **Figure 1**. These spikes coincide with the Polaris conference and WONCA pre-conference respectively. A decline in the use of #ruralcafe was then seen in June 2016. The use of #ruralcafe then gradually increased with a peak in October 2016 as shown in **Figure 1**. #ruralwomengp had a peak in May 2016 when the project was first initiated but its use remained low thereafter. Rural Success Stories had the least frequent hashtag use.

Facebook posts containing #ruralcafe were mainly announcements of past cafes and dates for upcoming cafes. Use of #ruralwomengp, as expected, was not seen until May 2016 when the project was initiated. Although used less frequently than #ruralcafe and #ruralstories, a gradual increase was seen. Between June 2016 and August 2016, #ruralstories was the most frequently used hashtag associated with the RFMC as shown in **Figure 2**. Facebook posts with #ruralstories were largely promotional with posts featuring quotes from stories that had been submitted. The engagement on Facebook did not follow the trends seen in use of the previously mentioned hashtags on Twitter.

Each RFMC was livestreamed to YouTube which allowed persons to watch the video at their convenience. Since the first café, the number of views has gradually declined as shown in **Figure 3**. The highest number of views was achieved with the first café. Not included on the graph in **Figure 3** are the views for the 14th RFMC held at the 2016 WONCA World Conference. The 14th RFMC was livestreamed *via* Facebook and had 407 views, the highest number of views for a RFMC. There was an inverse relationship between the number of Facebook page likes and the number of views on the RFMC YouTube channel with the number of views decreasing as the page likes increased. This is shown in **Figure 4**. There was a positive trend in the number of Facebook page likes (+273%) and Twitter hashtag use (+2,458%) but a negative trend (−92%) in the number of RFMC YouTube views. There was no statistically significant relationship between the number of views on the RFMC YouTube and RFMC associated SOME activity ($p = 0.141$). A significant relationship was shown between the number of Facebook page likes and the number of views on the RFMC YouTube ($p = 0.037$).

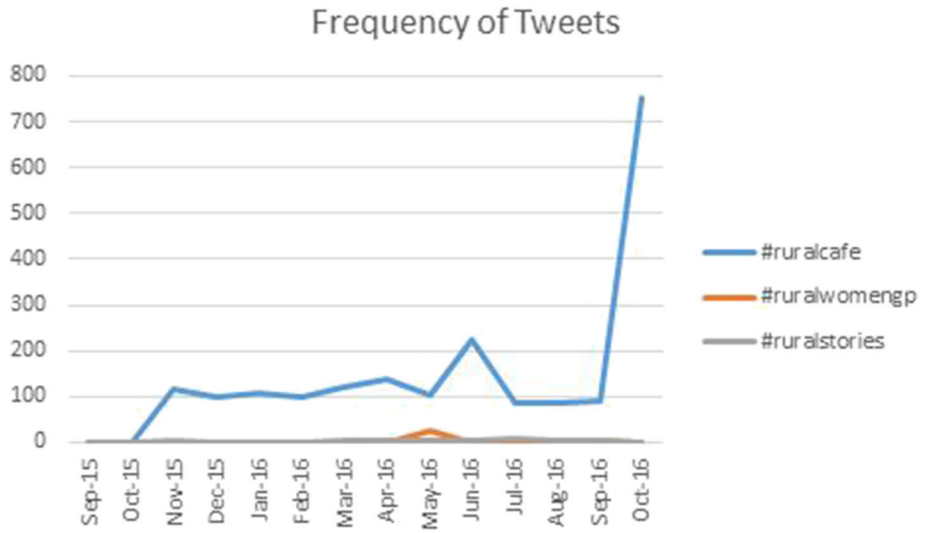

FIGURE 1 | Line graph showing the frequency of tweets with hashtags #ruralcafe, #ruralwomengp, and #ruralstories.

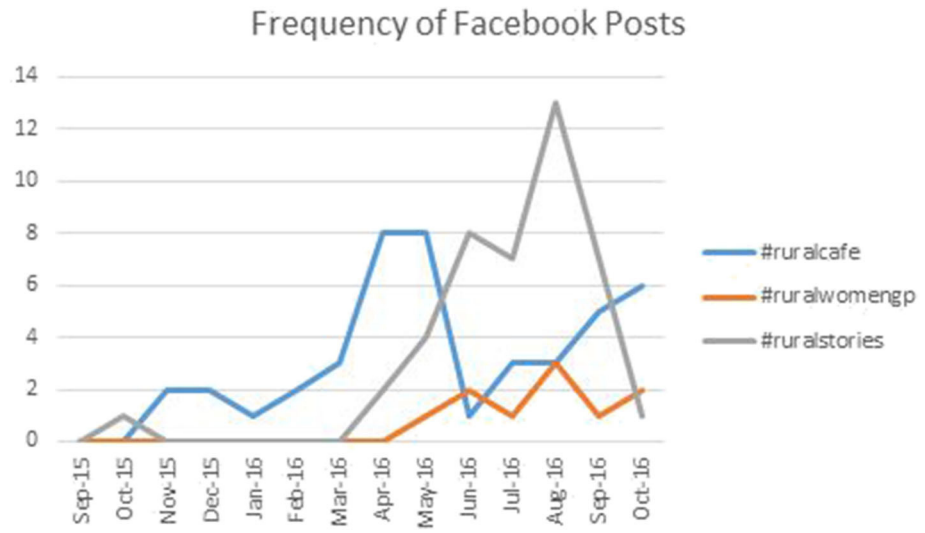

FIGURE 2 | Line graph showing the frequency of Facebook posts with #ruralcafe, #ruralwomengp, and #ruralstories.

Results of Participant Survey

53.7% of participants were female and 46.3% were male. The majority of participants, 61.1%, were between the ages of 26–39. The majority of participants were currently working in Family medicine either as qualified family doctors or trainees. 20.4% of participants were medical students. 51.9% of participants were currently practicing in the European continent. Thirteen percent of participants were practicing in Oceania, 13% in Asia, 11.1% in North America (the United States and Canada), and 9.3% in Africa.

The majority of participants used social networks occasionally for the purpose of learning with 27.8% using SOME frequently. When asked if they would use the RFMC for learning or professional development, 46.3% said they would probably use it, 22.2% said they would definitely use it, 16.7% would probably not use it, 11.1% were not sure, and 3.7% said they would definitely not use it for this purpose.

The majority of participants would recommend the RFMC to medical students interested in rural medicine. The majority of participants would also recommend the RFMC to their colleagues as a method for reducing professional isolation although this depended on how well the participant felt their colleague could navigate SOME. When asked about ease of access to the RFMC. 59.3% found it moderately difficult to access. 33.3% of participants found it easy to access the RFMC.

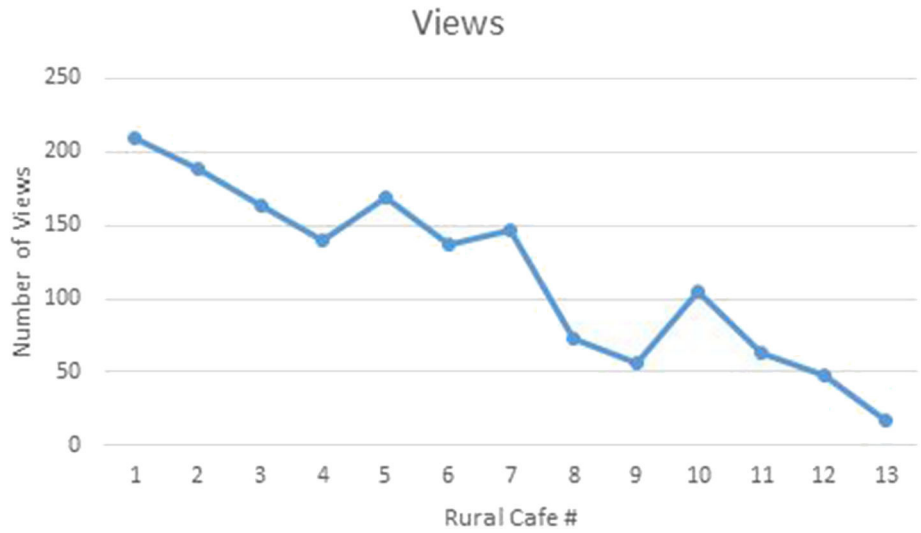

FIGURE 3 | Line graph showing the number of YouTube views of each Rural Family Medicine Café.

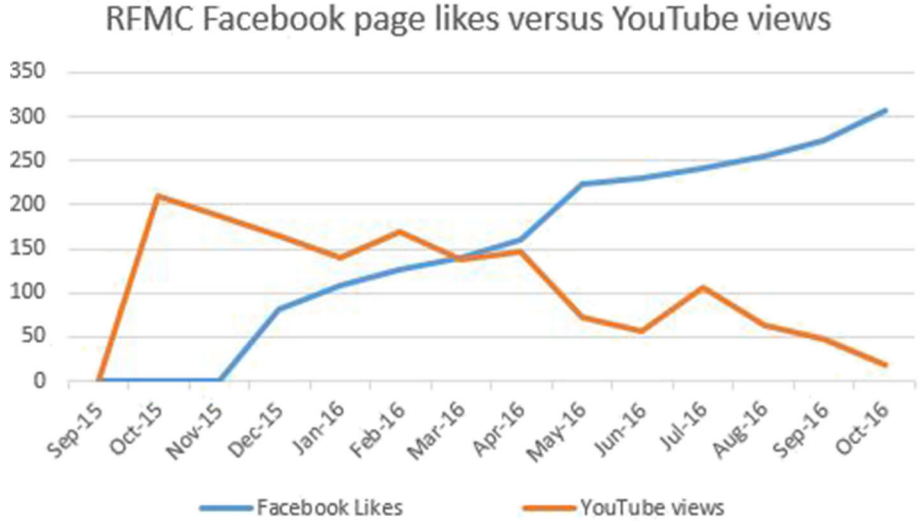

FIGURE 4 | Line graph showing the number of RFMC Facebook page lives vs. the number views on the RFMC YouTube channel.

Looking at the demographic data of participants, those who identified as interns, residents, or junior doctors were more likely to use SOME and more likely to use hashtags associated with the RFMC. There was no correlation between age, gender, or continent of practice with SOME use. Of note in the survey data, none of the 54 participants volunteered data on what SOME platforms they were currently using.

Graphs illustrating the survey results can be found in the **Supplementary Data**.

Qualitative Analysis

A thematic analysis using grounded theory was undertaken whereby authors analyzed separately the transcripts of interviews of a purposive sample of participants in the RFMC. The qualitative analysis was also used to assess participants' general response to the RFMC. Identified themes were discussed using a shared Google document group and themes refined. Interviewees were involved in triangulating the data through a process of consultation after the authors had completed their analysis and changes made to the conclusions after participant correction.

All interviewed participants in the RFMC had heard about the project either from a current participant or from hearing about it at conferences. Participants fit into two categories; regular attendees and *ad hoc* attendees. The main motivations for participating in the RFMC were; networking, international collaboration, sharing knowledge and experience,

and participating in a forum with equal power of voice. Themes such as "support," "education," "morale," "engagement," "community," and "network" were identified and grouped into five main themes which will be discussed in further detail later in this article. Benefits of participation noted by participants and elaborated by participant interviews included; reducing the feeling of isolation and improving social connections that could then be followed up on other platforms and/or face-to-face. Participants generally found the RFMC to be a source of stimulating learning through shared experience. For rural doctors in training, it was particularly beneficial to create links with more experienced doctors and found the experience empowering. Doctors in training found the informal cafe style facilitated networking and collaboration with more experienced doctors which would not necessarily occur as easily with face-to-face networking. The RFMC was noted to be of most benefit when it supplemented face-to-face connections. The RMFC also had a perspective of hope, which is key to move people and in this case especially rural health professionals (16).

DISCUSSION

The term #ruralcafe had the highest use in October 2016 due the 21st World WONCA conference. The pre-WONCA themed café was a platform to advertise the rural activities at WONCA and was also the 1 year birthday of the RFMC. At the WONCA conference, a live RFMC was held on November 5th, 2016. This achieved two things; (i) The RFMC was advertised to a larger audience and (ii) Participants were watching a discussion live and encouraged to tweet and post on Facebook. A number of participants expressed confusion on how to get involved in the RFMC so this second achievement may have removed a technological barrier to the café leading to increase SOME activity. Introducing the rural café at the 2016 World WONCA Conference in real time was also an easy way to introduce the use of SOME.

This suggests that the RFMC can be used in conjunction with promotion for conferences to improve sharing of information and networking. Additionally, the survey responses seem to suggest that an individual's previous experience with SOME was a better determinant for engagement that any other demographic. Qualitative analysis of interview responses collected identified 5 main themes; learning, impact on social and occupation isolation, recruitment and retention, rural advocacy, and networking and collaboration. Each of these themes will be discussed below.

Learning in the RFMC

The RFMC is underpinned by an accepted theory of adult education called "social constructivism" whereby meaningful learning occurs in a social environment (17). In constructivism learning theory, knowledge is obtained by participants actively interpreting information from the experience of others and using that to build upon pre-existing knowledge. Constructivism relies on participants leading the learning process and having a previous knowledge base in order to integrate new experiences (18). The RFMC can be seen as a forum where educational opportunities are set within the workplace, this increased the validity and impact of participation particularly as it is led by the participant (18).

In social constructivism, knowledge is built within a social setting such as a class or in the case of the RFMC a virtual café. The dynamics of the group, such as the cultural background of each participant, thus contributes to the learning process (19). By having a variety of participants, less experienced participants learn through interacting with those who are more experienced while those with more experience learn from participants with a different background (20). One of the unique features of SOME is that you cannot only facilitate networking with like-minded peers but also with those from alternative backgrounds which creates diversity. The experience exchange between different ages and settings could bring a sense of empowerment and validation of rural health professionals. When a person could understand their reality, they can raise hypotheses about the challenge of that reality and look for a solution and explore what makes it possible to transform it (16).

The RFMC was reported to have improved collaborations among participants. It provided an opportunity to participate in scholarly activity, and teach and/or learn from international experiences. The extent to which these opportunities happen are dependent on how active a participant was with the RFMC however, there was potential to develop changes in attitude, knowledge and access to resources.

Key benefits of participating in RFMC highlighted by interviewees was that it was an opportunity to engage with others, share best practices and create learning opportunities in communities. As the knowledge shared in each cafe was based on lived experience, learning was "experientially driven" and this was felt to make learning relevant and valid as it was done within a real world context (21). The increased "reach" of a virtual cafe also increased the learning opportunities across international borders (22). The RFMC was seen as a useful tool for learning from others within the global context of medical practice. By participating in activities such as the RFMC, it was felt that one could increase knowledge of developments and changing trends thus alleviating the fear of rural healthcare professionals being "left behind."

RFMC Impact on Social and Occupation Isolation

Interviewed participants highlighted the geographical, professional, and technological isolation that rural healthcare professionals face. Due to these factors, rural healthcare professionals often work in an environment with minimal or no support leading to social and professional isolation. One unique aspect of social isolation highlighted by an interviewee is that isolation follows power differentials. There is a unique aspect to this among doctors due to their role as healers in the community. The interviewee referred to the "Aesculapian power." Aesculapius was the Roman god of medicine and believed to hold the power of control over the quality of people's lives. In the doctor–patient relationship, Aesculapian power refers to the dynamic of power a doctor seems to have over their patient. The participant gave the example of the family physician

in a rural community also holding other positions of leadership in sports or school councils. Effectively this maintains their "Aesculapian power" and can lead to social isolation when they are unable to step out of this role (23). The RFMC provided an environment where such hierarchies were not as socially relevant and so a participant could socialize outside of the Aesculapian power dynamic.

Social Media and Rural Recruitment and Retention

SOME platforms can be used as a method of promoting careers in rural areas as well as promoting learning communities and events (9). Interviewed participants noted that the use of SOME platforms can help more experienced doctors engage with technological advances (24). This can in turn help in the recruitment of medical students/residents and facilitate rural exchanges. Anecdotally, there have been rural exchanges between participants of the RFMC as a result of networking on SOME. SOME can also help with rural recruitment and retention as it can lead to the development of social support mechanisms outside of the "Aesculapian power" dynamic previously mentioned (23). Students or young doctors are more likely to choose rural practice if they are aware of the opportunities of peer support (25).

SOME also has the positive impact of allowing personalities to be expressed which could aid in recruitment and the development of role models. It can also be used to increase the awareness of rural health professions. Many SOME platforms can be thought of as an open conversation that people can see without needing to actively participate in. Thus, SOME can act as a "shop window" for people interested in a career in rural health to see a variety of career possibilities.

Social Media and Rural Advocacy

The theme of advocacy was common among interview responses and participants mentioned using SOME as a platform to advocate for the future of rural medicine among rural stakeholders, universities, and governments. The RFMC was recognized as a way of advocating for rural health issues, promoting rural practice, and demonstrating to potential rural health care professionals that peer groups could be formed even *in situ*ations of remote isolation. This is particularly useful for rural recruitment and retention as it can lead to the development of social support mechanisms (26). One interviewee reported that the RFMC could be used as a platform to advocate on behalf of rural communities as well as for the working conditions of rural healthcare professionals. Indeed the RFMC has been used to highlight issues that particularly affect rural communities including indigenous health and environmental health (27).

Interviewed participants were asked to describe what they felt the future of rural medicine would look like. Participants anticipated that government health policy makers would invest into "building" rural health in the long term. In the short term, more private initiatives would most likely be driving this development. The rural medicine of the future would have increased access to treatment and diagnostic tools through technology in practice. Thus allowing for increased research and integration of live broadcasts from conferences or use of other technological platforms at conferences. With this increased use of technology, more international collaboration is anticipated.

Networking and Collaboration

The RFMC was used to encourage participants to attend conferences and meet face-to-face thus strengthening new interactions. The RFMC provided a "sense of community" and fostered connections that were followed up on other SOME platforms as well as face-to-face.

The RFMC was seen as a useful way of reducing both professional and social isolation. The RFMC was noted by one participant to provide an "alternative activity" in addition to providing peer support and meeting the needs of a "healer in a community" (23). The RFMC helped create links between more experienced doctors and less experienced doctors and students. This networking was reported to have relieved the anxiety of young doctors working in rural areas and also allowed for international collaboration in research.

An exemplar demonstration of this is the mentor–mentee program. This was a pilot project started by Rural Seeds which sought to pair newly qualified rural doctors with more experienced rural doctors. The pool of mentors and mentees was pulled from the Rural Seeds network which included participants of the RFMC. By having this connection, mentors, and mentees were able to build a relationship that led to international collaboration including presenting the experience of the mentor-mentee program at international conferences.

LIMITATIONS

The RFMC process was hampered by the availability of good internet connections and issues around time zones. The use of SOME platforms highlighted the "digital divide" where there was an inequity of access to technology needed for large group discussion (24). Using a cafe style means learning is synchronous and this limits accessibility due to time zone differences. In addition to this, cafes are usually 2 h long which is a long time commitment. The RFMC was also unilingual and conducted in English. In the cafe style, it is important that education is developed by participants so that they see the value in the activity. Thus, the digital and lingual divide impacted participation particularly from low and middle income countries. As a result of this, rural organizations such as the Rural Doctors Association of Southern Africa (RUDASA), WONCA Rural Group South Asia (WoRSA WoRSA) Young Doctor's Movement Spice Route, and Rural Seeds Brazil (28) conducted local cafes or cafe style meetings that met the needs of their community of healthcare professionals in their native language.

One limitation which is unique to the SOME aspect of the RFMC is that there is potential to create an echo chamber effect (29). This can occur where the cafe participants are all people working in a similar field with a similar interest interacting with each other across multiple platforms. This can create a situation where certain beliefs are repeated, amplified, and upheld without criticism (29). With SOME this can also develop into a "celebrity culture" around more active participants whose word is given more value.

SOME is still an evolving process and requires active participation and, to some extent, risk taking to develop. As a result of this, communication *via* SOME can sometimes come across as superficial. It was acknowledged that SOME can augment other forms of learning but not replace them.

FUTURE IMPROVEMENTS

One of the challenges of the RFMC will be overcoming technical issues and the digital divide to improve and increase engagement and create a stable learning community that can continue to grow while keeping participants actively involved. Suggestion for improvement included curating content and creating thematic summaries with key learning points and links to resources that could be shared asynchronously. This indicated that improving ease of offline access to content from the cafe would be beneficial. A potential solution would be to develop the RFMC into a user-friendly, integrated platform which covers the specific needs of rural healthcare professionals. This would increase awareness of the RFMC, improve accessibility to content, and potentially introduce the use of SOME to more healthcare professionals and students.

The networking and collaboration opportunities created by the RFMC work well in conjunction with existing methods such as conferences, both local and international, and in formal educational settings. While locally organized cafes do have their benefit, the greatest networking capability is through introducing the concept of the rural cafe to large groups. In conjunction with live cafes, the RFMC platform could be used as part of medical education which would improve engagement with the virtual community.

CONCLUSION

Social networking promotes communication as professionals, in our case healthcare professionals, with relatively common backgrounds and interests are able to interact. In other words, health care providers can communicate with other health professionals, patients, etc. Also specific social networking websites allow for the users to communicate in groups, and so the communication with different stakeholders is more practical.

The RFMC was a project which aimed to improve engagement of healthcare professionals, medical students, and rural community members *via* SOME. The RFMC has seen an increase in SOME activity particularly when used in conjunction with face-to-face meetings such as conferences. Analysis of the data gathered in this study suggests that this may be due to a handful of RFMC participants continuing discussions from the cafe on SOME, particularly Twitter, as well as in face-to-face discussions. Results from the survey suggest that the best indicator for a participant's likelihood to use SOME and RFMC related hashtags was their prior experience with SOME. By continuing RFMC discussions both on- and off-line, RFMC participants can engage with those who have previously not engaged with SOME thus building the virtual RFMC community. SOME and other new technologies have become more popular as they are a more cost-effective method of communication and collaboration. This has been demonstrated by the increased use of telecommunication and tele-health modalities due to the COVID-19 pandemic and restrictions on face-to-face meetings.

RFMC participants generally felt positively about the RFMC and benefits of participation identified were; the RFMC as an informal learning environment, reduction in social and occupational isolation, potential to improve recruitment and retention of rural healthcare professionals, potential to advocate for rural healthcare professionals and rural communities, and a method of networking and collaboration that reduces geographical and financial limitations. Limitations identified were that the RFMC is monolingual which created a language barrier and that participation relied on access to a device and stable internet connection. There were also difficulties around organizing a meeting with participants across several time zones. As a result of these limitations, several organizations held local RFMCs.

Potential areas of improvement identified were; curating content and creating thematic summaries from each cafe to facilitate offline access to content from the cafe. A potential solution would be to develop the RFMC into a user-friendly, integrated platform which covers the specific needs of rural healthcare professionals. This could facilitate the RFMC being used in conjunction with face-to-face settings for the purpose of medical education which would improve engagement with the virtual community.

The RFMC has grown into a virtual community and informal learning environment. This has helped to reduce feelings of social and occupational isolation among participants in addition to providing opportunities for networking and collaboration. As has become evident with the COVID19 pandemic, the training and the ongoing support for new technologies should be a high priority especially in order to provide qualified services in rural and difficult to access areas.

DATA AVAILABILITY STATEMENT

All datasets generated for this study are included in the article/**Supplementary Material**.

ETHICS STATEMENT

Ethical approval for this study was granted by the Swansea University College of Human and Health Sciences and College of Medicine Research Ethics Committee reference #020117.

AUTHOR CONTRIBUTIONS

The RFMC project was conceptualized and started by MF. The abstract of this paper was written by AW. The introduction and background of the project was done by MF, MB, and MK. Data collection including formulation, distribution, and analysis of the survey used in this research was done by AW, BS, and MF. There was a significant contribution to this section by JS-J. The conclusion was written by MK and AW. Overall editing and coordination of writers was done by AW. All authors were involved in qualitative analysis of interview responses and identifying recurring themes.

ACKNOWLEDGMENTS

The authors would like to thank Rural Seeds and the WONCA Working Party on Rural Practice for their continued support.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2020.595255/full#supplementary-material

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Public Health

METHODS
published: 27 November 2020
doi: 10.3389/fpubh.2020.583821

Pathways to Enable Primary Healthcare Nurses in Providing Comprehensive Primary Healthcare to Rural, Tribal Communities in Rajasthan, India

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OPEN ACCESS

Edited by:
Pratyush Kumar, Patna Medical College and Hospital, India

Reviewed by:
Pradeep Nair, Central University of Himachal Pradesh, India
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Specialty section:
This article was submitted to Public Health Education and Promotion, a section of the journal Frontiers in Public Health

Received: *15 July 2020*
Accepted: *04 November 2020*
Published: *27 November 2020*

Citation:
Amin A, Dutta M, Brahmawar Mohan S and Mohan P (2020) Pathways to Enable Primary Healthcare Nurses in Providing Comprehensive Primary Healthcare to Rural, Tribal Communities in Rajasthan, India. Front. Public Health 8:583821. doi: 10.3389/fpubh.2020.583821

Background: Emerging health needs and uneven distribution of human resources of health have led to poor access to quality healthcare in rural areas. Rural pathways provide an approach to plan and evaluate strategies for ensuring availability, retention, motivation, and performance of human resources for health in rural areas. While effectiveness of primary healthcare (PHC) nurses to deliver primary health care is established, there is not enough evidence on ways to ensure their availability, retention, motivation, and performance. The paper draws on the program experience and evidence from a primary healthcare network (AMRIT Clinics), in which nurses play a central role in delivering primary healthcare in rural tribal areas of Rajasthan, India, to bridge this gap.

Methods: Rural, tribal areas of Rajasthan have limited access to functional healthcare facilities, despite having a high burden of diseases. We used the rural pathway approach to describe factors that contributed to the performance of the nurses in AMRIT Clinics. We analyzed information from the human resource information system and health management information system; and supplemented it with semi-structured interviews with nurses, conducted by an independent organization.

Results: Most nurses were sourced from rural and tribal communities that the clinics serve; nurses from these communities were likely to have a higher retention than those from urban areas. Sourcing from rural and tribal communities, on-going training in clinical and social skills, a non-hierarchical work environment, and individualized mentoring appear to be responsible for high motivation of the primary healthcare nurses in AMRIT Clinics. Task redistribution with due credentialing, intensive and on-going training, and access to tele-consultation helped in sustaining high performance. However, family expectations to perform gendered roles and pull of government jobs affect their retention.

Conclusion: Rural and remote areas with healthcare needs and scarcity of health provisions need to optimize the health workforce by adopting a multi-pronged pathway in its design and implementation. At the same time, there is a need to focus on structural

factors that affect retention of workforce within the pathway. Our experience highlights a pathway of up-skilling PHC nurses in providing comprehensive primary healthcare in rural and remote communities in Low and Middle-Income Countries (LMICs).

Keywords: primary care, community health, rural pathway, task redistribution, primary healthcare nurses

1. INTRODUCTION

India has a population of 1.3 billion, about 2/3rd of which resides in rural areas (1), about 1 in 10 belong to one of the many scheduled tribes (2). Rural and tribal communities face a higher disease burden than others, but have much less access to healthcare (2). Poor access to healthcare for these communities is often on account of uneven distribution of qualified health providers between rural and urban areas; and between tribal and non-tribal areas. According to *The Health Workforce in India* report (2016), there are almost four times as many doctors and nurses in urban areas than rural areas (3). Moreover, high levels of absenteeism (4), low motivation marked by social and family isolation, poor educational opportunities for children, insufficient pay (5) affect quality of healthcare in these areas.

Task-shifting is one of the strategies used to enhance availability of skilled human resources in rural areas. The World Health Organization (WHO) defines task-shifting as: "*Specific tasks are moved, where appropriate, from highly qualified health workers to health workers with shorter training and fewer qualifications in order to make more efficient use of the available human resources for health*" (6). An emerging task-shifting strategy is up-skilling of nurses to undertake larger responsibilities than their historically defined role of assisting a physician. Task-redistribution is used synonymously to task-shifting, and we have preferentially used the former nomenclature.

Previous reviews highlight the effectiveness of up-skilling nurses in meeting healthcare demands amidst growing burden of diseases (7–10). The reviews clearly establish that when skilled, mandated, and supported, nurses are as effective as doctors in delivering primary health care. Higher patient satisfaction outcomes (7, 8) have been observed with nurses as first point of contact (11) and thus patients more likely to keep their follow-up appointments with the nurses (12). This satisfaction is also associated with greater engagement with the patient (13) through counseling, two-way communication and drawing in context-specific real life connect (14). Nurse-led clinics (15) have been effective in providing specialized curative care and in improving patient outcomes.

Rural Pathways refer to a multi-pronged approach taken to sustain efforts to improve health outcomes in rural areas. Rural pathways may be designed to address specific needs identified in the community like the scarcity of health workforce in rural areas. O'Sullivan et al. (16) drew evidence and came up with a comprehensive checklist for implementing rural pathways for rural workforce in low- and middle-income countries (LMICs). The checklist highlights several components that initiate from the community needs to health worker selection, training and up-skilling, accreditation, and recognition as well as monitoring of outcomes. Examples from LMICs which were key to the lessons drawn for the rural pathway checklist focussed largely on availability of physicians or on community volunteers' up-skilling to perform certain primary care functions in rural areas.

A significant proportion of task-redistribution and nurse-led healthcare interventions have been implemented and tested in high-income countries. Also, most research focuses on assessing effectiveness outcomes of nurse-led interventions. However, there is limited understanding of what it takes to ensure availability, retention and ensuring high performance of nurses in delivering primary health care, especially in rural and tribal areas. Several systemic barriers such as hierarchies in the workforce and structural barriers and gender inequality pose as barriers in enabling nurses (most of whom are women), to assume leadership roles in countries like India (17, 18).

There is a critical need for exploring rural pathways that ensure availability, retention, and effectiveness of nurses as primary healthcare providers in rural areas in LMICs. Basic Healthcare Services (BHS), a not-for-profit organization that authors are associated with, runs a network of six primary healthcare clinics (called AMRIT Clinics) in rural and tribal areas of South Rajasthan, India. The clinics are managed by Primary healthcare (PHC) nurses, supported by a visiting and on-call primary care physician at one end, and community health workers and volunteers on the other. We analyzed our evidence and experience of running these Clinics to identify what steps along the rural pathways are required to ensure availability and effectiveness of PHC nurses in delivering primary healthcare in such areas.

2. METHODOLOGY

2.1. Context

Southern region of Rajasthan is predominantly rural, most of which is inhabited by a population belonging to one or other scheduled tribes (19). The region has the lowest Human Development Index (HDI) of 0.5 (20). Only about 35% of women in these communities are literate (1). From as many as 45% households, at least one man migrates to cities in search of livelihood (21). Half of all children are underweight and a similar proportion of mothers are malnourished too (20). Absence of functional health facilities in the area due to high rates of absenteeism (4), poor availability of food (19), and distress migration have a detrimental impact on the health status of the population in these areas, especially women and children. Careseeking (22) among these households remain erratic with only 6%

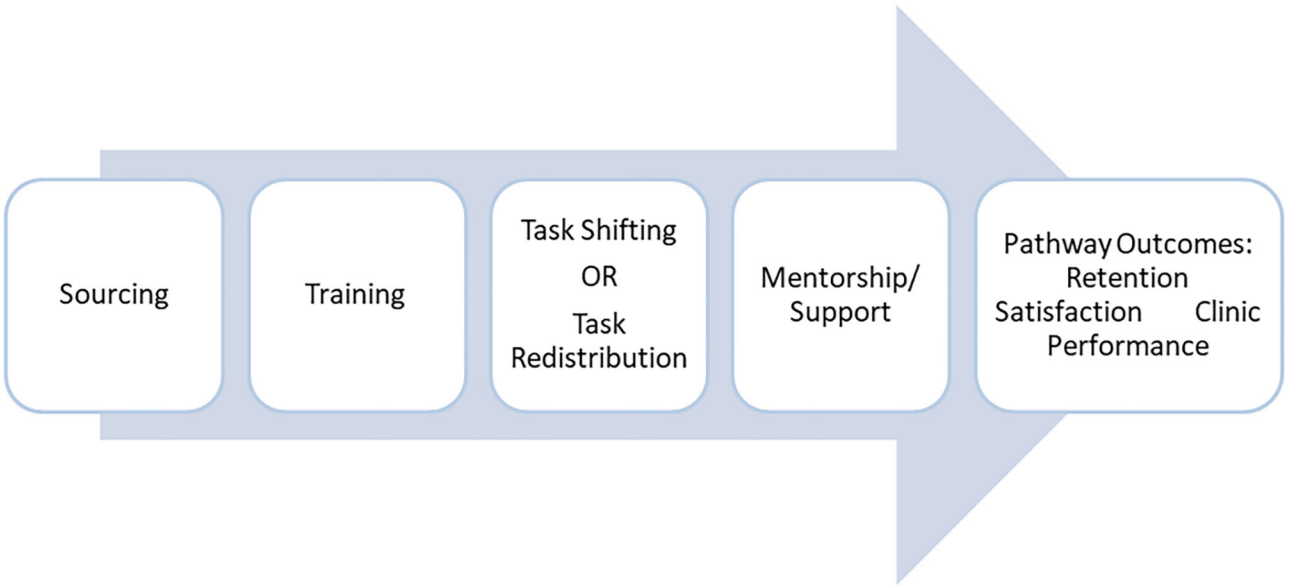

FIGURE 1 | Pathway to enable nurses to provide primary healthcare in rural areas.

TABLE 1 | Description of the steps in the Pathway.

Description of the pathway components	
Sourcing	Sourcing refers to the selection and recruitment of nurses done based on demographics, qualification, and experience
Training	Trainings are intended to keep the nurses' knowledge and practice updated.
Task shifting or task redistribution	Task shifting is the "*rational redistribution of tasks among health workforce teams*" (6)
Mentorship/support	Mentorship and support include ways in which nurses are supported to perform and grow personally and professionally
Outcome	(i) Retention: Duration for which nurses continue to be in their current jobs (ii) Satisfaction: A positive perception of the nurses on their role (iii) Performance: Effectiveness in meeting health needs of the populations served

TABLE 2 | The sources of data for the Pathway Components.

Sources of data for the pathway components		
Sourcing	Organization's Human Resource Information System	Nurses' qualification, background and place of origin data.
Training		The number of trainings conducted and the subject of trainings
Data on retention and attrition		The duration spent by each nurse at the clinic and the reasons for leaving.
Data on nurse's satisfaction	Qualitative data was accessed from nurses' interviews conducted by a third party organization named "Start Up!" for need assessment of leadership training (interviews conducted in February 2020)	Quotes suggestive of the themes identified in the interviews.
Data on patients managed	Organization's Health Management Information System (HMIS) (data retrieved for the years 2015–2019)	The data on the different types of cases managed by the nurses and the doctors.

of households seeking healthcare from formal qualified providers; others resorting to informal providers or traditional healers (4%).

2.2. Pathway Framework

To evaluate the effectiveness of strengthening capacities of PHC nurses, we adapted the existing rural pathway framework (16) and contextualized it (**Figure 1**). The components of the Pathway are described in **Table 1**.

2.3. Methods for the Study

To assess the effectiveness of the pathway and to evaluate the development outcomes, secondary data from three sources was analyzed. The sources of data for each pathway component are explained in **Table 2**.

The quantitative data was analyzed in MS Excel, using pivot tables to segregate provider level data and health condition wise data. For qualitative data, interview verbatim from a previous

TABLE 3 | Place of origin of Nurses.

	Non-tribal	Tribal	Total
Rural	5(13.5)	32 (86.5)	37 (92.5)
Urban	2 (66. 7)	1 (33.3)	3 (7.5)
Total	7 (17.5)	33 (82.5)	40

TABLE 4 | Comparison of remuneration and perks offered by Government facilities, private hospitals and AMRIT Clinics.

Indicator	Government Hospitals	AMRIT	Private Hospitals
Salary	26500	12,400	12,000
Holidays	7 weekly holidays in a month	4 weekly holidays a month	4 weekly holidays a month
Other perks	Other benefits like provident fund and Insurance are identical across all institutions		

source was accessed, translated, and analyzed while keeping the names of the respondents anonymous. Emerging themes were identified, and supporting quotes were elicited to substantiate the themes.

3. RESULTS

We analyzed information from above sources to describe and assess the different components of rural pathways for PHC nurses.

3.1. Sourcing

Nurses registered with Indian Nursing Council; with either a Bachelor of Science in Nursing (BSc Nursing) or a Diploma in General or Auxiliary Nursing and Midwifery (GNM or /ANM) were eligible for recruitment as PHC nurses in AMRIT Clinics. An affirmative action was taken to source them from rural and tribal areas, as they are more likely to live and stay in such areas and more empathetic to needs of the communities.

A total of 40 PHC nurses have been recruited in AMRIT Clinics from September 2012 till May 2020. Of these, 93% belonged to rural areas and 83% of them come from similar tribal communities that they serve (**Table 3**). Eighty-two percent of them had a diploma in GNM and 12.5% had a diploma in ANM. Two (5%) were interns pursuing a GNM degree.

3.2. Training

All nurses recruited as PHC Nurses undergo a focused one-month induction training, followed by 3–6 months intensive on-the-job training at clinics. This is followed by continuous nursing education, 2–3 days per month.

The training themes span across clinical knowledge and skills, communication and other soft skills, and management skills. Each component also emphasizes on context-specific understanding of social and cultural determinants of health. In addition, weekly primary care physician's visits and bi-monthly visits by Nurse Mentors are also opportunities to train on new and refresh on older learnings.

TABLE 5 | Clinic performance outcomes.

Management of different health conditions at AMRIT Clinics			
Indicator	**Total cases managed**	**Cases managed by PHC Nurses**	**Cases managed by Physicians**
All Illnesses	87,227	63,213 (62%)	24,014 (38%)
Reproductive health conditions	19,053	14,613 (77%)	4,440 (23%)
Childhood illnesses	10,452	7,253 (69%)	3,199 (31%)
Communicable diseases	25,964	15,059 (59%)	10,705 (41%)
Non-communicable diseases	9,287	3,835 (41%)	5,452 (59%)
Injuries	4,649	3,254 (70%)	1,395 (30%)

"*There is a good balance between training on clinical issues and (exposure to) social realities we see*" shares a Nurse Coordinator about the training imparted to them.

3.3. Task Redistribution

Task redistribution is a key component of the pathway that enables PHC Nurses to perform their duties effectively. In AMRIT Clinics, PHC Nurses are entrusted and credentialed to perform the primary curative functions, and enabled to do so through continuous training, standardized protocols, point-of-care diagnostics, and easy access to tele-consultation. PHC nurses reside in the Clinic villages and provide care on all days. Primary care physician lives in the nearby town, visits the clinics weekly on designated days, and is available for tele-consultation at all times. Redistributing the tasks of primary curative care between PHC nurses and the physician does not equate to shifting of responsibility: the responsibility is jointly shared by the two.

"*When a patient comes with a condition we are not certain, we call the consult the doctor on telephone. We also ask the patient to come on the designated day for doctor's visit after assessment. This is how wee ensure that no patient returns without receiving any counsel*" says a Nurse about the patient management procedure.

3.4. Support and Mentoring

The organization (BHS) supports PHC Nurses to play their role and mentors them for their personal and professional growth. Physicians provide mentoring and tele-consultation support to the PHC Nurses. Regular monitoring of data and feedback is provided to the clinic teams for quality of care.

Career advancement opportunities are provided to the PHC nurses: six of them have so far advanced to Nurse Coordinator position, and one of them has progressed to the Nurse Mentor position. The Nurse Mentor and a Clinic Associate supervise and mentor the PHC nurses individually through periodic on-site visits and through on-line support. The mentors identify opportunities for their personal and professional growth and assist them to tap those opportunities.

Additionally, an accommodation with basic amenities such as water, electricity, and sanitation; a competitive salary (comparable to salary in city hospitals) and a well-equipped clinic

with an amicable and respectful environment is made available to all of them.

3.5. Pathway Outcomes

3.5.1. Work Satisfaction and Motivation

Although no formal investigation was conducted to assess the job satisfaction, an independent organization conducted qualitative interviews with six PHC nurses to assess their leadership potential and needs for training. Interviews revealed a high sense of pride and satisfaction they perceived in managing the patients independently, equivalent to that of a physician:

"*We used to work under the doctor in the clinic but here we ourselves, it feels nice that we are doing doctor's work also*," shares a PHC nurse at one of the clinics.

Nurses appear to have a high level of patient-centeredness, as illustrated by the following quote by a nurse who was interviewed:

> "*We do not work for money here; days merge in nights, but we try to ensure that the patients get better.*"

High motivation appears to be also on account of the team spirit: "*Our team of doctors and nurses have always been supportive which keeps me motivated.*"

"*We feel gratified when we see the change in the community, it makes us forget all the fatigue from the hardwork*," shares a nurse about her work in AMRIT Clinics.

3.5.2. Retention

A total of 38 PHC nurses have been recruited in AMRIT over the last 7 years. Of those, 20 left the job after spending a median of 15 months (IQR: 8–35 months) A further analysis on segregating the PHC nurses based on their place of origin and caste found that the three from urban background areas stayed for a median duration of just over 6 months, while those from rural areas stayed for a median duration of 16 months.

Out of 38 PHC nurses employed so far, 20 left for various reasons. The two major reasons for leaving the job were: shifting to a government job (10), and for family reasons (10). The appeal of a "government" job is often what drives the PHC nurses' aspirations. As one of them shared:

> "*If we get a government job then we can get a posting near our home. We are working with this thought that in government job the salary will be better and would help in supporting our family.*"

While the salary at AMRIT Clinics is comparable to the best of private hospitals in cities, salaries and perception of job-security for government jobs is much higher.

Table 4 shows the comparison between the remuneration and perks offered by the government, private hospitals, and AMRIT Clinics.

The average age of PHC nurses who have worked at the clinics was found to be 27 years, with the age range being 21–38 years. Of the 38 PHC nurses, 30 are married and more than 20 of them were mothers often with more than one child. The "family" reasons for leaving often pertained to child bearing or child rearing roles and presence at home for carrying out other household chores, such as care of ailing parents-in-law. As one of the PHC nurses puts it: "*We are staying away from our family. We cannot bring them here. I have not stayed with the family since my marriage.*" The reason for their families not staying with them is lack of employment opportunities for their spouses and a poor quality of schools in the villages.

3.5.3. Performance

A retrospective analysis of the records from 2015 to 2019 of 3 AMRIT Clinics saw 87,227 patient visits, of whom 55,825 (64%) were women and 14,829 (17%) were children. While PHC nurses managed most of reproductive and child health conditions and communicable diseases, visiting physicians managed most of non-communicable diseases (**Table 5**).

A major indicator of quality of the service provided at the clinics is trust amongst the community. Sixty-three percent of the total patients visits made were repeat visits at reflect their perception of the care they receive at the clinic. The PHC nurses are also equipped with a protocol to manage patients with an array of conditions and also Standard Operating Procedures (SOPs) to ensure that the operation of the clinics are uniform and of high quality across all clinics.

4. DISCUSSION

Our analysis demonstrates that a rural workforce pathway approach can be effective in planning for and assessing the factors that contribute to availability, satisfaction, and performance of nurses to provide primary healthcare in rural underserved communities. While the components of such a pathway are similar to what have been described earlier for physicians (16), gender-based roles of female nurses and aspirations of government jobs emerged as additional factors to be mindful while planning and evaluating such pathways for PHC nurses.

The analysis showed that nurses from rural areas were likely to have a higher retention than those from urban areas. We also noted that these PHC nurses were more likely to have community connect, and performed better. Studies from other contexts have also demonstrated that healthcare staff are more likely to stay on in jobs if they belong to the similar communities they are expected to serve (23, 24); which in turn leads to their higher effectiveness (16).

At AMRIT Clinics, transition from an ANM or GNM to the role of primary healthcare nurse requires training to build the clinical acumen, understand the context and community needs and to build counseling and management skills. In preparing physicians to undertake rural health, there have been efforts to integrate in their training the values of empathy, social accountability, and community sensitivity (25). We have also observed the value of integrating these values within structured training as well as through mentoring and feedback provided to the PHC nurses.

While task-shifting and task redistribution have been used synonymously, we prefer the latter term, as it signifies the principles of equality (as opposed to hierarchy) and of shared responsibility and accountability. Task redistribution in AMRIT Clinics resulted in complementarity between roles of PHC

nurses and physicians: while the former played a larger role in managing maternal and child health conditions and communicable diseases, physician played a role in managing non-communicable diseases, providing tele-consultation, as well as in training PHC nurses on weekly visits. Both contributed significantly to the clinic performance. Such an arrangement allows the PHC nurses to perform their role with confidence, and for the team to have high performance.

One of the key challenges in providing primary healthcare services in rural and remote areas is sustaining the services through retention and sustenance of healthcare providers. There is no uniform strategy that looks at what works and what does not. Literature on human resource for health (26, 27) highlights working conditions and job satisfaction as important for retention. Studies also emphasize on remuneration and career advancement as key strategies as well (8, 26). Our experience also elicits the value of these components in building self-confidence and motivation of the PHC nurses. Additionally, from our experience, it appears that an enabling work environment, simple-to-use technology, and on-going mentoring sustains the motivation of the PHC nurses.

The opportunity to undertake responsibilities over and above normative responsibilities within nursing practice is perceived as equivalent to a physician's work. Therefore, the pathway enables the aspirations and potentials of this cadre by also drawing in a valuable role of the physician in shaping it.

Studies on nurse practitioners in high-income countries have elucidated how they have been able to provide services equivalent to physicians and have been effective in providing specialized care such as NCDs, maternal health, etc. (8–10). In our context, we observed that when mandated, skilled, and supported, PHC nurses can meet the complex health needs of rural and tribal populations effectively. In fact, they are likely to promote equitable access to healthcare, by extending care to women and children.

Studies on human resource in health highlight several push and pull factors that are responsible for retention of the healthcare workforce in rural areas (26, 28). This ranges from working conditions, home and family factors, local environment, and the national and international environment. In our context, the three areas inhibit retention. Firstly, family pressure owing to gendered expectations of the PHC nurses to manage their homes, children, and therefore desired proximity of the workplace closer to their home. Secondly, poor infrastructure of opportunities in the local environment such as housing for spouses, education facilities for children. Thirdly, in the context of India, a pull factor is the desire for a government job due to a higher remuneration offered for permanent nurses and job security.

Based on the findings, we propose to actively engage with families to identify ways to resolve the tension between their professional roles and gendered family roles. We also propose to explore public-private-partnerships in primary healthcare, so that some of the disparities in government and private salaries could be resolved, and optimize primary care nurses' availability in rural areas.

Implications on Policy and Practice

In India, rural-urban divide in access to healthcare and health outcomes is related to inequitable distribution of skilled and motivated human resources. The experience and evidence presented here suggests that the rural pathway approach, centered on task redistribution can help in bridging this divide. While recent guidelines in India [as part of Clause 32 of the National Medical Commission Bill (29)] have envisaged the role of nurses (as mid-level providers) in provision of comprehensive primary care in rural areas, it does not provide the pathways to enable them to do so. Our analysis provides some pointers. Sourcing nurses from rural and tribal communities (rather than from urban areas) to serve in rural areas is likely to be more effective since they are more likely to stay and be more empathetic to the communities they serve. A task redistribution approach, where tasks are redistributed between nurses and physicians, who work as a team with a shared responsibility, is likely to be more effective than a task shifting approach, which merely shifts the responsibility to deliver primary health care to nurses alone.

While the government has emphasized on higher remuneration to increase the nursing workforce, the current structure of hierarchy within medical practice does not foster a team approach. An emphasis on building non-hierarchical primary healthcare teams that draws on complementary strengths of PHC nurses and physicians will go a long way in advancing rural healthcare. Several forms of support systems, such as close mentoring, ensuring basic amenities, and good living and working conditions would be required to enable PHC nurses to play an effective role in delivering rural healthcare.

The rural pathway framework ordinarily focuses on systemic processes that can be influenced to strengthen the workforce. It does not encompass the structural factors, such as gender roles and family and societal expectations from the providers, which appear to significantly affect their availability, retention, and performance in rural areas. Future scoping and research should consider these factors while expanding existing pathways for rural workforce.

With dearth of studies in LMICs, the paper provides insights and evidence on a rural pathway approach to enhancing the role of PHC nurses in delivering primary healthcare in rural areas. Such a framework can be used in different contexts to plan and evaluate human resource interventions for improving rural healthcare.

Limitations of the Study

The study is based on experience of one organization in a rural, tribal area and therefore may not be generalizable to all such areas. It does however provide a framework for understanding the factors that would enable nurses in other similar areas to effectively provide primary healthcare.

We accepted the reasons that nurses stated for leaving the job, but did not conduct interviews with them to understand in-depth nuances of each case. However, the factors that emerged are helpful to design program level interventions to address retention.

Finally, the study did not measure quality of care provided by the nurses. While the large numbers of patient-visits managed

by the nurses provide an indication of their acceptance and perceived quality by the patients.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Ethical approval for this study and written informed consent from the participants of the study were not required in accordance with local legislation and national guidelines.

AUTHOR CONTRIBUTIONS

AA has contributed to the data analysis and writing of manuscript. MD has contributed to the literature review and writing of the manuscript. SB and PM have reviewed and designed the pathway framework as well as edited the manuscript. All authors have contributed to the conceptualization of the paper.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Medicine

BRIEF RESEARCH REPORT
published: 26 November 2020
doi: 10.3389/fmed.2020.594728

A Checklist for Implementing Rural Pathways to Train, Develop and Support Health Workers in Low and Middle-Income Countries

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OPEN ACCESS

Edited by:
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Reviewed by:
Torres Woolley, James Cook University, Australia
Harm Van Marwijk, Brighton and Sussex Medical School, United Kingdom

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Specialty section:
This article was submitted to Family Medicine and Primary Care, a section of the journal Frontiers in Medicine

Received: *14 August 2020*
Accepted: *30 October 2020*
Published: *26 November 2020*

Citation:
O'Sullivan B, Chater B, Bingham A, Wynn-Jones J, Couper I, Hegazy NN, Kumar R, Lawson H, Martinez-Bianchi V, Randenikumara S, Rourke J, Strasser S and Worley P (2020) A Checklist for Implementing Rural Pathways to Train, Develop and Support Health Workers in Low and Middle-Income Countries. Front. Med. 7:594728. doi: 10.3389/fmed.2020.594728

Background: There is an urgent need to scale up global action on rural workforce development. This World Health Organization-sponsored research aimed to develop a Rural Pathways Checklist. Its purpose was to guide the practical implementation of rural workforce training, development, and support strategies in low and middle-income countries (LMICs). It was intended for any LMICs, stakeholder, health worker, context, or health problem.

Method: Multi-methods involved: (1) focus group concept testing; (2) a policy analysis; (3) a scoping review of LMIC literature; (4) consultation with a global Expert Reference Group and; (5) field-testing over an 18-month period.

Results: The Checklist included eight actions for implementing rural pathways in LMICs: establishing community needs; policies and partners; exploring existing workers and scope; selecting health workers; education and training; working conditions for recruitment and retention; accreditation and recognition of workers; professional support/up-skilling and; monitoring and evaluation. For each action, a summary of LMICs-specific evidence and prompts was developed to stimulate reflection and learning. To support implementation, rural pathways exemplars from different WHO regions were also compiled. Field-testing showed the Checklist is fit for purpose to guide holistic planning and benchmarking of rural pathways, irrespective of LMICs, stakeholder, or health worker type.

Conclusion: The Rural Pathways Checklist provides an agreed global conceptual framework for the practical implementation of "grow your own" strategies in LMICs. It can be applied to scale-up activity for rural workforce training and development in LMICs, where health workers are most limited and health needs are greatest.

Keywords: rural workforce, rural health workers, training, education, professional support, implement, LMICs, guide

INTRODUCTION

Poor access to healthcare has major implications for the health and well-being of millions of people. Globally, countries with the highest proportion of rural residents correlate with poorest access. In countries where rural populations exceed 70%, only 16% of the population has access to universal health coverage (1). The most affected people are those in rural communities of LMICs (2). More than 90 per cent of people of low-income countries have no access to basic health care (3).

A critical issue for increasing universal health coverage is addressing the availability of a skilled rural health workforce (4, 5). The International Labor Organization (ILO) estimates that there is a current global shortfall of 10.3 million health workers needed to ensure provision of quality health services (3). Further, the World Health Organization (WHO) suggests that, based on increasing healthcare demand, ∼18 million health workers are needed by 2030, mainly in LMIC (6).

To increase access to rural and remote health workers worldwide, the WHO released its evidence-based global recommendations of effective strategies in 2010 (7). These focus on four areas of intervention: rural education, regulatory, financial, and personal and professional support. Of these strategies, investing in "grow your own" educational approaches (selecting and training health workers in rural areas) are considered as a mainstay. They particularly play a role in achieving a skilled and satisfied rural workforce, over relying on regulatory strategies like obligatory rural service requirements (8–14). However, educational strategies are some of the most complicated to translate into practice because they involve multiple stakeholders and complex actions at different systems levels. Compared with financial or regulatory strategies which can be enacted through a change in central government policy or legislation, to be successful, rural educational strategies involve a holistic package of linked interventions that are managed over a longer-term cycle. Further, they rely on tailoring to different rural places, training systems, types of health workers, and health system infrastructure. This makes their implementation relatively complicated, particularly for LMICs where there are many competing healthcare priorities to address within restricted resources.

Effective translation of the WHO recommendations into practice is also challenging because there are no known practical tools which integrate the WHO "rural education" and "personal and professional support" strategies into a package for implementation. This is important as rural education, unless backed up with ongoing development and support, is likely to fail as a longer-term workforce development strategy. The availability of practical tools like Checklists, may help to integrate rural training and professional development and support actions, tailored to different LMICs and rural and remote settings.

Implementing training and development strategies in rural locations, apart from improving access to healthcare, has a significant role in addressing rural social and economic development. This approach rebalances the range of training and practice resources, skills, and jobs that are typically concentrated in cities, to be available in rural communities. The WHO High-Level Commission identifies the links between health and health sector jobs, in rural communities and social, economic, and health outcomes (15). The urgent need for more health workers in LMICs over the next 15 years presents a significant global challenge, but by addressing this challenge through fostering more rural-based health worker training and development interventions, it is possible also to generate economic growth where it is most needed (15). Developing more rural training and development also reinforces the United Nations' Sustainable Development Goals, by improving access to rural quality education and work, they reduce poverty, improve gender equality, build community partnerships, and promote health and well-being in rural places (16).

There is no globally agreed and LMIC-sensitive terminology that addresses the training, development, and support strategies needed to grow the rural workforce. Colloquially, the term "*grown your own*" and "*rural training*" only picks up on elements related to training. "*Rural pipelines*" is also often used, however, it purveys being stuck in a rigid structure "*pipeline*." The term "*rural pathways*" has the potential to better reflect the choice of the trainee/worker to participate at each stage of their development and ongoing work, as a continuum of experience toward being skilled and supported for ongoing work in rural communities.

Our research aimed to confirm whether *rural pathways* terminology was appropriate, and describe what it entailed. Secondly, we aimed to design a Rural Pathways Checklist (Checklist) as a tool to guide the implementation of rural pathways in LMICs contexts. Finally, we intended to disseminate and test the application of the Checklist, assessing whether it addressed its purpose.

METHODS

This project was sponsored by the WHO and had ethics approval from Monash University, Victoria, Australia (Project

number 17636) ratified by the University of Queensland (Project number 2019002437). At project commencement, we engaged 13 experienced rural pathways implementers/rural health researchers from around the world, in a Steering Committee (October—December 2018). This group had experience of LMIC settings in different WHO regions and oversaw all aspects of project governance, quality, decision-making, and engagement. The Steering Committee, in consultation with the WHO, firstly agreed a clear vision, principles, and methods for the Checklist. These are outlined below.

Focus Groups

Two focus groups were held face-to-face with LMIC participants at the World Rural Health Conference (run by Rural WONCA—the Working Party on Rural Practice of the World Organization of Family Doctors) in 2018. These aimed to test LMIC concepts and terminology for "*rural pathways*," "*training*," "*recruitment*," and "*professional support*." Participants were trained primary healthcare workers and rural educators. They participated in open discussion with facilitators, where group comments were noted on a whiteboard, printed out and shared with the research team for analysis and informing the next stages of a policy and scoping review.

Policy Review

A desktop review of existing LMIC rural health workforce policies aimed to describe the progress and outcomes of rural focused policies and programs in LMIC settings, based on concepts and terminology from the focus groups. This was considered an important background for interpreting rural pathways strategies and describing the context of implementation. Articles or reports were accessed via key websites, sourced by the Steering Committee and Expert Reference Group or identified from published papers about LMIC human resource and rural pathways policies (by-products of the scoping which is described below).

Scoping Review

A scoping review was done using the five stage Arksey and O'Malley process (17, 18). The research question was to identify the extent, range and nature of LMIC rural pathways evidence and identify any exemplars. The search strategy and inclusion criteria (**Table 1**) were iteratively developed and informed by the LMICs concepts/terminology emerging from the focus groups, Steering Committee discussions and other global workforce reports (7, 20). In order to identify material and activity occurring in Latin-American and Francophone countries, English, French, and Spanish articles were included.

Consultation

Consultation with an Expert Reference Group aimed to test and refine the Checklist with practical users, including stakeholders involved in rural workforce development in LMICs as well as personnel in high income countries (HICs) with knowledge of LMICs rural contexts and training systems. The Expert Reference Group included 70 rural pathways implementers who were

TABLE 1 | Search strategy and inclusion criteria.

Item	Description
Search period	The search was limited to literature published between 1st January 1998 and 30th October 2018
Databases	Six databases were chosen based on scope and relevance of literature content: Medline, Social Science Citation Index, CINAHL, ERIC, Rural and Remote Health, Informit Health Collection, and the Cochrane Database of Systematic reviews. The search strategy included a Boolean search using the three sets of search terms
Additional sources	Other literature was also identified from snowballing, hand searching and directly identified by the Steering Committee and an Expert Reference Group
Sensitivity	A sensitivity analysis of the search strategy was performed, ensuring that results included known or key texts identified by steering committee members
Search concepts	The concepts applied to the search were based on the review question: *What are the main elements of rural pathways to train and support the rural workforce in LMIC and what are their outcomes? What contextual factors influence implementation of rural pathways in LMIC to inform a Checklist for these countries? Are there any vignettes of best practice models that would support reflection?* Concept 1: Rural or remote. Concept 2: "health work*" or doctor OR "general practitioner" OR "physician OR nurse" OR "nurse practitioner" OR "rural generalist" OR "rural nurse" OR "allied health" OR dentist OR specialist OR "community health worker" OR "family physician" OR "family doctor" OR "health prof*" OR "clinical officer" OR "clinical assistant" OR "health assistant" OR "mid-level worker." Concept 3 train* OR curricul* OR develop* OR course OR placement OR immersion OR skill OR education OR qualification OR competen* OR recruit* OR retention)
Inclusion criteria	Rural or remote Based in a LMIC (or literature review which incorporated LMICs) (19) About any type of health workers in frontline clinical services (excluding non-clinical or liaison roles) Outcomes of any aspect of rural pathways to develop the capacity, skills, scope or distribution of the rural workforce based on the WHO framework (themes of education and training and professionally supportive environment) (7) 1998–2018 English, Spanish, or French
Exclusion criteria	High-income country consistently over last 20 years No outcomes reported—discussion of an intervention only or broadly about human resource statistics rather than rural pipeline LMIC-based training for developing health workers from high-income countries Technological interventions but not specific to supporting rural workforce in LMIC setting Not about rural pathways for the growth and development of the rural workforce <15 people in sample About worker satisfaction with limited breakdown to inform supportive environment factors About intention for rural practice if not linked to a rural pathways factor (such as broad surveys of University student cohorts without delineating relationship to rural training) Rural training was <3 weeks duration Full text not available (via find full text using Endnote, Google or direct library searching)

TABLE 2 | Questions posed during Expert Reference Group consultation.

Round	Focus	Questions
1	Provide information about rural pathways activities in your area	What rural pathways strategies using, where, the aim, enablers, barriers?
2	Feedback on a draft copy of the Checklist (with reflections and dot points of individual textual description about cited published evidence per action)	What do you think about the range, quality and structure of the draft Checklist? Who would use the Checklist in your setting? What do you prefer—"pathways" or "pipelines" for describing this activity?
3	Feedback on a graphically-designed copy of the Checklist (with reflections and a brief summary of evidence per action)	Is there anything missing? In which action areas have you already made progress? What would enable implementation of actions and how would you measure success?

part of the global rural health policy and practice community associated with Rural WONCA. Participants covered a range of health disciplines, countries and WHO regions, 42 (60%) were from LMICs. Consultation occurred over three stages, via tailored *Qualtrics* surveys sent by Email using Rural WONCA's regular Email list (covering all countries, rural stakeholders, and health worker types). The first round sought to gather general information about rural pathways activity for informing Checklist development. The 2nd and 3rd rounds sought feedback about the draft Checklist (**Table 2**).

Dissemination, Engagement, and Field-Testing

Dissemination, engagement, and field-testing of the Checklist occurred between January 2019 and February 2020. To aid distribution and access to the materials, a short version of the Checklist which was translated into 12 languages: Arabic, Bengali, Burmese, Chinese, French, Hindi, Indonesian, Portuguese, Russian, Spanish, Swahili, and Thai. The Checklist and translated materials were then provided on the Rural WONCA website and sent by email circulation to the global rural health policy and practice network associated with Rural WONCA and other experts these people identified. The materials were also provided to the Expert Reference Group. The Checklist was then presented at six international primary care conference workshops in 5 locations (Kyoto, Bratislava, Darwin, Uganda, Albuquerque), and at key workforce planning networks that the Steering Committee members were involved in.

The field-testing process followed and aimed to test whether the Checklist addressed its intended purpose, including being applicable to a range of LMICs countries and rural and remote contexts, health workers, stakeholders, and rural health problems, for its planned purpose of benchmarking and planning rural pathways implementation. To do this, interactive workshops were held, inclusive of a mix of stakeholders at conferences. Further, direct meetings were held with Expert Reference Group members from LMICs who nominated an interest in the Checklist and a willingness to test its application to their situation.

To aid data collection from meetings and workshops, a self-assessment tool, which was an adaptation of the Checklist, was applied to field-testing. This was developed by changing the reflective questions of the Checklist action areas into a series of 4–6 statements representing components of the action. A copy of this tool and the Checklist was provided to participants in advance of field-testing workshops or meetings.

For field-testing, the Checklist and its intended purpose was firstly explained. Then individuals were asked to consider a problem in their own rural community and the types of health workers they needed to support it. Following this, participants were asked to apply the self-assessment tool to rate their progress on actions for this issue (from 0 to 4 as "nil" to "strong"). The sum of progress scores on each item was then calculated giving participants an overall benchmark score of their progress in each Checklist action area. The process took ∼40 min to complete and was followed by 20 min of discussion and reflection, whereby a facilitator recorded participant feedback. When the session concluded, the completed self-assessment tools were collected as data. In addition to this, participants were encouraged to take a copy of the Checklist and materials and apply them to real-world planning in their own communities and submit more detailed feedback via email.

RESULTS

The agreed vision for the Checklist was *to inform the implementation of all levels of action required for effectively training and supporting health workers in LMICs to improve the capacity, skills, scope, distribution, and retention of qualified rural generalist teams, adaptable for different rural, and remote communities*. For impact, the focus was not just on the quantity of health workers, but also on their quality and relevance to the community (21).

The Checklist principles were also agreed: the Checklist would be informed by the literature about successful LMICs strategies; easy to use; based on universally understood terminology; able to promote reflection and learning; and applicable for planning tailored action for different LMICs, stakeholders, health workers, and community problems/contexts, at any stage of rural pathways development.

Focus Groups

From the focus groups, LMICs stakeholders identified that the term "*rural pathways*" covered broad strategies encompassing recruitment, education, training, professional support, and retention. In their context, bridging courses and step-wise qualifications were commonly used. Producing fit for purpose generalist teams of rural health workers was agreed to include people with certified skills. Trained or untrained health workers with only basic general qualifications were not considered to meet the criteria, nor support rural equity, or quality care.

TABLE 3 | Rural Pathways Checklist including eight actions[a].

Checklist action	Summary of evidence	Reflective questions
Community needs, rural policies, and partners	Working with rural communities to explore their needs for healthcare helps to work out priorities for action community. A scan of the national policies and plans for rural health provides insights into directions for governments and potential synergies between policies and the local priorities. Priorities may need to be sorted into an order, particularly in the face of competing demands for resources and in some cases, extensive unmet need. Government and other partners, along with decentralized finance and management is important for enabling solutions to be appropriately tailored and for ensuring appropriate technical and financial support is available.	What do our rural communities need? • Is the community involved in defining priorities and possible solutions? • What are key priorities now, which can be built on later? What rural health policies/plans exist to support action? • Are they implemented? • Do these cover health workforce, training, and rural health priority areas? • Is policy/planning decentralized? • Are new policies needed? What global, national, or local partnerships can we build to help? • Who can assist? • How can the partnership be sustained? (7, 8, 23, 25, 36–43)
Existing workers and their scope	The skill levels of rural workers may not be sufficient to meet rural and remote community needs. A scan of existing rural and remote health workers and their skills, practices, and motivations can inform rural pathways strategies. Rural and remote healthcare teams having a wider range of skills, supported by organizations to address community need, can improve comprehensive local care, and potentially help to improve health worker satisfaction and retention. Communities need to balance short-term recruitment needs with long-term workforce building processes.	What rural healthcare teams, working within what scope, are needed? Do workers already exist with skills for this scope of work, easily recruited/retained? • What are their qualifications and training relative to the skills demands of the role? • Are they motivated to work at the required scope? • Is their health service supporting their increased scope? • Are they being retained in rural and remote areas? • Are they attracted to work in rural and remote communities? • Are there short-term recruitment options whilst longer-term workforce is developed? (41, 44–54)
Selection of health workers	An extensive range of community selection options are demonstrated involving selecting people with a connection to "place," commitment to serve others, motivated to learn, and invested in improving access to community health services. Universities and training courses with a social accountability for developing health workers with a desire to serve others, trained, and ready to work where they are most needed, tend to select students committed to helping underserved. Selection of rural background, people from disadvantaged communities of different race and language groups relative to the country and rural context is important, along with financial and social support for these groups to fully participate in city courses. Cost benefits of developing new workers are important considerations and should be evaluated.	How can we select workers for this role from the community? • Are there people in the rural community who could fill roles with some education and training? • What process and criteria will effectively select them *from the community for the community*? • What is the entry level standard appropriate for coping with the training? • What financial and social support do community members need to access training? • What are the cost-benefits of training a new worker and who will share the costs of training? (27, 28, 32, 55–70)
Education and training	Optimal education and training for rural practice occurs through exposure to rural and remote practice, teams, and health systems. Learning the range of skills needed is effective through distributed training systems using locally-available qualified teachers and supervisors, in the place where people are going to practice and involving of the people that the workers are going to help after they finish training. This often occurs within University and other training organizations with a social accountability for developing health workers with desire to serve others, trained, and ready to work where they are most needed. And also by providing options for existing rural workers to learn and get qualified, on the job, through supervision, and decentralized courses. For optimal effect, more practical training in the rural communities is best, along with bundled support to optimize the educational experience. Compulsory service strategies work best if they are combined with selection, education, and support strategies. Beyond any one course, there should be options for doing more advanced training, for career progression. Training covers the breadth of skills needed for the role. Sustainable funding and technical support for decentralized training is important.	How can we effectively educate, train, and up-skill people *in* rural areas and for the breadth of skills needed by rural communities or support existing rural workers to learn on the job? • What bridging courses are required? • What rural curriculum is relevant? Who will develop and validate this? • How can theoretical and practical components be delivered in rural areas? • How much real-time supervision and virtual supervision will work to learn practical skills safely? • How can practical learning support the scope and complexity of skills required? • What further training can the qualification articulate with for career development (short course or university)? • How much would it cost to train/employ/support students and how can this be funded? • How can the local government, community, and champions support the training? (8, 24–28, 33, 34, 56, 62, 71–91)

(Continued)

TABLE 3 | Continued

Checklist action	Summary of evidence	Reflective questions
Working conditions for recruitment and retention	Education and training is only likely to be effective in recruiting and retaining health workers if the practice conditions are right, there is a supportive learning culture and strong management in the health service and there are supplies, clinical infrastructure, safe housing, good remuneration, and sustainable workload. Health worker motivation and engagement is better if employers regularly check in with them about their goals and any factors impacting their performance. Structured orientation and community-based projects for new staff can improve transition to rural work as a new worker and interest in continuing in the role.	What are the practice conditions in the community which could affect satisfaction, recruitment and retention? • Are we recruiting people who completed training in the community to work in the community? • Do the rosters make the workload sustainable? • Are we creating jobs with satisfactory employment terms and variety, volume, and scope of work? • Is remuneration appropriately rewarding employees? • Is there an orientation to the workplace? • Is there orientation to the community? • Are senior workers and supervisors available onsite/virtual? • Is there training for health service managers? • What support is there for housing and meals? • Do health workers have transport for their work? • Are there baseline stocks of medical supplies, equipment, and drugs? • Are the health service buildings and clinical infrastructure of reasonable standard? • Is there security for workers? • Are workers given enough time off? • Are there subsidies for work away from home? • Do workers have access to technology support and internet? • Is there rural health team cohesion? (62, 92–103)
Accreditation and recognition	Accreditation and formal professional recognition of the worker is important for recognizing the worker's training and scope of work. It helps reinforce their investment in doing more training and supports their retention in the role and use of all their skills. Clear accreditation and recognition also helps the community to identify qualified health workers. Recognition of supervisors is equally important.	How can people who are trained for rural work be accredited and recognized for transferability of the qualification? • What qualification can they be given? • How can the community value graduates of the training? • Is there a professional title for graduates? • Are the graduates recognized at country level for what they do? • Can the graduates be paid appropriately for using the skills they have developed? • Do they have options for progressing their career path? (62, 81, 92, 96, 104, 105)
Professional support and up-skilling	It is important to provide professional supervision and networking opportunities to reduce health worker isolation and reinforce skills development. Online communities of practice and peer exchange systems can be useful but they need to be tailored to the health workers' needs, organized, and evaluated. If senior staff are not onsite, then at least monthly virtual or face-to-face meetings and case reviews by senior staff should be facilitated. Structured orientation and community-based projects for new staff can improve transition to new workers to rural work and support their interest in continuing the role.	How can rural workers be professionally supported? • What senior clinician support and supervision is available? • Are the information systems available to the health workers optimal for the job? • What systems (outreach, telehealth and onsite) are there for getting feedback on challenging cases? • What refresher courses and simulations could be available for low volume but important skills? • How can the health workers access peer support - professional meetings and practice discussions? • What professional networking is possible? • Are there opportunities to participate in local research projects? (21, 97, 106–128)
Monitoring and evaluation	Monitoring and evaluation of rural pathways plays a central role in informing any adjustment to the pathways as well as providing evidence about the effect on rural workforce, their supply, qualifications and retention, accessible health services and demonstrating community health, social, and economic outcomes. This requires consideration of routine data collection for pre and post testing or using control groups of rural communities without pathways.	Are the activities and outputs of the program being implemented as planned? What are the intended outcomes of pathways and how can we collect data to measure this effect? • Do we have workforce registries and health data or how can these be built and managed? • Are partnerships set up for strong evaluation? • What do we want to measure? - Is community need being monitored? - Is selection and training effective for pathways goals? - Are there more rural students / local workers and supervisors? - Is professional development effective?

(Continued)

TABLE 3 | Continued

Checklist action	Summary of evidence	Reflective questions
		- Is there more infrastructure? - Is workforce retention better? - Is access to health services better? (earlier intervention, continuity and prevention measures) - Have there been changes in service volume and complexity? - What are the social, economic and health outcomes in the community? (7, 21, 39, 129, 130)

[a] *Please see the graphically-designed Checklist in* ***Data Sheet 1****.*

Policy Review

Over 350 articles or reports were accessed in relation to LMIC policies. Substantial variation of rural workforce policy development was apparent for different LMICs and WHO regions. Few countries had strong national-scale rural health or rural workforce strategies. If they did, the strategic directions were often confined to one health worker type or targeted at a particular community health issue like maternal health (22, 23). The evidence of integrated rural pathways strategies was most developed in Thailand and the Philippines for medical doctors, including at University and early graduate levels (24–28). There were also examples of step-wise models included Community Health Worker training in Ethiopia (29, 30) and international partnerships to boost intelligence and resources for building rural pathways (31). However, there was limited evidence of holistic planning for training and supporting the range of skilled health workers needed by rural communities (32–34). This highlighted the potential value of a Checklist as a systems framework.

Scoping Review

The scoping review identified 7,127 articles (**Figure 1**). After screening titles and abstracts, 97 empirical studies (83 from the literature search and 14 identified by the Steering Committee and Expert Reference Group) and 30 literature reviews (27 from the literature search and 3 from the Steering Committee) were included. After full text screening, data extraction was done using an Excel spreadsheet based on criteria that had been iteratively developed to ascertain material relevant to the scoping review question.

Most of the evidence was published since 2010. Empirical studies were from Africa ($n = 45$); Southeast Asia (25); Western Pacific (14); South or Central America (12), and Eastern Mediterranean regions (2) as formally defined WHO regions (35). Of the 97 empirical articles, 63 were about doctors/physicians; 28 were about other primary health care workers, mainly Community Health Workers, Health Extension Workers, Mid-Level Health Workers, Health Assistants, and Auxiliary Midwives. There were also two studies about other disciplines: Radiographers and Nutritionists/Physiotherapists/Speech Therapists/Occupational Therapists. Three other studies focused on Midwives, Nurse Practitioners, and Nurses, respectively. A single study concerned Rural Health Service Managers.

The literature was firstly charted according to broad training and personal/professional support categories based on the strategy areas of the 2010 WHO global recommendations for *Increasing access to health workers in remote and rural areas through improved retention* (7). Inductive thematic analysis was then applied to progressively layer and reorganize material into key themes related to guiding implementation without any pre-existing coding framework. This resulted in a draft framework of rural pathways actions that was discussed and refined based on feedback from the Steering Committee, Expert Reference Group, and staff at the WHO. Eventually the draft Checklist comprised eight equally balanced actions, presented in a Microsoft Word document (shown in **Table 3** before being applied as the graphically-designed Checklist in **Data Sheet 1**). These actions were: establishing community needs, policies, and partners; exploring existing workers and their scope; selecting health workers; education and training; considering working conditions for recruitment and retention; accreditation and recognition of qualified workers; professional support and up-skilling and; monitoring and evaluation. For each action area, reflective questions underpinned by supporting evidence (individual references to research and what it showed) was developed. This design specifically aimed to address the objective of stimulating reflection and learning for implementing each action specific to the LMICs context.

Consultation

The consultation with the Expert Reference Group at round 2 (**Table 2**), suggested that the draft Checklist was well-structured and comprehensive—applicable to any LMICs, stakeholder, health worker, context, or health problem, regardless of the starting point. The reflective questions were considered useful:

> *"In resource poor settings, a checklist of basic tools/equipment for the workers being trained is an important practical aspect for reflection".*
> *"Reflective questions fit our setting which is poorly resourced (human and material)".*

The stakeholders gave feedback that they preferred that the evidence was provided in summary references only. Further, some respondents indicated that the Checklist may

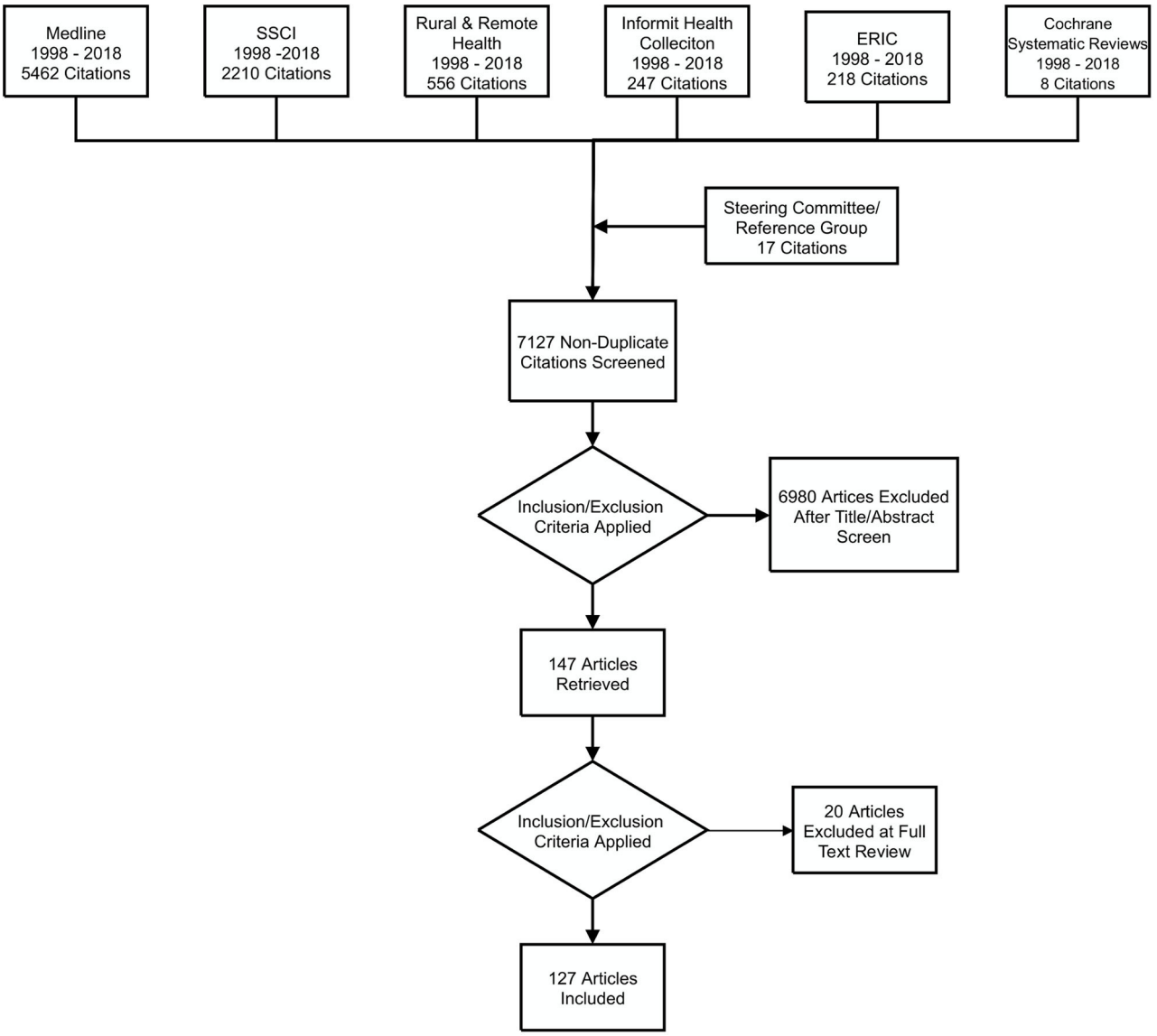

FIGURE 1 | Outcomes of the search strategy.

be more successful if there was more consideration as to the context of implementation. To address this, the Steering Committee decided it was relevant to develop a stakeholder map to accompany the Checklist, which could represent the partners in relation to implementing the 8 Checklist actions (**Data Sheet 2**). Also, a series of rural pathways implementation exemplars was developed. These were based on the highest quality examples of rural pathways activities that had been identified by the policy, scoping review and consultation phases, targeting coverage of different WHO regions (**Data Sheet 3**) (35, 131). Round 2 feedback confirmed that the term "*rural pathways*" was preferred over terms like "*rural pipelines*." Respondents noted the former was easier to translate in all LMIC languages and encompassed different entry points, iterative lifelong learning and progression through training and development events, rather sealed and inflexible routes.

The round 3 feedback from the Expert Reference Group related to the graphically-designed version of the Checklist (131) (**Data Sheet 1**). This unanimously confirmed that the Checklist was comprehensive and complete:

> *"It's very well structured and is the way forward for any country"*
> *"This graphic display presents the key elements very clearly"*
> *"…I think it can be used at many different levels of the healthcare system and planning processes… to identify gaps."*

This feedback also identified that the priorities and the degree of progress with rural pathways implementation across the 8 actions was highly variable by country. Respondents reported

that a key enabler for implementing actions were a government commitment to rural health, formalized in policy, and through sustained investment. They also mentioned that health service engagement and using coordinators who could assist to broker pathways and relevant partnerships may be helpful. The key barriers to implementation in LMICs included: time and funding; sharing resources with rural communities and; embedding the value of rural work and learning into policy action.

Dissemination, Engagement, and Field-Testing

Dissemination, engagement, and field-testing provided a range of positive feedback about the Checklist and no major changes were suggested. Participants unanimously noted that the tool was highly applicable as a practical resource for implementing rural pathways in HICs (reaching beyond the intended purpose). The self-assessment tool (**Data Sheet 4**) was used to test the Checklist's application. Overall 56 participants from 20 countries participated in this process. Of these, 38 worked in rural areas, 21 were from LMICs—Brazil, Liberia, Guatemala, Malawi, India, Papua New Guinea, Latin America, Philippines and Uganda, and 35 were from HIC—Canada, Australia, United Kingdom, and United States of America (5 of whom were serving LMICs– Haiti, Kyrgyzstan, Syria, Iraq, Thailand, Asia, and Africa). Participants represented various stakeholders (director to student/community levels) from a range of organizations including universities, trainers/educators, global and rural health programs and researchers, overseas missions, policy and planning institutes, health services, and community boards.

Participants identified a wide range of real-world rural health problems and health workforce challenges for which the Checklist was considered relevant. The data from the self-assessment tool also showed that the Checklist was effective for any type of stakeholder to self-identify gaps in their rural pathway actions for specific rural health workers they were trying to train, develop, and support. Stakeholders suggested that it helped them to see gaps in the pathway that they needed to discuss with other stakeholders, so they could work out jointly agreed strategies to address these. Some considered that the Checklist and associated materials could be valuable to use with different rural pathways implementers in the one training sub-system, for example during collaborative meetings, to agree on community needs, stakeholder actions, and responsibilities, thereafter checking in regularly to refine action. The self-assessment tool was also considered applicable to support regular planning over the long-term rural pathways implementation cycle. This includes when reflexive action may be needed based on changing conditions. A summary participant's reflections is outlined (**Table 4**). Beyond the field-testing meetings, selected stakeholders applied the Checklist to real-world planning in their countries. One such study is published to date, finding the Checklist was applicable for developing strategies to expand rural healthcare workforce in Kyrgyzstan (132).

With respect to HIC use, stakeholders noted that the state of progress toward rural pathways implementation was fairly strong, but the Checklist particularly applied to them as they noted their rural pathways were complicated by extensive numbers of stakeholders, professional competition, and workforce regulations which sometimes detracted from addressing community goals.

TABLE 4 | Stakeholder feedback about the Checklist, following field-testing.

The Checklist and self- assessment tool really helped me with my issue of developing online medical education
I identified lack of recognition as an issue for doing the training
It is adaptable to recruitment and retention in any population or health worker group
I was initially concerned but it relates significantly to me
It is exactly the type of tool I am looking for
I identified weaknesses in the project I am working on
It is possibly a resource for measuring outcomes of rural based training
I realize we need to decentralize care. It helped me map the new interventions we need.
I can take it to a group or practice community involved in developing a rural pathway to help them plan together and get a common agreement
Nothing helped me as closely to work out what we had to do than the Checklist
It could help us to appraise our new national training system
I knew the problem already but I realized I have not addressed all the issues so this helped me work out how effective the program is
It could be good to facilitate brainstorming and illuminate on the gaps because each part of the rural pathway is so complex, and some of them we know more than others
… could be used to check-in regularly with others involved in implementation, our perceptions may differ My answers about our progress would possibly be different to policy-makers
We get so many initiatives from top down and we get caught in expectations of being accountable to funding bodies that we forget to be accountable to the community. This tool reminded me about that.
This has application in building workforce capacity for primary care innovation, which will help us to keep people out of hospitals…tools like this can drive community prevention as well
It could help to bring entities together to find a common purpose
…It makes things explicit, brings them up for discussion.
…We are glad the Checklist fits the whole workforce and any problem… not just country level stuff but also local situations.
…helped me see the gaps. We may identify cost-neutral strategies from some of the prompts.

DISCUSSION

This project involved developing an agreed terminology and framework to support practical implementation of rural pathways in LMICs. The resulting Rural Pathways Checklist evolved from a breadth of methods including reviewing evidence, consultation, and engagement and field-testing to ensure it was both evidence-based and pragmatic, for greatest utility in LMICs. The Checklist is a step forward in achieving a globally-agreed conceptual framework and language which integrates eight training and personal/professional support actions to train, develop, and support rural health workers under a continuous quality improvement cycle. Building on the 2010 WHO recommendations for increasing access to health workers,

the Checklist actions are focused on a community goal. They attempt to drive more comprehensive rural pathways interventions through long-term effort of many stakeholders, rather than through discrete or siloed strategies. We note from our consultation, that for LMICs to achieve holistic rural pathways implementation, relies on political commitment to decentralize training and resources to rural communities over the long-term. The Checklist may be a tool that LMICs can use to advocate for clear rural training/professional support strategies and more rural investment.

Developed with LMICs evidence as the reference point, the Checklist is the first of its type to be sensitive to countries with the most extreme healthcare needs and most significant shortages of health workers. Although HICs found the Checklist useful and applicable to their own setting, its application may have the most benefit in LMICs given the outstanding levels of socio-economic and health disadvantage, extreme geographical isolation, and poverty. Starting the process of implementing rural pathways in this context has the greatest potential to alleviate global poverty by increasing access to rural work and health, enabling universal health coverage. Critically, it may also bolster local health workers trained for the problems in the community who are more likely to be retained in their community of origin. By increasing trained health workers, local health services are able to cope with the volume of presentations locally and diversify their service platform, supporting rural social, and economic development goals. The demands for a skilled and stable rural health workforce have been particularly notable during the COVID-19 pandemic. The pandemic situation has placed extensive strain on a small number of rural health workers to work at a broad scope, often without the training and professional support they may need. The Checklist may be a way to navigate out of this situation and build self-reliant rural communities with sufficient skilled health workers.

The project identified that countries, districts, and communities are at different starting points with respect to rural pathways implementation and have different health needs, but the Checklist may be a viable reference point for planning and evaluating action regardless. As opposed to other tools that are discipline, stakeholder or country specific, the Checklist may aid as a resource that is applicable to diverse countries, rural locations, and workforce issues and help to break down siloed profession-based workforce planning, in vertical disease areas. Such effort does not address holistic rural community need in LMICs. The self-assessment tool provides a means of regularly evaluating progress with rural pathways implementation in the complex dynamic environment of rural communities, where changes are common and adjustment is regularly needed. Regular use of the self-assessment tool may increase the potential for timely identification and response to emerging challenges.

Our project has some limitations. The scoping review identified 127 relevant studies from LMICs, applicable to the Checklist but as more evidence emerges, the Checklist may need to be updated. We only commenced the process of collecting exemplars from different WHO regions in this project. Yet there is great potential to build on this and foster global communities of practice in this area, including through online exchanges. This may help with information-sharing and mitigate professional isolation that many rural pathways implementers may face in their own countries or regions. The Checklist has the potential to support more comparative multi-national research about rural pathways. Its utility may also be facilitated if further work was done to marry this with a suite of other global tools to guide action for improving universal health coverage worldwide. The field-testing we did was limited to a convenience sample covering diverse rural contexts, but further research could usefully test the applicability of the Checklist to a set of rural pathways stakeholders of individual countries such as some studies are starting to do (132). Finally, our research explored whether the Checklist applied to all types of health workers needed in rural areas, but it may be pertinent to test how well it applies to particular primary health cadres across a sub-set of LMICs, to gather more data about its reliability.

CONCLUSION

Our study developed a Rural Pathways Checklist to support practical implementation of integrated rural training, development, and support strategies for health workers in LMICs rural areas. Through diverse methods which drew on both theory and practice, we identified eight actions, reflective questions, and additional resources. Together, these support a continuous, connected and sustained effort for rural pathways implementation in LMICs. Although this Checklist requires further validation, it is possible that it can produce real improvements in access to health workers, fit for the needs of LMICs communities worldwide, as a key step for addressing major inequalities in rural health and sustainable development in rural places.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by This study had ethics approval from Monash University, Victoria, Australia (Project Number 17636) ratified by the University of Queensland (Project Number 2019002437). Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

BO'S led the conceptual design, ethics, data collection, field-testing, analysis, and writing. BC and JW-J led the establishment of the global and expert steering groups and the concept testing phase. AB assisted with the scoping review, expert reference group surveys, and field-testing protocol. All authors contributed to design, data collection, analysis, and writing and agreed on the final manuscript and Checklist materials for publication.

The WHO approved the Checklist and final manuscript for submission for peer review publication.

FUNDING

This work was funded by the World Health Organization (WHO).

ACKNOWLEDGMENTS

This work was done in collaboration with the World Organization of Family Doctors (WONCA) through the WONCA Working Party on Rural Practice (Rural WONCA). We acknowledge the substantial feedback and advice of a Steering Committee and an Expert Reference Group along with input and testing of the Checklist by rural pathways implementers from around the world. The views and opinions expressed in this article are those of the author(s).

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fmed.2020.594728/full#supplementary-material

Data Sheet 1 | Graphically-designed Checklist.

Data Sheet 2 | Stakeholder map.

Data Sheet 3 | Exemplars from WHO regions.

Data Sheet 4 | Self-assessment tool.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Medicine

PERSPECTIVE
published: 14 January 2021
doi: 10.3389/fmed.2020.582130

Family Medicine Training in Lesotho: A Strategy of Decentralized Training for Rural Physician Workforce Development

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Family medicine is a relatively new but rapidly expanding medical discipline in Sub-Saharan Africa. Specialization in family medicine is an effective means for building and retaining a highly skilled rural physician workforce in low- and middle-income countries. The Lesotho Boston Health Alliance Family Medicine Specialty Training Program is the first and only postgraduate family medicine program and the only accredited postgraduate training program in the Kingdom of Lesotho. Lesotho has unique challenges as a small mountainous enclave of South Africa with one of the lowest physician-to-patient ratios in the world. Most health professionals are based in the capital city, and the kingdom faces challenging health problems such as high human immunodeficiency virus prevalence, high maternal mortality, and malnutrition, as well as increasing burdens of non-communicable diseases such as hypertension, diabetes, and obesity. In response to these health crises and the severe shortage of health professionals, Lesotho Boston Health Alliance partnered with the Lesotho Ministry of Health in 2008 to introduce family medicine as a new specialty in order to recruit home and retain Basotho doctors. Family medicine training in Lesotho uses a unique decentralized, non-university-based model with trainees posted at rural district hospitals throughout the country. While family medicine in Lesotho is still in the early stages of development, this model of decentralized training demonstrates an effective strategy to develop the rural health workforce in Lesotho, has the potential to change the physician workforce and health care system of Lesotho, and can be a model for physician training in similar environments.

Keywords: Lesotho, family medicine, primary care education, family medicine training, rural training

OPEN ACCESS

Edited by:
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Reviewed by:
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Specialty section:
This article was submitted to Family Medicine and Primary Care, a section of the journal Frontiers in Medicine

Received: *10 July 2020*
Accepted: *30 November 2020*
Published: *14 January 2021*

Citation:
Bryden B, Bryden M, Steer-Massaro J and Malope S (2021) Family Medicine Training in Lesotho: A Strategy of Decentralized Training for Rural Physician Workforce Development. Front. Med. 7:582130. doi: 10.3389/fmed.2020.582130

BACKGROUND

Specialization in family medicine (FM) is an effective means of building and retaining a highly skilled rural physician workforce in low- and middle-income countries. FM is a relatively new but rapidly expanding medical discipline in Sub-Saharan Africa, and several postgraduate training programs in FM have started in the last several years or are in the process of planning for enrollment (1–3).

The Lesotho Boston Health Alliance (LeBoHA) Family Medicine Specialty Training Program (FMSTP) is the first and only accredited postgraduate medical education program in the Kingdom of Lesotho and was started in 2008. Lesotho is a predominantly rural country with mountainous terrain, making travel and health care delivery challenging. Thus, it offers an ideal setting for decentralization of health care services and training of a highly skilled rural physician workforce. In Lesotho, rural is broadly defined as outside of the capital city of Maseru, which is the main urban center of the Kingdom. Lesotho has nine predominantly rural districts, each with a small capital and a district hospital that oversees several rural health centers and health posts (4).

CONTEXT

Lesotho is a small enclave country within South Africa and as a nation faces major health systems challenges including a predominantly centralized health services model. Although the population is primarily rural, the majority of the country's health professionals, health care budget, and single tertiary hospital are based in the capital city of Maseru. (5). The nation has the world's second highest human immunodeficiency virus prevalence, affecting ∼25% of adults, high maternal and infant mortality, widespread malnutrition, and increasing burdens of non-communicable diseases such as diabetes, hypertension, and obesity (4, 6). Lesotho ranks 164 out of 189 on the United Nations Human Development Index (7). In 2017, Lesotho had a ratio of doctors to population of ∼0.9 per 10,000, and a nurse-midwife to population ratio of 10.2 per 10,000, about one-third of the African average for doctor ratio to population and well below the World Health Organization–desired doctor–population ratio of 1:1,000 (8, 9). With no medical school in Lesotho, Basotho students must leave the country to train in South Africa and other countries, where many choose to remain after their education because of higher salaries, better working conditions, and more comfortable living conditions (10). The poor retention of Basotho doctors is complex; difficult working conditions, little opportunity for continuing education, isolation in rural hospitals, limited opportunities for advancement or career development, and challenges from working in a poorly functioning health care system are all major contributing factors. Because of these challenges and the enormous burden physicians face, unsurprisingly burnout and poor attrition are common (11).

PROJECT DESCRIPTION

LeBoHA was created as a partnership between Boston University and the Lesotho Ministry of Health (MOH) in response to this health crisis and the severe shortage of health professionals, particularly where they are needed most in rural areas. Boston University has partnered with the Lesotho MOH since the 1990s to support the Lesotho health care system through capacity building, human resource development, and strengthening of civil society. This long-term partnership culminated in the formation of LeBoHA in 2001 and the development of the FMSTP in 2008. The purpose of the FSMTP is to respond to the severe shortage of health care professionals in Lesotho by developing the human resources to improve and sustain high quality and comprehensive health care throughout the country. The FMSTP is a 4 year, part-time FM training program that allows for specialization in FM. The program is multidimensional and involves partnerships with the Lesotho government, including the Ministries of Health and Education, educational accrediting bodies including the Lesotho Council of Higher Education, multiple non-governmental organizations, and several regional universities. Building on the success of the FMSTP, in 2019 the Lesotho MOH, in partnership with LeBoHA, initiated a medical internship program furthering its effort to develop and retain a local physician workforce.

FM training in Lesotho has been adapted to the local environment and includes comprehensive, broad-spectrum training in clinical medicine, community-oriented primary care, district health management, operational health systems research, public health, quality improvement, leadership, and clinical governance. The FMSTP uses a teaching model that involves monthly didactic training at weeklong contact sessions for first- and second-year registrars (doctors enrolled in this program), focused primarily on clinical medicine topics, and quarterly weeklong contact session for third- and fourth-year registrars, focused on public health, leadership and management, and research skills. Contact sessions are held at Motebang Hospital, the largest district hospital in the country. Registrars complete supervised clinical rotations alongside local physicians as well as visiting regional and international specialists. Family physicians in Lesotho are upskilled in certain critical areas such as obstetrics and gynecology, diagnostic imaging including ultrasound, and surgical skills. Supervised clinical rotations are geared toward providing registrars opportunities to learn specialized skills and procedures previously only available at the referral level in order to decentralize some of these to the district level. Additionally, they complete a community-oriented primary care project, a quality improvement initiative, and a research thesis. As registrars are based throughout the country, this network of FM trainees allows best practices to be quickly disseminated throughout the country.

The majority of learning occurs at the facility where a registrar works and is guided by a portfolio of learning and quarterly site supervision by faculty consultants. These supervision visits of the registrars in their home facilities focus on both their clinical and non-clinical activities, with special attention paid to how registrars are incorporating their new knowledge and skills at their facilities. The portfolio of learning serves as a record of a registrar's progress through the program and a roadmap of what they still have to learn, enabling self-directed learning with support from program faculty as well as local mentors. The vast majority of time in training is spent at the district level in keeping with the program's goal to train doctors to work in a rural environment.

The program enrolls physicians of all nationalities who are practicing in Lesotho who have completed internship, have a commitment to staying long term in Lesotho, and are employed

TABLE 1 | Profile of FMSTP graduates.

	Graduation date	Sex	Nationality	Current position	Employer	Location
Graduate 1	2011	M	Mosotho	FMSTP Director	Lesotho MOH	Leribe District
Graduate 2	2013	F	Mosotho	MOH Director of Clinical Services	Lesotho MOH	Maseru District
Graduate 3	2019	M	Mosotho	Private Practice, Family Physician	Private	Mafeteng District
Graduate 4	2019	F	Mosotho	District Medical Officer	Lesotho MOH	Butha Buthe District
Graduate 5	2019	F	Mosotho	District Medical Officer	Lesotho MOH	Mokhotlong District
Graduate 6	2019	F	Mosotho	Internship Deputy Director	Lesotho MOH	Maseru/Leribe District
Graduate 7	2020	M	Mosotho	Medical Officer/Family Physician	Lesotho MOH	Qacha's Nek District
Graduate 8	2020	F	Mosotho	Family Physician	NGO	Maseru District
Graduate 9	2020	M	Mosotho	District Medical Officer	Lesotho MOH	Leribe District

in all sectors (government, Christian Health Association of Lesotho, and private). Basotho physicians employed by the government are preferentially accepted into the program, and the government of Lesotho sponsors the tuition of Basotho nationals. All current graduates of the program are Basotho nationals, with the majority retained as government civil servants. The majority of those enrolled in the program currently are Basotho nationals and government civil servants. Many registrars hold leadership positions as medical superintendent or district medical officer.

DISCUSSION

The introduction of FM as a new specialty is a strategy to not only retain and recruit doctors to live and work in Lesotho, but specifically to ensure there are highly skilled doctors in rural areas where high-quality health care is most needed but currently least available. In Lesotho, similar to other countries in the region, most doctors are generalist medical officers who have completed medical school and 1 to 2 years of internship prior to practicing. The LeBoHA FMSTP is unique in that family physicians are trained in a decentralized environment outside of a national university, although the program is a fully accredited postgraduate academic institution. Registrars in the program are trained comprehensively in primary health care to act as leaders of their primary health care team and are also trained as consultants to be an expert in services and procedures that are available at the district level.

FM is an officially recognized medical specialty in Lesotho, and after graduation, doctors in the government system are eligible for promotion to the consultant grade, the highest level of pay for civil service in Lesotho. The LeBoHA FMSTP provides opportunities for continued career development for graduates, and these benefits are proving effective in motivating the training and retention of highly skilled rural family physicians. Although the program is relatively young, all graduates thus far have been retained in Lesotho, with the majority remaining in rural areas and in government service. The program has nine graduates including three who completed in 2020. A qualitative study on job satisfaction of family graduates of the program is planned for the future (**Table 1**).

While medical schools in Sub-Saharan Africa and around the world are starting to decentralize clinical training at the undergraduate and internship level due to strains on tertiary institutions, it is unusual for postgraduate training to occur at the community level in a rural environment (12–14). Although FM is a dynamic field where the scope of skills and training of family doctors varies depending on context, throughout the world family physicians are employed in rural environments, and there are models for community training of family doctors in settings such as Brazil, Cuba, Australia, and North America in a community setting (15). While other postgraduate FM training programs in the region primarily offer university-based training, the program in Lesotho challenges this model by retaining postgraduate trainees in the environment where they are intended to work and be leaders. Additionally, the FMSTP demonstrates that postgraduate medical education can occur without a local medical school. There are challenges with this model, such as difficulties in cultivating an academic environment and lack of multidisciplinary support. Despite these challenges, we believe that training family physicians in the environment where they are most needed is the best way to retain physicians and improve the health care system from within.

CONCLUSIONS

FM as a field shifts the focus of health care from the disease to the person, and from the hospital to the community. Decentralizing the training of family physicians out of the tertiary and university settings and into districts and often isolated communities offers a model of how to make these shifts. The LeBoHA FMSTP demonstrates this model in action and thus far has been successful in retaining physicians within the country and largely in the public sector. As more family physicians graduate and work in rural environments in Lesotho, the program's impact will need to be evaluated, and future research will need to be done on retention of family physicians in Lesotho and in rural areas and the impact of family physicians on the health care system.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

BB is faculty for the program described in the article and wrote the initial draft of the manuscript. MB and JS-M are faculty for the program described in the article and wrote and edited key sections of the manuscript. SM is the program director of the program described in the article and wrote and edited key sections of the manuscript. All authors contributed to the article and approved the submitted version.

ACKNOWLEDGMENTS

The authors would like to thank the Lesotho Boston Health Alliance, LeBoHA Director Brian Jack, former FMSTP director Dr. Rudolf Schumacher, LeBoHA Country Director Elizabeth Limakatso Nkabane-Nkholongo, and the Lesotho Ministry of Health for their ongoing commitment to improving the Lesotho health care system and health of the Basotho people.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Public Health

COMMUNITY CASE STUDY
published: 03 February 2021
doi: 10.3389/fpubh.2020.612531

Rocketship and the Rural Health Workforce Revolution in the Pacific: Growing Skilled Medical Generalists Across the "Blue Continent"

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Dramatic shifts are occurring in the size, shape and skill of rural health workforces in Pacific island countries (PICs) due to an unprecedented convergence of political agreement, policy commitment, donor support and technical assistance. In particular, the impact of "medical internationalism" is being felt across the Pacific region, with new doctors returning home in far greater numbers than ever before, the majority having graduated from medical schools in Cuba, China and other countries outside the region, in addition to the more typical numbers graduating and returning home from the region's main medical schools in Fiji and Papua New Guinea. With an agreed regional vision of "Healthy Islands" across the Pacific, the main objective of expanding overseas training opportunities for Pacific island medical students has been to correct the widespread centralization and maldistribution of the medical workforce in PICs and improve health access and quality of care in rural areas by deploying the new graduates to outer-island facilities. However, the return of these new graduates in several PICs has demonstrated that additional training is required to equip them with the knowledge and skills necessary to practice safely and sustainably in unsupervised settings. Thus, the development of specific postgraduate programmes has been urgently needed to provide pathways to vocational training and specialization in rural medicine appropriate to the Pacific region. Rocketship Pacific Ltd. (Rocketship) is an international health charity, based in Australia, dedicated to improving health in Pacific island countries through stronger primary care. Rocketship's particular focus to date has been on education and capacity-building for doctors and nurses working in rural communities and outer-island facilities. Since 2015, Rocketship has been working in partnership with the Ministries of Health and other key partners in Solomon Islands, Timor-Leste, Tonga and Vanuatu to design and deliver postgraduate training programmes in the core generalist disciplines family, community and rural hospital medicine. To date, this has resulted in new postgraduate Family Medicine courses being established in Timor-Leste and Tonga; a rural medical workforce support programme being delivered in Vanuatu; and a new Postgraduate Diploma in Rural Generalist Medicine being designed in Solomon Islands. These new programmes, as well as other notable initiatives elsewhere in the Pacific such as the Master of Medicine (Rural) programme in Papua New Guinea, the Diploma and Master of Family Medicine programme in Fiji and the Cook Islands Fellowship in General Practice, are transforming the health workforce in PICs with the

OPEN ACCESS

Edited by:
Belinda Gabrielle O'Sullivan, University of Queensland, Australia

Reviewed by:
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Specialty section:
This article was submitted to Public Health Education and Promotion, a section of the journal Frontiers in Public Health

Received: *06 October 2020*
Accepted: *23 December 2020*
Published: *03 February 2021*

Citation:
McIver L, Manahan D, Jones S and 'Ulufonua L (2021) Rocketship and the Rural Health Workforce Revolution in the Pacific: Growing Skilled Medical Generalists Across the "Blue Continent". Front. Public Health 8:612531. doi: 10.3389/fpubh.2020.612531

potential to benefit island people across the "Blue Continent." This paper describes the establishment of new postgraduate training programmes in family, community and rural hospital medicine in Timor-Leste, Tonga, Solomon Islands and Vanuatu from the perspective of Rocketship, the non-profit organization engaged by each country's Ministry of Health (or equivalent) to provide expert technical assistance with their initiative.

Keywords: rural, medical, Pacific, workforce, training, island, generalist

INTRODUCTION

For decades, the populations of Pacific island countries (PICs) have suffered from a lack of access to health care. Like most developing countries in the world, the health workforce in PICs has for many years been too small, too specialized and too centralized, with the majority of clinicians—particularly doctors—concentrated in the urban centers (1). This is despite the fact that, in-keeping with the global trends, the majority of the populations of these islands live in rural areas and experience greater health burdens. In their first-ever regional meeting, held in Yanuca island in Fiji in 1995, the health ministers of PICs signed the "Yanuca Declaration," committing to a "Healthy Islands" vision for the Pacific, making clear that strengthening primary healthcare (PHC) was the principle strategy to achieve that goal (2, 3). The following years witnessed growing alarm about the likely impacts of both non-communicable diseases (NCDs) and climate change in PICs, with these two major health threats being considered alongside communicable diseases as representing the "triple burden of disease" in the region (4). These concerns have unfortunately proven accurate, with PICs now occupying the majority of the top rankings of countries around the world with the highest burdens of NCDs (5) and PICs widely acknowledged as the "canaries in the coal-mine" with respect to the impacts of climate change, including on health (6).

The commitment to the "Healthy Islands" vision was reaffirmed 20 years later at the corresponding Pacific Health Ministers Meeting, in which it was acknowledged that the efforts and progress over the previous two decades had been relevant, but fell far short of achieving the goals of universal health access and improved health outcomes for Pacific island people (7). Despite the establishment and growth of nursing colleges, such as those in Vanuatu and Solomon Islands, the systems of training, deploying and supporting health professionals in PICs still lacked the capacity to produce sufficient numbers of clinicians and the vast majority of the region's doctors were concentrated in the referral hospitals. The region's main medical schools, Fiji National University (FNU, formerly known as the Fiji School of Medicine) and the University of Papua New Guinea (UPNG), require students from other PICs to relocate to Fiji and PNG for the duration of their undergraduate training, with only very small numbers of medical students from the other countries—typically one or two—graduating and returning home each year. While both institutions also provide postgraduate training, this requires several more years living abroad and these opportunities have, until recently, been limited to the traditional specialties of surgery, medicine, anesthetics, pediatrics and obstetrics and gynecology, with the more recent addition of emergency medicine. As a result, many outer-island hospitals and health centers across the Pacific region have had no permanent medical staff for many years, with those who have been deployed in the rural facilities typically having little, if any, postgraduate training.

In an attempt to address this rural medical workforce crisis, the governments of several PICs sought assistance from outside the region, with one potential solution clearly standing out: Cuba. Since the 1960s, Cuba has developed a reputation for having a health system that performs relatively well, with its citizens enjoying better access to healthcare and longer life expectancies than those of many developed countries, including—as is frequently and gleefully pointed out—the United States (8, 9). Cuba's deployment of hundreds of thousands of their doctors to work in over a hundred countries during that time has resulted in the "Cuban medical brigade" becoming the country's most valuable export (10, 11). Furthermore, the establishment of the Escuela Latinoamericana de Medicina (ELAM—the Latin American School of Medicine) has enabled around one hundred of those countries to send their own students to train as doctors in Cuba, usually on full scholarships. The ELAM programme produces thousands of medical graduates each year, who return home to their countries of origin—mostly developing countries—after spending 6–7 years living in Cuba, learning medicine in Spanish. In terms of its impact on global health, Cuba's system of "medical internationalism" has been nothing short of a revolution.

In the early 2,000 s, representatives of countries in the south and western Pacific region began negotiations with the Cuban government to host Cuban doctors as clinicians and trainers and send students to ELAM to become doctors. Timor-Leste was the first, sending nearly 700 students to ELAM in 2003–2004, followed by—in cohorts ranging in size from 3 to 25—Kiribati in 2007, Solomon Islands and Vanuatu in 2008, Tonga and Tuvalu in 2009 and Fiji in 2010 (12, 13).

As the 20th anniversary of the Yanuca Declaration approached and preparations began for the return of the first cohorts of ELAM graduates to their Pacific island homes, several of those governments requested assistance in developing programmes to integrate the new graduates. A particular focus, of course, was in placing the graduate doctors in the rural and outer-island facilities, in order to improve health access and outcomes for those communities. This was complicated by emerging reports of gaps in the knowledge and skills of the medical graduates trained in the ELAM system. At the same time, the renewal of the region's health ministers' commitment to the "Healthy Islands" vision led to a belated recognition of the dearth of postgraduate training pathways in what may be considered the

primary care or generalist specialties—family, community and rural hospital medicine—and a renewed interest in developing such programmes in the Pacific region. While UPNG had established a Master of Medicine (Rural) programme, providing a narrow but robust pipeline of broadly-skilled rural medical specialists (14), and a small programme had been set up in Cook Islands to train doctors to diploma level as rural general practitioners, supported by the University of Otago and the Royal New Zealand College of General Practitioners (15), no other primary care or generalist medical training programmes existed in the Pacific.

Given the clear need for such postgraduate generalist training programmes to be established, and with strong support from health leaders in Fiji, Tuvalu and Vanuatu, in particular, the concept for a new and unique collaboration was born. The concept would draw on the previous two decades of rural medical workforce development experience in Australia and would link Ministries of Health and training institutions in the Pacific with, *inter alia*, the Australian College of Rural and Remote Medicine (ACRRM), the Remote Vocational Training Scheme (RVTS) and the Rural Generalist Pathway (RGP) in Queensland. Each of these initiatives was undertaken with the aim of improving health access and outcomes for rural communities, with the combined effect that Australia was, by the time of the inaugural World Summit on Rural Generalist Medicine in 2013, acknowledged as the undisputed world leader in the field (16). The outcomes statement from that summit, known as the "Cairns Consensus," defined the concept of rural generalist medicine, affirmed its critical importance and outlined pathways by which doctors could train in the discipline.

The scope of rural generalist medicine, as defined in the Cairns Consensus, is as follows:

- Comprehensive primary care for individuals, families and communities;
- Hospital in-patient and/or related secondary medical care in the institutional, home or ambulatory setting;
- Emergency care;
- Extended and evolving service in one or more areas of focused cognitive and/or procedural practice as required to sustain needed health services locally among a network of colleagues;
- A population health approach that is relevant to the community;
- Working as part of a multi-professional and multi-disciplinary team of colleagues, both local and distant, to provide services within a "system of care" that is aligned and responsive to community needs.

The few Pacific island participants at the Summit took that message home and, with the support of several high-level representatives from ACRRM, RVTS and RGP, an international health non-government organization (NGO) was founded with a mission to assist PICs in improving the health of their communities through stronger primary care and a particular focus on the establishment and delivery of rural generalist training programmes. The new organization was named "Rocketship"—an acronym for Remote Opportunities for Clinical Knowledge, Education, Training and Support for Health In the Pacific.

This paper addresses a significant gap in the literature on human resources for health in low- and middle-income countries, including in the Pacific region, by presenting four case studies of rural medical workforce development over the last five years in Timor-Leste, Vanuatu, Tonga and Solomon Islands. The paper describes the innovative partnership arrangements that have led to each country establishing postgraduate training pathways in family, community and rural hospital medicine (noting that these terms are used more or less interchangeably in the Pacific region, even if a clearer distinction is usually made elsewhere). These programmes, while at different stages of development, have all been made possible with the support of Rocketship.

CONTEXT

Timor-Leste

As the first country in the region to engage with Cuban medical internationalism, and the one with by far the greatest number of graduates from the ELAM system, Timor-Leste is unique within this group of case studies. At the time of its independence in 2002, Timor-Leste had <50 doctors serving its population of ∼1 million. By late 2012, it had close to one thousand doctors, with almost all of them either trained in Cuba or by Cuban doctors in Timor-Leste (17). The Universidade Nacional Timor Lorosa'e (UNTL—National University of Timor-Leste) established a medical school, with ELAM support, and hundreds of new graduates were sent to work in community health centers (CHCs) under the government's "Doctors For The Districts" initiative. Unfortunately, the experiment did not prove especially successful (13, 18). The experience of the first years of the programme led to a recognition of some critical shortfalls in the undergraduate training programmes in question and the need to provide further, formal postgraduate training to enable the new graduates to practise safely and competently across the scope of generalist clinical medicine to meet the health needs of their communities. Over the period 2013–2014, a plan for the country's first Family Medicine Programme (FMP) was developed, with the objective of providing Timorese doctors with a dedicated training pathway "to acquire the necessary knowledge, skills and behaviors to support their delivery of essential health services at the community health level" (19). The Royal Australasian College of Surgeons (RACS), with an office in the national referral hospital, funding from the Australian government and a strong track record of clinical service and postgraduate training support in Timor-Leste, requested Rocketship's assistance to design and implement the FMP for its first cohort in 2015.

Vanuatu

In 2013, it was estimated that the health workforce providing care to Vanuatu's population of ∼250,000 consisted of 46 doctors, 335 nurses and 62 midwives, along with 206 village health workers (VHWs) spread across aid posts in rural communities (20). This translated to a health worker to population ratio (excluding VHWs) of 1.77 per 1,000 population—one of the lowest in the Pacific region and well below the minimum threshold of 2.3–4.1 per 1,000 recommended by the World Health Organization (21). In 2008, as part of the implementation plan for Vanuatu's own

"Healthy Islands" primary care systems strengthening strategy (22), the first cohort of students from Vanuatu were sent to Cuba to train as doctors at ELAM, with two subsequent cohorts making up a total of 37 by 2012 (12). The arrival of the first 14 of these graduates in 2015, therefore, represented a ∼30% increase in the total number of doctors in the country. This increased to a roughly 50% increase over the next three years as the remaining graduates returned home. With almost all of the country's doctors concentrated in the two largest population centers, only a third practising as generalists in hospital and community primary care settings, and approximately one third of Vanuatu's hospitals having no doctors at all, there was a strong political imperative for the new graduates to be deployed to the outer-island facilities as quickly as possible. From 2015 to 2019, the Vanuatu Ministry of Health (MoH) requested support from the various managing contractors of Australian government funding for Vanuatu's health sector (including Health Specialists Limited and Aspen Medical) to redesign the national junior doctor training programme to integrate the new graduates and strengthen the medical capacity of the outer-island facilities. This, in turn, led to Rocketship's engagement to provide clinical service and training support in Vanuatu, with a focus on the new medical graduates and the chronically under-staffed rural hospitals—a partnership made possible due to Rocketship's previous collaborations with the Vanuatu MoH conducting professional development needs assessments for primary care nurses working in community settings, as well as delivering *ad-hoc* trainings for rural nurses and doctor-led clinics in remote villages.

Tonga

Tonga was one of the last countries in the Pacific to send students to train as doctors in Cuba, and even those were very few in number, but it did so in acknowledgment of the fact that its population of ∼100,000 lacked the resources to provide adequate medical care and manage the country's NCD crisis, in particular (23). With renewed commitment to growing and strengthening its health workforce in its national Strategic Development Framework (2015–2025) and Health Strategic Plan (2015–2020), the government of the Kingdom of Tonga began exploring innovative solutions to train Tongan doctors as specialist-level generalists. This initiative reflected the government's commitment to improving health access and outcomes in rural communities and outer islands, as per the MoH's Package of Essential Health Services (24). Tonga's high-level representative at the Third World Summit on Rural Generalist Medicine in Australia in 2017 thereby requested Rocketship's support to establish an in-country training programme for Tongan doctors, based on the model pioneered by Rocketship, RACS and the Timorese MoH with the FMP in Timor-Leste.

Solomon Islands

The population of Solomon Islands is ∼650,000 people spread across some 300 inhabited islands. The country's medical workforce, however, is highly concentrated in the capital city, with over 75% of the country's doctors based at the National Referral Hospital and large urban clinics in Honiara, where <15% of the population reside. In an attempt to address not only the maldistribution of the medical workforce, but the larger health burden borne by rural communities, the Solomon Islands Ministry of Health and Medical Services (MHMS) sent several dozen students to train as doctors in Cuba. When these graduates began to return, in relatively large numbers, in 2014, the substantial expansion of the country's medical workforce was initially viewed very positively, with the anticipated growth and professional development of the new graduates incorporated into long-term medical workforce planning on the part of the MHMS (25). However, when over the ensuing years similar gaps were identified in the graduates' knowledge and skills as had been demonstrated previously in Timor-Leste and concurrently in Kiribati and Vanuatu, it was acknowledged that a new, specific programme was required to train Solomon Islands doctors as rural medical specialists. The managing contractor for Australian government health sector funding, AVI (previously known as Australian Volunteers International), put out a competitive tender in 2019 to conduct a feasibility study of the establishment of a Postgraduate Diploma in Rural Medicine in Solomon Islands, which was ultimately awarded to Rocketship.

DEVELOPMENT OF PROGRAMMES

The development of the abovementioned programmes took place quite differently in each country, although the overall objective of growing a medical workforce equipped with the knowledge and skills necessary to provide safe, quality care across the scope of rural generalist practice was essentially identical. What follows is a brief overview of the process, structure and outcomes of each country's establishment of such programmes with support from Rocketship and other partners.

Timor-Leste

The FMP in Timor-Leste was designed as a two-year diploma programme, with the first year consisting of clinical rotations at the national referral hospital in Dili and the second year focused on training based in—and for practice specific to—the CHCs. The RACS-Rocketship partnership was established to enable delivery of the critically important community-based training phase. This followed a review of the initial FMP curriculum by members of the Rocketship team, at the request of RACS, which identified some critical gaps in the proposed educational and clinical apprenticeship programme in its second year, from the perspectives of core curriculum content, skills development and training support. The almost complete lack at the time of qualified family physicians in Timor-Leste available to mentor, supervise, support and act as role models for the FMP trainees was a particularly critical factor leading to the formation of this partnership.

From January to June 2016, a pilot programme was implemented that saw experienced rural generalist medical educators, recruited via Rocketship, coordinated by RACS and endorsed by the Timorese MoH, travel to Dili on a one-week-in-three rotating roster to deliver on-site supervision and teaching for the 12 trainees progressing through their second year of the FMP. This fly-in/fly-out (FIFO) model of clinical

and education support was backed up by a Technical Advisory Group (TAG), comprised of the Rocketship Board of Directors—all leaders in the field of rural generalist medicine in Australia—who undertook a further, more detailed review of the FMP curriculum, drafted the teaching schedule for the visiting trainers, hosted regular team teleconferences and provided additional administrative support. The TAG also worked with the three-member Trainer Team to create the multiple choice question (MCQ) paper used in the final exams for the FMP trainees, along with a clinical case-based discussion assessment.

During each visit by the Trainer Team, the schedule of activities included workplace-based teaching, supervised clinical activities, discussion of "best practice" primary medical care and practical skills training. The topics covered over the 6-month period of collaboration were drawn from the educational programme proposed by Rocketship in relation to the curriculum review. The results of the final assessments were that eight of the first cohort of 12 FMP trainees passed both the abovementioned examinations to the standard of UNTL, as the awarding academic institution, thus successfully completing the inaugural programme. Rocketship went on to provide a scaled-back package of technical support for the final assessments of the FMP cohorts in 2017 and 2018. Over this period, in-country training capacity was built and responsibility for delivery of the community-based phase of the programme was transferred back to partners in Timor-Leste (notably RACS and the NGO Maluk Timor), as had always been the aim.

Vanuatu

The Vanuatu MoH, in anticipation of the need for an intensive programme of support for the new medical graduates returning home from Cuba, created a role as Academic Programme Leader, which was funded by the Australian government, via the managing contractor in place in 2015, and taken up by one of the authors of this paper (LM). Over a period of several months and based on wide-ranging consultations, both with senior clinicians and policy-makers in Vanuatu and programme coordinators in other countries with similar programme (including Kiribati and Solomon Islands), a 3-month trainee internship programme was developed for Vanuatu to provide the necessary "bridging" for the ELAM graduates, with a revised and strengthened 2-year internship to follow.

The first cohort of 14 graduates arrived in late 2015. The majority successfully completed the trainee internship programme, as determined by the standards set by Vanuatu's national Medical Registration and Training Committee, and proceeded to internship in early 2016. Five were unsuccessful in their assessments and repeated the trainee internship programme for periods ranging from 3–9 months, with additional evaluations being conducted prior to their eventual transition to internship. During the trainee internship phase, Rocketship was requested by the Vanuatu MoH to provide short-term clinical cover for both the national referral hospital, which had no doctors working in the Emergency Department, as well as for the largest and busiest of the country's doctorless facilities—Lenakel Hospital in the southern province of Tanna. Three experienced rural generalists were therefore deployed by Rocketship to support the two facilities over a period of several months. In 2018, following completion of the 2-year internship programme which, for the first time in Vanuatu, included a specific curriculum in rural medicine (strongly influenced by Rocketship's experience and expertise), the junior doctors began extended placements in the outer-island hospitals and health centers. Over the following 18 months, Rocketship was once again engaged by the Australian government's managing contractor to provide additional supervisory and training support for the rural-based doctors. This led to Rocketship deploying 12 senior clinicians—predominantly rural generalists, with a small number of emergency physicians—to the country's two largest hospitals (Vila Central and Northern Provincial), and sending the most experienced of those to the outer-island facilities to provide feedback on and support to the junior doctors working, mostly alone and unsupervised, in those remote locations.

Despite significant enthusiasm on the part of several of Vanuatu's junior doctor cohort to specialize in rural medicine—as evidenced in their responses to surveys about their career ambitions when they first returned home from Cuba and following completion of their internship—no such pathway has yet been established in Vanuatu. In 2019, the first ni-Vanuatu doctor was enrolled in the UPNG Master of Medicine (Rural) programme, providing a small glimmer of hope for the longer-term future of rural medical workforce strengthening in Vanuatu.

Tonga

A key enabler of the corresponding postgraduate training pathway in Tonga was the establishment of new Diploma and Master of Family Medicine programmes at FNU. This process involved Rocketship from an early stage, with representatives of the organization conducting a scoping visit to Fiji at the request of the FNU Dean of Medicine in 2014, conducting a series of consultations with both MoH and community representatives and strongly recommending that the university establish a postgraduate generalist training programme that would be open to trainees from across the Pacific region. This eventually transpired, with FNU launching a Diploma in Family Medicine programme in early 2018, with academic support from James Cook University in Australia. By this time, Rocketship's consultations and technical advice in Tonga had led to a partnership being created between Rocketship and the Tonga MoH, with funding from the Australian government to enable four Tongan trainees to commence the FNU Diploma, with the critical innovation being that they could remain living and working in Tonga for the duration of their training, rather than needing to relocate to Fiji. This was made possible due to a parallel partnership arrangement between Rocketship and FNU, whereby the university delegated key elements of the supervision, workplace-based training and assessments to Rocketship's Trainer Team—a new group of four experienced rural generalist medical educators co-led by one of the members of the previous Trainer Team that Rocketship had deployed in Timor-Leste. Using a similar FIFO model of regular country visits and remote mentorship and learning support, Rocketship's Trainer Team provided a 12-month education platform from which the four trainees were all able to successfully complete

their assessments and be awarded their diplomas. Three of those achieved sufficiently high marks to be able to progress to the Master's programme, with a further four enrolling in the Diploma programme in 2020.

Solomon Islands

The most recent of the four countries' training initiatives, the establishment of the Postgraduate Diploma in Rural Medicine (PGDRM) in Solomon Islands is, at the time of writing, yet to be officially approved by the MHMS. After Rocketship was awarded the contract to conduct the feasibility study of the proposed programme in late 2019, a series of consultations was held with representatives of the intended partner organizations—namely Solomon Islands National University (SINU) as the academic institution; DFAT as the funder; AVI as the managing contractor; and the MHMS, including the national medical training committee, the National Referral Hospital and the provincial hospitals intended to be used as training sites. The consultations were conducted over a period of 5 months, including two visits to Solomon Islands involving four Rocketship representatives. The findings of the study were that the proposed new programme was urgently needed and should be feasible, although there were significant hurdles that would have to be overcome. Among the most important of these obstacles are: (1) there are currently no rural medical specialists in Solomon Islands; (2) SINU, the proposed host academic institution, has neither a medical school nor any track record of training doctors; and (3) the internet connectivity across the country is poor at present, particularly in the outer islands. The curriculum that has been drafted is robust and appropriate, as determined by the TAG assembled by Rocketship to support the feasibility study—a group that included two Rocketship Directors, a former President and a former Director of ACRRM, the former Director of the Queensland Rural Generalist Pathway, a Professor of General Practice in Australia and the Director of the Papua New Guinea Master of Rural Medicine programme. There appears to be strong support for the PGDRM from policy-makers, clinicians and communities, as well as a commitment from the donor and managing contractor to fund the programme, at least in its initial phase(s). These latter factors, combined with Rocketship's capacity to partner with MHMS and SINU in the subsequent phases of design and delivery of the programme, would likely enable the initiative to progress. If it was to launch, and prove successful, it would become the first Diploma in Rural Medicine programme in the Pacific region (noting the UPNG programme is to Master's level, with no Diploma at present), which would, in turn, likely make it a very appealing model for other PICs to follow. However, the Covid-19 pandemic and the ensuing diversion of resources and restrictions on travel have hampered efforts to have the PGDRM ready to commence in early 2021.

FINDINGS AND IMPLICATIONS

The aims and outcomes to date of these health workforce initiatives in PICs, focused as they are on improving healthcare access and health outcomes for rural communities, in particular by training specialists in family/community/rural hospital medicine, are closely aligned with the recommendations of the World Health Organization (WHO) in their seminal report, *Global strategy on human resources for health: workforce 2030* (26). Those same objectives are similarly aligned at the regional scale with the "Healthy Islands" vision for the Pacific (7). Some of these case studies from the Pacific have, in fact, already been used as exemplars in WHO guidelines for rural workforce development in low- and middle-income countries (27). The rural generalist model is acknowledged to be one of the most strategically valuable and effective means to achieve a higher standard of medical care for rural communities (28), including in island settings (16, 29), such that the establishment of these programmes is certainly timely, if not long overdue. Acknowledging the challenges of setting up such programmes in geographically isolated, resource-constrained environments—of which more below—the steps taken by the health leaders, senior clinicians and community representatives to build these pathways in each of these four countries is to be commended, as is the support from donors, particularly the Australian government, and regional partners such as FNU.

It is anticipated that these programmes will be expanded over the coming years, both in terms of other PICs joining the FNU Diploma and Master of Family Medicine programmes, likely adopting the in-country training model successfully trialed in Tonga with Rocketship support, and/or other PICs setting up their own programmes. Samoa is currently the only other PIC with its own university (the National University of Samoa) and medical school. The University of the South Pacific is a separate regional entity with campuses in most PICs, but no faculty of medicine at present.

The most valuable outcome of those programmes in the medium term should be the establishment and growth of a cohort of Master's-level (i.e., specialist) graduates in family, community and rural hospital medicine. With the right type and amount of professional development support, ideally aligned with WHO's guidance on health professionals' education and training (30), these Pacific island pioneer doctors have the potential to become supervisors, mentors and trainers of trainers, thus gradually eliminating, over time, the need for external and/or expatriate support.

Of particular interest, given the current global context, is the vital role of frontline primary care practitioners and the resilient nature of these training programmes that have been developed. Not only has this bold and innovative collaboration between Rocketship, the Tonga MoH and FNU proven the viability of in-country specialty training, thus enabling the trainees to remain in their own communities and the country to avoid losing valuable members of their medical workforce for postgraduate training overseas, the Family Medicine programme has proved to be the only specialty training programme at FNU to have been able to continue during the Covid-19 pandemic. This was made possible due to the distance education and mentorship model and provides an important precedent for future medical training initiatives in the Pacific region.

ISSUES AND CONSTRAINTS

In addition to the aforementioned challenges related to distance, geography, poor IT infrastructure and resource constraints,

it must be acknowledged that training programmes reliant on expatriate trainers providing remote support and relatively brief, infrequent visits are not an ideal, nor a long-term, solution. While the latter model is still preferable, in many respects, to trainees being required to relocate to a different country for the majority or duration of their training, the long-term viability and sustainability of these programmes will only be truly secured when sufficient doctors have graduated from the various pathways and been further trained as trainers, supervisors and mentors for future cohorts. To achieve this long-term goal, donors and regional partners, including Rocketship, must be willing to continue to support these initiatives over the coming years, until such a critical mass of qualified medical generalists in each country has been reached.

CONCLUSION

The last 5 years have seen a seismic shift take place in the structure of the health workforce in several PICs, due to both the influx of new medical graduates, predominantly from Cuba, and the establishment of a variety of new postgraduate training programmes focused on the generalist disciplines of family, community and rural hospital medicine. Each of the four countries included here as case studies has demonstrated vision, leadership and foresight in capitalizing on the goodwill and expertise of Rocketship, other technical support organisations, regional academic institutions and the support of donors, particularly the Australian government, in enabling the new programmes to be designed and implemented in innovative ways, adapted to the context and requirements of each country. These initiatives are crucial in building a health workforce in the Pacific region that is of an adequate size, an appropriate distribution and a level of skill necessary to meet the needs of rural communities across the "Blue Continent."

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

LM led the design and drafting of the manuscript. DM, SJ, and L'U all provided inputs, participated in the reviewing and revising processes and approved the final version of the manuscript. All authors contributed to the article and approved the submitted version.

ACKNOWLEDGMENTS

The authors respectfully acknowledge the leadership of each country's Ministry of Health (or equivalent) and the abovementioned universities, as well as the expert supervision of each country's senior clinicians in supporting these initiatives and the trainees themselves. For their individual, invaluable efforts, the authors would like to specifically acknowledge: Dr. Antony Chenhall, Ms. Kate Moss, Dr. Jeremy Beckett, and Dr. Bethany Beckett in Timor-Leste; Dr. Basil Leodoro, Dr. Tony Harry, and Dr. Andy Ilo in Vanuatu; Dr. Siale 'Akauola in Tonga; and Dr. Aaron Oritaimae, Dr. Jane Barker, and Ms. Suzanne Pohlner in Solomon Islands. Additional credit must go to Dr. William May, Dr. Odile Chang, Dr. Ruth Eagles and Dr. Nadim Cody for their instrumental roles in establishing and implementing the FNU Family Medicine programme.

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Conflict of Interest: LM, DM, and L'U currently, or have been SJ, unpaid volunteers for the international health non-profit organization Rocketship Pacific Ltd., including in their respective capacities as pro-bono directors on the Board.

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Public Health

ORIGINAL RESEARCH
published: 12 February 2021
doi: 10.3389/fpubh.2021.594894

Preparing Graduates for Interprofessional Practice in South Africa: The Dissonance Between Learning and Practice

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With South Africa's tumultuous history and resulting burden of disease and disability persisting post-democracy in 1994, a proposed decentralization of heath care with an urgent focus on disease prevention strategies ensued in 2010. Subsequently a nationwide call by students to adapt teaching and learning to an African context spoke to the need for responsive health professions training. Institutions of higher education are therefore encouraged to commit to person-centered comprehensive primary health care (PHC) education which equates to distributed training along the continuum of care. To cope with the complexity of patient care and health care systems, interprofessional education and collaborative practice has been recommended in undergraduate clinical training. Stellenbosch University, South Africa, introduced interprofessional home visits as part of the students' contextual PHC exposure in a rural community in 2012. This interprofessional approach to patient assessment and management in an under-resourced setting challenges students to collaboratively find local solutions to the complex problems identified. This paper reports on an explorative pilot study investigating students' and graduates' perceived value of their interprofessional home visit exposure in preparing them for working in South Africa. Qualitative semi-structured individual and focus group interviews with students and graduates from five different health sciences programmes were conducted. Primary and secondary data sources were analyzed using an inductive approach. Thematic analysis was conducted independently by two researchers and revealed insights into effective patient management requiring an interprofessional team approach. Understanding social determinants of health, other professions' roles, as well as scope and limitations of practice in a resource constrained environment can act as a precursor for collaborative patient care. The continuity of an interprofessional approach to patient care after graduation was perceived to be largely dependent on relationships and professional hierarchy in the workplace. Issues of hierarchy, which are often systemic, affect a sense of professional value, efficacy in patient management and job satisfaction. Limitations to using secondary data for analysis are discussed, noting the need for a

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Edited by:
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Specialty section:
This article was submitted to Family Medicine and Primary Care, a section of the journal Frontiers in Public Health

Received: *14 August 2020*
Accepted: *22 January 2021*
Published: *12 February 2021*

Citation:
Müller J and Couper I (2021) Preparing Graduates for Interprofessional Practice in South Africa: The Dissonance Between Learning and Practice. Front. Public Health 9:594894. doi: 10.3389/fpubh.2021.594894

larger more comprehensive study. Recommendations for rural training pathways include interprofessional teamwork and health care worker advocacy to facilitate collaborative care in practice.

Keywords: interprofessional, collaborative care, primary health care, hierarchy, clinical training, rural training pathways, health professions education

INTRODUCTION

International studies indicate that effective primary health care (PHC) requires the devolution of hospital-based care into the community, and should include interprofessional collaboration of health professionals to improve patient outcomes (1). In 2010, the South African National Department of Health proposed decentralization of heath care with an urgent focus on disease prevention strategies, early disease detection and intervention at a PHC level in the community (2). Although South Africa is ranked as an upper-middle income country (3), it is the country with the highest income disparity internationally according to the Gini coefficient (4), where poverty, unemployment and related socio-economic factors add significantly to the burden of disease.

The World Health Organization (WHO) defines collaborative health care as a system in which multiple health care workers unite with patients, families, carers and the community to provide comprehensive services of the highest quality across all settings (5). This would imply that health care workers should not only be able to work in interprofessional teams, but also in collaboration with the community they serve. South Africa is considered a melting pot of culture, language, heritage and traditional beliefs, all of which influences how communities function and interact with one another.

Considering the proposed devolution of health care into communities, institutions of higher education had to take conscious steps to adapt curricula in order to train a fit-for-purpose workforce, by introducing PHC training at an undergraduate level (6). Health worker training, which is still predominantly centralized and not distributed along the continuum of care, was further challenged by the nationwide call for relevant and responsive education specific to the African context (7). This call speaks to the need for contextual training based on local clinical problems and health care models. Health care students need to be confronted with the realities, challenges and importance of PHC in a culturally diverse and socio-economic disparate South Africa (8). Finding innovative models for experiential learning that is contextual, transformative and collaborative in nature is an important response to this call. Interprofessional education (IPE), defined as members from two or more professions learning about, from and with each other (9), is a model through which students can develop the necessary skills of working together for improved patient outcomes and also to expose them to the diversity of their peers.

BACKGROUND

In 2012, Stellenbosch University (SU) Faculty of Medicine and Health Sciences opened the country's first Rural Clinical School (RCS) campus in Worcester, a town of about 100,000 people situated in the Western Cape Province. This was a timeous response to the need for a national change in the approach to health care service delivery and education (2). The overarching intention of the RCS is to support rural training pathways by providing longitudinal rural exposure and clinical training for undergraduate students focused on social impact and community engagement. This is achieved using hands-on experience of the health issues facing rural, under-served and resource-limited communities in South Africa. The resultant value of this initiative in producing graduates willing to remain in public service and return to rural practice is evident in literature related to the RCS (10, 11). Final year undergraduate Medicine, Occupational Therapy, Human Nutrition, Physiotherapy, and Speech-Language and Hearing Therapy students spend between 6 weeks and 10 months at the RCS, depending on the programme.

In response to a study on the socioeconomic and social capital of a historically disadvantaged and resource-constrained community in Worcester (12), a PHC community-based interprofessional project was piloted from the RCS in 2012. An interprofessional group of academics, health care students from SU, local community organizations and the local community health care workers (CHWs) were involved in the development of the project. The aim of the Collaborative Care Project (CCP) is to expose students to contextually relevant interprofessional learning opportunities that focus on early detection of disease, collaborative management of chronic illnesses and the prevention of disability (13). This is done to aid interprofessional collaborative competency development of students (14), with the aim to foster graduates who work together to promote change. The CCP is an ongoing IPE initiative. Teams of up to five students from different degree programmes based at the RCS and a CHW meet at a health post on a weekly basis to collaboratively plan, conduct home visits and reflect on their experiences. The aim of the interprofessional home visits is for students to collectively identify any previously unreported environmental, personal and health risk factors that patients and their families face. Referrals to appropriate organizations or health care facilities are made by the interprofessional team to provide the household with optimal care in the prevention and management of disease and to address environmental or personal barriers to wellness (15). The collaborative decision-making and writing of referrals promotes engagement during the IPE. The CHWs have intimate knowledge of the community and are expert links between students and families, helping students learn and practice in a culturally sensitive manner. Students reflect at the end of each session in a large group facilitated by a lecturer. They participate in CCP home visits between 6 and 10 times during their clinical rotations in Worcester, which translates to between 18 and 30 hours of interprofessional collaborative engagement.

The available literature exploring students' perceptions of working in interprofessional undergraduate teams in a PHC setting in South Africa largely focuses on competency development and experience of IPE (16). There is a paucity of research in the available literature relating to students' perceptions of practical IPE in preparing them for work in the African context. Such research is necessary to understand better the value of undergraduate IPE in shaping a future workforce (17). This study explored the perceptions of participating undergraduates in the CCP and again as graduates regarding the relevance of IPE in preparing them for work in South Africa. This paper speaks to the factors perceived to impact the carryover of interprofessional collaborative practice into the workplace post-graduation, and the barriers to and facilitators of learning during this project.

METHODS

The first author (JM) was intimately involved in the development of the CCP, and was responsible for coordinating and facilitating the interprofessional patient discussions, home visits and reflections on the process. JM had prior exposure to and knowledge of students' experiences which afforded insight into student perceptions, which was the motivating factor for designing the study. The study adopted a constructivist approach to data collection and an interpretivist paradigm to synthesize and analyze the qualitative data (18).

This study was exploratory in nature and both primary and secondary data sources from individual and focus group interviews were analyzed regarding the relevance and value of the interprofessional home visit project. Primary data were collected through standardized individual telephonic interviews with allied health science (AHS) graduates during 2014 by JM. Secondary data were interview transcripts from two previous research projects investigating students' perceptions of their training at the RCS in 2013, which are described in more detail below.

Profile of Respondents

Undergraduates who had participated in the CCP during 2013 were interviewed at the end of their academic year and again as graduates during their first year of work in 2014. All respondents were from SU Faculty of Medicine and Health Sciences. They included students from Medicine and the AHS, namely Human Nutrition, Medicine, Occupational Therapy, Physiotherapy, Speech-Language and Hearing Therapy in their final year of study, ranging between the ages of 22 and 35. No undergraduate nursing programme existed at SU during the study period. Of the 76 students who rotated through the CCP at the RCS in 2013, 14 were medical students and 62 were from AHS programmes. See **Table 1**.

Most respondents were female, especially from the four AHS professions because of the nature of student intake into these undergraduate professions. The same student cohort was then interviewed as graduates in their first year of working as professionals employed by the national public health care system.

TABLE 1 | Numbers of final year undergraduates participating in the CCP during 2013.

Degree programme	Number of students
Human nutrition	8
Medicine	14
Occupational therapy	8
Physiotherapy	20
Speech-language and hearing therapy	26
Total	76

Sample and Data Collection

For the purposes of this study, primary and secondary data sampling and collection are described separately, as the processes differed.

Primary Data

A purposive sample of 20 AHS graduates who had participated in the CCP as undergraduate students were selected by JM to ensure feedback from a representative number of professions. Selection criteria ensured that five graduates were selected per AHS profession with an equal distribution of participants working in rural and urban environments (10 rural and 10 urban). Primary data were collected by individual telephonic semi-structured interviews conducted by JM in October 2014, towards the end of the AHS graduates' first year as working professionals. The interviews were conducted in English and/or Afrikaans and lasted 45–60 minutes. Interviews were recorded, transcribed, translated as necessary and anonymised for analysis.

Secondary Data

Secondary data were interview transcripts from two research studies exploring the experiences and perceptions of students training at the RCS.

The first study was a five-year longitudinal study investigating the experience of medical students' training at the RCS, which resulted in a number of publications (10, 11). Semi-structured individual interviews, on average 60 minutes long, were conducted by a research assistant. See the basic interview schedule outlined in **Table 2**. Data used from this study originated from five individual face-to-face interviews with undergraduate medical students who had spent their entire final year at the RCS in Worcester and two individual telephonic interviews with medical graduates in their first year of practice. The transcribed interviews made specific mention of interprofessional education, the CCP project and/or home visits and were therefore included in the dataset for this study.

The second study was an investigation of AHS students' practice at the RCS in 2013 (19). JM was a co-researcher for this study and was involved in all stages of the research project, including data collection and analysis. Data collection included four semi-structured focus group interviews with final year undergraduates who rotated through Worcester during 2013. See **Table 2** for the basic interview schedule. Each of the four AHS professions in the faculty (Human Nutrition,

TABLE 2 | Interview schedules used for primary and secondary data collection.

Primary data source: semi-structured interviews

1. Where are you currently working?
2. What kind of work do you do there?
3. How are you involved in interprofessional work?
4. What opportunities do you have to do home visits where you work?
5. What are some of the challenges you face in treating patients holistically?
6. What is communicating and collaborating with other professionals like where you work?
7. How do you feel you contribute to the medical team at the site where you are working?
8. Can you think of a situation where you have applied holistic patient management in your professional career?
9. How do you think the power dynamics in the workplace influence patient's well-being where you work?
10. Tell me about your experience of the interprofessional home visit project as a student? What do you think you've been able to apply in your workplace?

Secondary data source—Study 1: semi-structured interviews: medical students and interns

Medical students:

1. Tell me about your experiences as an SI at the RCS/longitudinal model?
2. Highlights—special moments
3. Challenges—tough times
4. What about your learning experiences?
5. How did you experience:

   Clinical training

   Patient-centered approach

   Tutorials

   Service-learning component

   Assessment
6. How did you find working with the hospital staff (might one need to prompt them about other medical staff, nurses, and AHS?)
7. How prepared do you feel for internship? What concerns do you have?
8. What are you hoping to do once you complete your community service?
9. Any other comments?

Internship placement:

1. Did you get placed where you wanted to be placed?
2. What has been your overriding experience as an intern since the start of this year?
3. How has the transition from student to intern been?
4. What aspects of your responsibilities did you feel most prepared for? Why?
5. What aspects of your undergraduate training stand out as having been of greatest benefit in terms of your preparedness?
6. What aspects of your responsibilities in the hospital or regarding patient care did you feel least prepared for?
7. What values do you think the MBChB programme taught you?
8. Tell me about the extent to which "external" or community placements affected your preparation for internship, if at all?
9. What have you found most challenging during the past year?
10. Looking back, what do you think could have been different in your undergraduate studies to have ensured that you would have been better equipped as an Intern?
11. To which extent is holistic patient management a feature in the hospital?
12. To which extent did the interprofessional home visits that you conducted last year prepare you for your internship and/or influenced your thinking?
13. What are you hoping to do when you complete your Internship and has this changed over the past few months?

(Continued)

TABLE 2 | Continued

Secondary data source—Study 2: AHS focus group semi-structured interviews

1. What are your perceptions (substitute: thoughts) about rural clinical training for your discipline(s)?
2. Reasons for the statements made
3. Examples of perceived experiences
4. People/stakeholders involved
5. Contextual details where the experience(s) occurred
6. Process and strategies that connect to the perception such as teaching, learning and assessment strategies

TABLE 3 | Distribution of final-year student and graduate interviews analyzed.

	2013	2014
Final year student interviews		
Medical—individual	5	
Physiotherapy—focus group	1	
Occupational therapy—focus group	1	
Speech language and hearing therapy—focus group	1	
Human nutrition—focus group	1	
Total number of final year student interviews	9	
Graduate individual interviews		
Medical		2
Physiotherapy		4
Occupational therapy		4
Speech language and hearing therapy		4
Human nutrition		3
Total number of graduate interviews	0	17
Total number of interviews	26	

Medicine, Occupational Therapy, Physiotherapy, Speech-Language and Hearing Therapy) were represented in this data (See **Table 3**).

Data Analysis

Qualitative data was analyzed using a thematic analysis approach (20) to explore the participants' perceived relevance and value of the CCP. Analysis of all transcripts was conducted by both JM and an independent researcher in rural health professions education, who had no prior knowledge of, or involvement in, the CCP. Each transcript was read, re-read, coded and the emerging data was thematically grouped to systematically identify common threads within the data (20). This was first done individually by the two researchers who then collaboratively agreed upon the final themes. Intercoder reliability was to ensure confirmability of the data by means of investigator triangulation to minimize potential interpretation bias, since JM was also the project coordinator and student learning facilitator for the CCP (21). Written and verbal consent was provided by participants.

Ethical clearance was granted for this study by the Stellenbosch University Faculty of Medicine and Health

TABLE 4 | Key to abbreviations used for respondents.

Key to abbreviations:	
Med	Medical
AHS	Allied health sciences
G	Graduate/professional
S	Student/pre-service

Sciences Human Research Ethics Committee (HREC) in 2014 (N14/07/094). It was decided not to interview students from the RCS involved in existing studies to avoid over-researching them. Therefore, the data from primary and secondary data sources were utilized; the limitations thereof are discussed later in the paper.

FINDINGS

A total of 26 interview transcripts were analyzed. This includes the 11 transcripts from the two previously conducted studies and 15 AHS graduate interview transcripts. Due to unreliability of the graduate contact information only 15 of the intended 20 AHS graduates were interviewed.

Themes identified included (1) Appreciation of context (2) Becoming a team (3) Understanding professional limitations and the contribution of other professions (4) Relationships and hierarchy. **Table 4** provides a key to the abbreviations used for the respondents.

Appreciation of Context

Student participants reported that involvement in contextual clinical training had an impact on their understanding of the realities of their country, which surpassed the knowledge afforded them by learning in the classroom. "You get to their home, you don't know what to expect, and he's in his wheelchair, but in the rural area, there are potholes everywhere. The RDP houses, they have steps to go into the house and you can't do that with a wheelchair. And that is the community for whom the (state supplied) RDP houses were built. Most of those people in the wheelchairs don't have money to build ramps." S.AHS4.

The influence social determinants of health have on patient health became real to the students during home visits: "You need to ask (the patients) about their life, how they cope at home. I understand 100% that's why we do home visits. You're shocked to see, oh hectic, wow, this is bad. This is why my patient didn't arrive (for follow up) or this is why they don't have money, or why they want a (social) grant, they really just can't get by." (translated) S.Med4. This insight resulted in contextual, holistic assessments and relevant patient management. "Seeing this is where they live and this what they have to deal with, and this is what they have available to them. So, I think that rounds you more as a clinician, to see how you can treat a patient within their setting and what would be more appropriate for them." S.Med3.

"The highlights for me was always the home visit. I think the therapy is much more concentrating on what the people need, or you see first-hand where they struggle, and you can make a difference there. When you see them in a clinic and you ask them what they struggle with you can't always give them a solution they need, a practical solution you either don't understand or can't see or doesn't make sense to you. So practically solving problems with them was definitely the highlight for me." G.AHS7.

Having clearer insight into a patient's home and community environment helped participants reimagine treatment plans along the continuum of care in a resource constrained environment.

"After being on the home visits you are constantly asking okay, what does the home environment look like, like do they have stairs at home, where is their bathroom. So, I think it has helped you in that regard to think out of the box, not just to think can they get out of the hospital but can they function at home." G.AHS14.

Affording students the opportunity to interact with their patient's context and culture was an important step in helping achieve the goal of improving competency and confidence as a clinician working in a resource constrained environment. "I think the fact that we are asked to make a difference in someone's life, and you don't feel confident about it. Just going with the mind-set of trying to help people in any way possible and not thinking you gonna save the world, but rather making small changes for people, and I think that is what we miss most of the time as an undergraduate." G.AHS7. Based on these experiences, participants became more realistic about their expectations of themselves and their patients as well as learning to make use of the resources available to them. "You can't think that you need to get this patient with a CVA (cerebrovascular accident) to walk in a week, which is not realistic in their context. Not going in thinking that there will be equipment and thinking there will be everything that you want and what you think you will need for therapy, but where they can use anything in their homes." G.AHS7.

"We get to function in the system, and I think that's very valuable, exploring everything that is available instead of just doing robot monotonous kind of work." S.Med11.

Becoming a Team

The value of practically working together in the clinical environment was perceived as beneficial in optimizing IPE opportunities and promoting collaborative patient management. "In varsity you don't really get the chance to learn about other disciplines, and when you do it in a work context then it is much easier to see practically what to look at, how they see a patient differently." G.AHS7

"If you work together, physically work together going on a home visit. You are forced to work together, because while you are an undergraduate you think quite in the box and not out of the box and it really helps to have people with you." G.AHS4.

Participants reported a cultivation of respect and interest in their own, but also other professions, where they reported feeling comfortable knowing who they should approach in the team for assistance and how to do that. "It is definitely helpful just being more comfortable with approaching other people and referring patients, you know what the other disciplines do, so you are not blindly referring or not referring, because you don't know what a physio or dietician do." G.Med2

Insight into other professional contributions added value to the notion of what being and becoming a team really means and influenced the degree to which young professionals engaged in interprofessional patient care after graduation. "It's not something completely new, you're not completely unexposed to other people and other disciplines so if you have work with them before it's easy to know what part of the patient they have to look at, or what part you have to ask them about or anything like that." G.AHS7.

"You sort of have the confidence to go out to the pediatrician and say, 'No I have been involved with this before, can we try this? I really think it could help us both.' It gave me more confidence to do the initial hello how are you, can we do this thing." G.AHS1.

"I think that benefits me a lot. You can definitely see the difference between people that have worked in the team before and the ones that have not... So, you are not just blindly referring or some of the patients don't get referred to because you don't know what the physio does, or a dietician." G.AHS2.

The team approach used in CCP to identify and manage health and environmental challenges that patients and their families face was seen as a positive catalyst to foster a sense of belonging and value as part of a health care team. "You are with them (AHS students) with a patient they have been rehabbing, but now they maybe found something that's wrong with the patient that needs medical assistance, and then you realize oh my word, so I am actually of use here." S.Med3.

"… you're not just someone, you're actually a therapist, basically you're a team member." G.AHS6.

Understanding Professional Limitations and the Contribution of Other Professions

The very nature of working together and learning about, from and with each other helped provide a more holistic picture of the patient's situation. "Speech got involved and asked random questions that we never heard before. So, we got to see what they did and where they could help our patient. It really helped us with regards to seeing your patient as a whole person." S.AHS1.

Having insight into the complex nature of a patient's well-being afforded by working as an interprofessional team challenged individualized management approaches. "So, you know up unto where you can help the patient and where you have to draw on other team members to help the patient, because you can't do everything yourself. Where the professions fill each other or complement each other" G.AHS6.

"It shapes better clinicians and teaches us how to work in interdisciplinary teams, which is very important, because the thing is, it would be ideal for South Africa to follow an interdisciplinary model, as a patient would get better treatment." G.Med1.

Understanding and accepting professional limitations and being part of a cohesive group who were like-minded with shared meaning created a valuable learning environment that contributed to the development of skills required for a sustainable workforce. Graduates reported understanding their own limitations and expressed a sense of relief that there was more that could be done beyond what they knew within their professions. "I mean that's medicine for me (the interprofessional home visit project) and that's where we are going to be when we are out there next year, that's what we are going to see and that's what we will have to be able to do. I mean, you are going to burn yourself out if you think you are going to do everything on your own (chuckles). So, for me I think that's how medicine should be." S.Med7.

This understanding of professional limitations and contributions of team members included the allocation of roles and responsibilities depending on the patients' needs and not basing leadership on the traditional hierarchical model of doctor as team leader. One medical student put it as follows: "But it was also nice to just have someone else leading for once, because especially when you're in hospital, you see the doctor is usually the one who takes charge and leads the team. But then we have been on home visits where the physio student is the one who is leading, allocating tasks, and asking for everybody's opinion. So, it was nice, it was actually refreshing to see other people also taking the lead." S.Med3.

The value of the CHWs was recognized, not only as being an integral part of the health care team, but also as co-facilitators of learning, especially with regards to students' exposure to and understanding of the community. "Definite highlights for me were working with the community health care workers. Just getting to know them. … They know the patients on a more intimate level. I felt that they were more accepted in the community, they were more accepted by the family than we really were." G.AHS7.

Graduates reported that the quality of care they could provide patients as individuals was hindered by the inherent limitations of their scope of practice. This was markedly so with regards to a lack of exposure to dealing collaboratively with social issues in a resource constrained environment. This affected the perceived impact the graduates felt they could have. "The patients come with all their social issues, and I can't really do anything about the social issues, so I get frustrated, and although the social issues have got an influence obviously on their physical illness." G.Med9.

"(teach us)… how to protect these kids, because some of these kids get abused or raped, but we have never had counseling; I don't know how to counsel a patient. We are not psychologists or counselors, but how to maybe deal about the things that affects our therapy, which is not medical, but is more emotional or social, because that is the hardest for me." G.AHS12.

The need for a comprehensive understanding of the contributions of other professions and the existing health and social care structures was highlighted by the following quote.

"I think yes, we worked a lot with the PT's, OT's and the doctors, but not much with the social workers, I think we never went into the social side of patient, because over here that hit us really hard and its impact on how you're able to apply your therapy on patients going home and not coming for therapy, either they've been hit by their boyfriends, crossing rivers, doesn't have money, so I would have liked if we could have maybe worked more with social workers or with people would help more on that side, because what is the point of

educating a patient on strengthening your right limb when you don't have food and transport to come to therapy... also learning more about the other places you could refer to for these people to get help or assistance which is not medical, talking about care centers, special schools stuff like that besides therapy." G.AHS6.

One student commented that the experience of working with other professions during the CCP enabled her to consider moving outside her scope of practice and develop specific skills to be better equipped as a therapist in a resource constrained environment.

"I am a Speech Therapist, but there are some other things I can work on, for example balance and muscle strengthening … be more flexible with what you can do and maybe read up about seating or movement. Things that actually may not have anything to do with us, but you have to equip yourself to be more of a general practitioner." S.AHS2.

Although there was perceived value in learning about what other professions actually do, whether exposure to IPE changed future practice was not always clear. "So that was good to see oh, this is what you are actually doing. Whether that changes my management now I'm not too sure, because I would still refer to the physio or the OT. Yes, maybe I have a better idea now what they are doing, and in that way yes, maybe my thinking is a bit different." G.Med9.

Relationships and Hierarchy

The continuation of an interprofessional approach to patient management as graduates was dependent on multiple factors such as relationships, hierarchy and/or a sense of agency.

Relationships among different professionals in the health care team seemed to influence the amount of interprofessional collaboration during the graduates' first year of work and this depended heavily on the responsiveness and availability of doctors and/or senior staff as well as opportunities to connect with one another and be part of a collective. "There was never the opportunity to necessarily bond with them (the doctors) or to visit them or to feel that you can be friends with them." (translated) G.AHS9.

This was in contrast to another graduate who spoke about "a cool group of doctors that we have, because they even ask for suggestions and what we think and call us and talk about patients over the phone with us." G.AHS7.

Often graduates felt disempowered by their status as newly qualified professionals to initiate interprofessional collaboration or make recommendations for holistic patient management. This was primarily due to their perceptions of hierarchy and professional status and their comments reveal negative perceptions of their role in the professional team.

"… but you are lower than them, that you're younger and don't have experience." G.Med4.

Frequent references were made by allied health professionals to "feeling inferior to" or "submissive to" doctors during their first year as working professionals.

"We have wards rounds once a week, but it's more where the doctors speak to the patients mostly and if they feel they want to know something from the physios they ask, but the doctors here are different, we are like the last resource. They're not so keen on the allieds." G.AHS6.

"… we (allied health therapists) are the bottom of the food chain" (translated) G.AHS8.

"They (medical doctors) are above us, so it didn't even feel as if we (allied health therapists) were halfway equal to them." (translated) G.AHS1.

Interestingly, there was a negative perception of medical undergraduates' understanding of contributions of the rest of the health care team, which seemed to be a motivating factor for earlier IPE. "Allied Health wants to spend more time with the medical professions from an earlier stage, not because they don't know what medicine does, but medicine doesn't know what they do." G.AHS2. The value of interprofessional exposure to reduce ignorance relating to other professions also seemed to contribute to the notion of seeing students from other professional programmes as "people." "I have especially been fascinated by occupational therapists. I didn't realize they can do so many different things. It's only now that you get to see what they do, and also just interacting with them in the hostel as well, getting to know them as people and getting to understand what they go through as well as students." S.Med4.

Despite AHS graduates' experiences during the CCP working with medical students or leading interprofessional patient management, not all graduates felt comfortable initiating interprofessional communication. I: "And from your experience last year, did it make it any easier for you to talk to the doctors this year?" R: "I wouldn't say any easier. Here at our hospital for example we try to have as much contact with the doctors as well, but they are not always available." G.AHS9.

There were graduates whose sense of agency enabled their participation in the health care team.

"What we did this year, we just sort of included ourselves in their world (the medical doctors' world), going to morbidity and mortality meetings, doctors' ward rounds, things like that. So we were there. We sort of bring ourselves to the forefront that is the easiest way." G.AHS1.

Some graduates commented on the need to maintain their internal Monologues to empower themselves in the workplace. "You must be confident in your profession. Although doctors perhaps they have the knowledge of other things … you must still think I am the speech therapist, I am the occupational therapist and I know about this… You must give your opinion to them and not feel submissive to." (translated) G.AHS4.

In responding to a question regarding the advice they would give to graduates wanting to work in interprofessional teams but struggling with initiating communication, based on their experience, a participant stated:

"I'd probably tell them to invest in getting to know people and being involved as much as possible and forcing your way into ward rounds like I have. I would just pitch up and be like, 'can I please join your ward rounds?' and it's hard for them to say no." G.AHS10.

In order for there to be adequate exposure to other professions and ways of working within the health care system, graduates felt that practice-based IPE happened too late in their training and suggested that the relationship development between student

professions be threaded throughout undergraduate training to help foster and establish relationships for life.

"I think not just to implement that multi-disciplinary thing only in your final year, but throughout varsity so that the doctors see what the physios do and the OTs and whatever and work together more in your university years instead of just in the hospital. I think that is something that will help that you see that person as someone who complements your profession, not just someone you can use if you want to. Because I often feel that's the idea they have, they are there, that is fine, but we can also do that." G.AHS9.

DISCUSSION

The findings indicate that students' involvement in the collaborative care project (CCP) helped them understand more about their own and other professionals' roles in the team and how a team approach contributes to improved patient care and potentially job satisfaction. The results also indicate that students who understand their role and scope of practice within a team have better discharge planning and continuity of care. These findings are in line with the existing literature on the value of interprofessional collaborative care (22–24). However, the extent to which this knowledge impacts on practice as a graduate appears to be limited (17).

Having a defined scope of practice in a resource constrained environment, where the presence of professionals with other skill sets may be limited, affected the extent to which graduates felt competent in managing the complexity of patient care. The limited contribution they felt able to make to patient-centered care in the absence of an interprofessional team was tangible. These challenges can, in part, be addressed by helping professionals develop diverse skill sets to address their feelings of inadequacy when confronted by the burden of disease and lack of health care resources (1, 25). Professionals with a broader skills set than their own is what Rhoda et al. (26) refer to as a "T-shaped graduate," where the graduate not only has deep insight into his/her profession, but also basic knowledge and skills of other professions that could assist them in their work with patients and families in South Africa. Alternatively, improved interprofessional relationship development between professions in resource limited settings could enable remote collaborative discussion and idea sharing regarding patient management, as demonstrated by the CCP.

Curricula aimed at helping undergraduates develop higher-order thinking around their role as transformative, adaptive, self-confident health care team members are important (27), especially given the existing traditional hierarchies, siloed patient management and limited resources (28, 29). Graduates to traverse the disparate worlds of state and private health care, urban and rural areas, discrepancies in staff to patient ratios as well as the range of burden of disease for varying communities in South Africa and in many lower-middle income countries (LMICs) (1, 30). Interprofessional collaboration in a complex, disparate health care system is non-negotiable. However, considering that only a small percentage of SU's undergraduates experience practical IPE via the CCP, it is unrealistic to expect graduates to relinquish or share control of patient care in a team-based approach. Exploring what exposure a fit-for-purpose health care graduate needs to navigate any given context as empowered change agents is important for improved patient outcomes.

Despite the exposure and evidence of learning described by the participants, it is clear that the carryover of interprofessional practice into the workplace is not always possible and depends on relationships, hierarchy and agency, which mirrors the findings from international literature (17). Role modeling and professional hierarchy at sites where graduates work have been shown to have an important influence on agency in the workplace and interprofessional collaboration (17, 31, 32). It appears that the lack of awareness of other professions' contribution to patient management may add to the traditional models of hierarchy in the workplace after graduation. Literature indicates that even in clinical environments where physicians believed the departments they worked in were not hierarchical, issues of hierarchy are still evident (33). The very nature, understanding and enactment of collaborative practice is a challenge if hierarchy persists (33, 34).

Role models are not always available in the clinical setting and some graduates felt disempowered to act as change agents and encourage interprofessional collaboration in their working environments. The graduates' sense of agency seemed to influence the extent to which they would use and expand on the existing interprofessional engagements at the hospital, which is also evident in other contexts (17). The notion of being someone "you can just use," of being "lower than" or not "powerful enough to initiate changes" within a system or even to make recommendations regarding patient management is a concern. Perceptions such as these resulted in graduates feeling afraid to appeal to senior staff for assistance when needed, and may hamper skills development, patient care and establishing future professional relationships. Research shows that these factors influence the prevalence of burn-out and disillusionment within the public health sector (25, 35, 36). They have also been shown to have a direct influence on patient experiences and continuity of care (25, 32). Students and graduates who are exposed to institutional hierarchy may construct marginalized identities and perpetuate patterns of power and hierarchy in the workplace. Patient management is often dominated by a specific person, most commonly a doctor, as a result of the socialization of medical and health science students in organized tertiary education settings (37). Alternatively, patient care can take the form of collaboration allowing for interdependent participation and decision-making. This is dependent on the exercise of collaborative power by individuals in the group (37) and should be a consideration when planning rural training pathways.

Understanding how students interpret hierarchy is important, especially since the role they assume as part of the team is often context specific (17). Exposing students to the complexity of PHC so that they understand the value of an interprofessional approach in improved patient care and job satisfaction is one thing, but enabling students to graduate as transformative change agents in a hierarchical system is quite another. Health professions education has to speak to workforce sustainability by adopting approaches that empower graduates

to initiate and engage in collaborative patient care in resource constrained environments.

Having a clear understanding of the intended purpose of IPE is necessary to determine the extent to which one can expect graduates to engage in collaborative care or initiate change within existing health care systems. The discourse of collaborative care has been described as being either utilitarian (about achieving better patient care) or emancipatory (about working better together and disrupting hierarchy in systems to improve outcomes) (38). In reflecting on the CCP, the primary aim of the project is utilitarian, and it does not, as yet, actively aim to address issues of hierarchy or competencies that are emancipatory in nature.

Considering this, undergraduate training will need to strive at capacitating students and graduates to navigate systemic hierarchy and power relations in order to build interprofessional relationships if there is to be a change in existing dynamics (39). It should be noted, however, that institutional structures affect the extent to which non-hierarchical collaborative practice is possible as a team, given that established traditions and systems are not easily changed (37, 40).

The results of this study echo previous research that emphasize the need to implement practical IPE earlier in undergraduate training and that it should be an integral part of patient care and clinical education and not seen as an add on, nor should it be considered simply part of the "hidden curriculum" (41–43). The emphasis on improving collaborative practice should focus not on students alone, but also on clinicians and institutions. There is a need to reflect on the institutionalized values and beliefs that have been adopted as the norm if we are to disrupt the traditional hierarchy that exists in the health care system (17, 37, 44). This can only be achieved through relationships developed in co-location whereby mature interprofessional collaboration is the norm and practiced by both academics and clinician role models (39). Teaching students and their preceptors to adopt a collaborative inquiry approach to patient management is a possible strategy which has shown to be effective in various professional teams from the medical to the aviation industry (34). This approach to collaborative care allows for a cycle of decision making, reflection, group inquiry, reasoning and planning, where members of the team adopt a self-correcting dialogue as part of their advocacy and patient care (34, 45).

Limitations

Although this study is limited to the experiences of a select group of students in a specific context, it does echo the results found in previous international literature. The experience of graduates has limited transferability, not only due to the small number of participants, but also to the challenges of using secondary data for analysis where more pointed questions relating to IPE could have been asked. There is a paucity of literature available on the transfer of IPE to collaborative practice after graduation and a more robust and rigorous study of the CCP following this pilot study could contribute to that literature (17). It is therefore recommended that a larger study with purposively selected, representative samples interviewed with the specific intention to explore the perception of the CCP be done, both at an undergraduate and graduate level. Assessment of interprofessional competency development during IPE is also recommended.

JM's relationship to the project as one of the original facilitators and the coordinator of the CCP since 2012 would have influenced the interpretation of the data and contributed to the depth of understanding and construction of the findings. This was dealt with through reflexivity and by involving an independent researcher from a different ethnic, socio-economic and cultural background to analyze and critically compare findings to those of JM. IC, who acted in a supervisory capacity during the analysis of the results in relation to the existing literature, was not involved in CCP at the time of the research and played a crucial role in ensuring critical reflection during the writing of this article. The primary and secondary data being collected by different interviewers, with their own interview schedules and prompts would have influenced the richness of data regarding the CCP, though the fact that the project was raised spontaneously as a significant aspect of learning has significant. Thus, the results may not be representative of the entire student or graduate group. Using an explicit theoretical basis and exploring the influence working environments have on graduates' perceptions would give a richer understanding of the perceived value of the project (17, 46).

The insight gained from this study could inform further research into understanding professional development in context, how to best prepare students for working within the existing health care system and the value this affords professionals working in resource constrained environments. Understanding how to reinforce a professional's sense of belonging and relationship despite power and hierarchy in the workplace is crucial in terms of the sustainability of collaborative practice and needs further exploration.

CONCLUSION

All universities have a responsibility to educate students in relevant, representative contexts to equip them to manage their patients collaboratively (47). Exposure to a variety of communities and cultures is necessary for students to develop insight into the health care needs of populations and be able to adapt their management plans accordingly. The study findings suggest that undergraduate IPE, which is clinical and contextually relevant, has merit in improving comprehensive patient evaluation, management and discharge planning, but it needs to happen earlier in students' training. Graduates who understand the value of, and know how to work in an interprofessional team are more likely to manage patients holistically, feel part of a system, have more confidence and feel less overwhelmed by the complexity of patient care in under resourced settings. Exploring the influences on graduates actioning interprofessional collaborative care in resource constrained environments would be valuable future research. The findings of this study reflect the limitations that health care environments place on the actual practice of collaborative patient care and the extent to which this is possible in health systems where hierarchy and siloed patient management are the norm. If patients with complex challenges

are going to be managed effectively in low resourced PHC settings, a critical reflection on the training and experiences students and graduates are offered is necessary.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, within the limitations of the ethical clearance granted.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Stellenbosch University Faculty of Medicine and Health Sciences Human Research Ethics committee. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

JM has been one of the original project facilitators since 2012 and is the coordinator of the Collaborative Care Project (CCP). She was responsible for the planning of the research study and was involved with data collection and analysis. IC acted in a supervisory capacity, was not involved in the CCP and played a crucial role in ensuring critical reflection during the writing of this article. All authors were involved in the writing of this article.

FUNDING

The sole funding source for this research was internal institutional funds in the Ukwanda Centre for Rural Health. The Ukwanda Centre for Rural Health is part of the Department of Global Health, Stellenbosch University.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The handling editor is currently organizing a Research Topic with one of the authors IC.

frontiers in Public Health

ORIGINAL RESEARCH
published: 20 April 2021
doi: 10.3389/fpubh.2021.601026

Training for Transformation: Opportunities and Challenges for Health Workforce Sustainability in Developing a Remote Clinical Training Platform

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OPEN ACCESS

Edited by:
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University of Waikato, New Zealand

Reviewed by:
Kirsten Petrie,
The University of Waikato, New Zealand
Greville Wellesley Wood,
University of Otago, New Zealand

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Specialty section:
This article was submitted to Public Health Education and Promotion, a section of the journal Frontiers in Public Health

Received: 01 September 2020
Accepted: 16 March 2021
Published: 20 April 2021

Citation:
Muller J, Reardon C, Hanekom S, Bester J, Coetzee F, Dube K, du Plessis E and Couper I (2021) Training for Transformation: Opportunities and Challenges for Health Workforce Sustainability in Developing a Remote Clinical Training Platform. Front. Public Health 9:601026. doi: 10.3389/fpubh.2021.601026

Background: In 2018, Stellenbosch University's Ukwanda Centre for Rural Health led a faculty initiative to expand undergraduate health professions training to a new site, 9 hours drive from the health sciences campus in the sparsely populated Northern Cape Province of South Africa in the town of Upington. This is part of a faculty strategy to extend undergraduate health sciences training into an under-resourced part of the country, where there is no medical school. During 2019, the first year of implementation, four final year medical students undertook a longitudinal integrated clerkship at this site, while final year students from other programmes undertook short 5-week rotations, with plans for extending rotations and including more disciplines in 2020. The aim of this study was to understand stakeholder perceptions regarding the development of Upington as a rural clinical training site and how this influenced existing services, workforce sustainability and health professions education.

Methods: An iterative thematic analysis of qualitative data collected from 55 participants between January and November 2019 was conducted as part of the case study. A constructivist approach to data collection was utilized to explore participants' perceptions, experiences and understanding of the new training site. Triangulation of data collection and reflexive thematic analysis contributed to the trustworthiness of the data and credibility of the findings.

Findings: The perceptions of three key groups of stakeholders are reported: (1) Dr. Harry Surtie Hospital and Academic Programme Managers; (2) Supervising and non-supervising clinical staff and (3) Students from three undergraduate programs of the Faculty. Five themes emerged regarding the development of the site. The themes include the process of development; the influence on the health service; workforce sustainability; a change in perspective and equipping a future workforce.

Discussion: This case study provides data to support the value of establishing a rural clinical training platform in a resource constrained environment. The influence of the

expansion initiative on the current workforce speaks to the potential for improved capacity and competence in patient management with an impact on encouraging a rural oriented workforce. Using this case study to explore how the establishment of a new rural clinical training site is perceived to influence rural workforce sustainability and pathways, may have relevance to other institutions in similar settings. The degree of sustainability of the clinical training initiative is explored.

Keywords: rural, undergraduate, clinical training, distance education, workforce sustainability

INTRODUCTION

Rural clinical exposure during undergraduate health professions training is one of a number of important educational strategies to develop and strengthen the rural health workforce (1). Evidence suggests that early rural exposure positively influences health professionals' decisions to practice in rural environments (2). Because clinical exposure in a rural setting may better capacitate and retain the future rural workforce (3), this contextual educational approach has intuitive appeal for countries where the rural health workforce remains challenged by inadequate resources. Much of the positive evidence regarding the efficacy of educational strategies to address rural health workforce needs has been generated in high income countries (HICs)—Australia, USA and Canada (4–6). While there is growing evidence for efficacy in other contexts (7–10), comparatively little is known about the effectiveness of these strategies in Low and Middle-Income Countries (LMICs) despite these contexts being most affected by rural health workforce shortages (11). Considerable differences in the healthcare climates between HICs and LMICs could plausibly impact the efficacy of rural training pathway strategies across these contexts. If LMICs are going to use undergraduate rural clinical exposure as a strategy for rural pathway development (12), it is critical to understand what the barriers to and facilitators of developing training sites might be. The need to rethink how the future workforce is trained, where they are trained and how to support existing rural health care services is imperative in speaking to the needs of LMICs and countries where disparities in health care provision are significant (2, 13), especially because of the complexity involved in implementing such strategies given the demands of competing healthcare priorities (12).

The classification of LMICs is based on the Gross National Income per capita, which categorizes South Africa (SA) as an upper-middle-income-country (11). One could therefore argue that experiences or research relating to health care in SA may not be comparable or transferable to LMIC contexts. However, SA is highly disparate, with the highest GINI coefficient worldwide, which impacts all of society, including the healthcare system. Healthcare disparities exist between the private and public healthcare systems and geographically between urban and rural locations (14). Rural, public healthcare facilities in South Africa face many of the same challenges that are prevalent in LMICs. Inequitable resource allocation, inadequate infrastructure, and severe personnel shortages are but some of the major health system challenges (15). Approximately 83.5% of SA's population are dependent on the public health care system (16) which is staffed by 30% of the medical personnel (17). There are stark disparities in specialist distribution in the public and private sector with 7 specialists per 100,000 population in the public sector compared to 69 in the private sector (18).

There is emerging evidence that undergraduate distributed clinical training for final year health professional students can complement quality of care and help alleviate clinical workload in rural and resource constrained environments (8). Students are perceived to improve patient satisfaction, workforce competency development and community-based services in other rural and urban SA contexts (8). By improving quality of care and potentially the accessibility of services, partnerships between rural health services and universities have the potential to meet some of the universal health coverage goals despite the current human resource challenges (19). Locating undergraduate health professions training outside of urban areas is a necessary intervention in the SA context to prepare the future health care workforce of the country (20). In order to deliver undergraduate clinical training successfully at rural, distributed sites in the SA context, major health system challenges such as the lack of physical teaching spaces, the burden of heavy workloads and the shortages of both academics and clinicians must be overcome (21).

The latent potential that exists within a health system-university partnership speaks directly to the need for a cooperative approach in facing the health challenges that exist at district level across SA (22). Ensuring sustainability of a distributed training site is necessary to optimize the potential value of university-health service partnerships. Based on a review of 19 studies, Scheirer (23) presents five crucial factors that influence the degree of sustainability of health-related programs, which provide a useful framework for assessing the sustainability of a clinical training site. These factors are (a) being able to modify the project to suit the local environment; (b) having a champion at the project site; (c) ensuring the project is aligned with the organization's mission and vision; (d) visible benefits to clients; and (e) support from stakeholders in other organizations (23).

Contextual Background

The Stellenbosch University (SU) Ukwanda Centre for Rural Health (Ukwanda) has developed a network of rural distributed training sites to support undergraduate rural health professions education since 2002 and currently manages programmes across 5 rural towns within the Western Cape. The development of

these distributed sites was slow and deliberate, spanning over 10 years and relying on established relationships within a relatively well-resourced rural healthcare system. In 2018, Ukwanda expanded SU's rural distributed training footprint to the remote setting of Upington, situated in the Northern Cape Province, 9 hours drive from the SU Faculty of Medicine and Health Sciences campus.

The Northern Cape Province, with an estimated 1.29 million inhabitants, is the least populous but largest in South Africa. It has no medical school and faces significant health system challenges, which are akin to the health systems challenges in LMICs. Upington is home to the only regional hospital in the province, Dr. Harry Surtie (DHS) Hospital, with 327 beds, situated 400 km from its nearest referral hospital. The local health district is plagued by severe health personnel shortages. Locally there are 23.0 medical practitioners, 0.4 medical specialists, 5.5 physiotherapists and 4.0 occupational therapists per 100,000 population (24). Issues with recruitment and retention of health personnel have contributed to inefficiencies within the public health system in the province (17). In a 2020 publication investigating the technical efficiency of provincial public health care in South Africa, the Northern Cape Province was classified as inefficient in providing public health care and recommendations for recruiting and retaining more medical personnel, specialists and researchers were suggested by the authors (17).

These health system challenges and the geographical remoteness as well as the absence of pre-existing relationships between Stellenbosch University and the health service formed the backdrop for the development of this clinical training site.

A process of cooperative development between the Northern Cape Department of Health and Ukwanda resulted in four final year medical students pioneering a longitudinal integrated clerkship of 10 months at DHS Hospital in 2019. Additionally, final year students from medicine, occupational therapy and physiotherapy undertook shorter rotations of between 4 and 6 weeks over the course of the same year. During this initial phase of development all students were primarily based at the hospital and clinical exposure varied across programmes with students either completing traditional discipline-based rotations or integrated rotations across both inpatient and outpatient settings. In addition, medical students rotated through four local primary care clinics in the surrounding area.

Local clinicians fulfilled dual roles as health care providers and student preceptors. Clinicians were supported in their roles as clinical educators through outreach visits and faculty development workshops conducted by academic staff from SU. Supplementary academic support was provided by SU and varied across programmes, including direct contact or online support or both. Online support activities included tutorials, case management discussions and remote ward rounds to supplement students' learning.

The rate and scale of this development and its interprofessional ethos against a backdrop of geographical remoteness and significant health system challenges has been encouraging. Understanding if an over-burdened health system in an under-resourced context is able to offer sufficient support for sustainable undergraduate health professions education has potentially important implications for rural workforce development in LMICs. However, exploring mutual benefit and the potential this initiative may have on the existing rural workforce is equally important.

The aim of this paper is to explore the potential value of this educational strategy for promoting rural workforce development from the perspective of multiple stakeholders. The degree of sustainability of this clinical training initiative is explored using the five factors recommended by Scheirer (23).

METHODS

Ethical approval was obtained from Stellenbosch University's Faculty of Medicine and Health Sciences Human Research Ethics Committee (#N19/02/026) and permission to conduct the research was provided by the Northern Cape Department of Health and Stellenbosch University Committee for Undergraduate Teaching. Only individuals providing written consent were included as research participants.

A case study design using an interpretivist paradigm was adopted for this study. The system under scrutiny was the training site as a whole. The study population comprised of students, student supervisors, academic programme and facility managers from the clinical and academic sites, and nursing preceptors, district managers and local clinicians working at the Hospital. Fifty five participants (**Table 1**) participated in various activities between January and November of 2019 to explore perceptions related to the value of the expansion initiative and the degree of sustainability (25). Triangulation of data collection and analysis contributed to the trustworthiness of the data and credibility of the findings (26).

Qualitative data was collected using semi-structured individual interviews, focus group interviews, brief semi-structured conversations and open-ended survey questions. Interview guides (**Appendix 1**) were used for all interviews and aimed to explore stakeholders' perceptions and future aspirations related to the expansion of the clinical training site.

Semi-structured Face-to-Face Interviews

Purposive sampling was employed to select 21 participants for individual interviews (**Table 1**). Two participants who were crucial to the initial engagement with the Upington stakeholders were interviewed twice—at the beginning of the academic year, prior to the students' arrival and at the end of the academic year, prior to the students' final examinations. One of these participants' role expanded from a medical student supervisor to a newly appointed facility manager at the time of the second interview. An adapted interview guide exploring both roles was used (**Appendix 1**).

Focus Group Interview and Management Meeting

Two focus group meetings were held with nursing preceptors and district health managers, respectively (**Table 1**). An adapted interview guide with several open-ended questions explored district health participants' expectations, concerns,

TABLE 1 | Summary of participants.

Participants	Number of participants	Data collection: method	Data collection: person	Abbreviation used in article
Supervising clinicians	6	Semi-structured individual interviews*	Research Team	SC
Facility Managers	3		Research Team	HFM
Academic Programme Managers	8		Independent researcher	APM
Longitudinal Integrated Clerkship Medical Students	4		Research Team	MS
District Health Managers	5	Focus group meeting*	Research Team	FGDM
Nursing Preceptors	3	Focus group meeting*	Research Team	FGNP
Non-supervising clinicians and staff	12	Brief semi-structured conversations*	Research Team and assistant familiar with hospital	NCS
Short Rotation students	14	Pre- and post-rotation surveys**	Research Team	SRS
Total participants	**55**			

*Interview schedule ***Appendix 1***.
Interview schedule ***Appendix 2*.

opportunities and future aspirations regarding expansion of faculty programmes into the district clinics.

Brief Semi-structured Conversations

Brief semi-structured conversations took place in the physical locations where the staff were working in order to use the environment as a prompt, by letting them envisage where and how students had engaged in that context (27). Twelve consenting staff members, from 5 hospital departments, namely the Rehabilitation, Internal Medicine, Pediatric, Orthopedic, and Surgical departments as well as staff working in the Intensive Care Unit participated. Participants included professional nurses, enrolled nurses, administrative ward clerks, newly qualified medical and allied health clinicians who worked and interacted with students but were not directly involved in their supervision. A research assistant, who had no prior relationship with any of the departments or staff working in the wards, conveniently selected individuals who were available and willing to participate at the time the researchers visited the ward.

Survey Responses

Final year undergraduate students enrolled in Medicine (Primary Health Care module), Physiotherapy and Occupational Therapy undertook short clinical rotations for between 4 and 6 weeks. Two surveys were developed (**Appendix 2**) and distributed to the 14 consenting students through the Research Electronic Data Capture (REDCap^{TM}) software (28). Pre-rotation surveys were sent prior to the start of students' rotations. The survey explored their expectations and concerns about the upcoming rotation. Post-rotation surveys were sent on the day that the rotation ended. The survey documented their experiences, and comments on various aspects such as supervision, interprofessional engagement and clinical exposure.

Analysis

All semi-structured interviews, focus group interviews, and brief conversations were audio-recorded using a digital recorder, transcribed verbatim and translated from Afrikaans to English where required. All data was de-identified by assigning pseudonyms describing participants' roles (**Table 1**). Transcripts were emailed to all individual interview participants for member checking; five were returned with edits. Inductive analysis was initially undertaken by five members of the research team who immersed themselves in the data and developed individual code lists, before combining these and agreeing on a final list of codes for detailed analysis. All transcript and survey data were then allocated to members of the full research team, who undertook further detailed thematic content analysis using the code list.

FINDINGS

The analysis of the findings identified five main themes representative of the participating stakeholders' perceptions of the University's engagement with the hospital in the development of a new clinical training site in Upington. See **Table 2**.

Theme 1: The Process of Development

The process followed in developing the training site was seen to be an important contributor to the early successes that were spoken of by participants.

> The "teaching institution and practical institution. We need to work together. We need to see through the same glasses. Because we have one vision." (HFM 3).

The partnership that developed between the University and the local health service and the need for continuous communication

TABLE 2 | Themes and sub-themes.

Theme	Sub-theme
Theme 1: The process of development	Communication Phased approach
Theme 2: Influence on the health service	Workload Specialist outreach Quality of care Accountability
Theme 3: Workforce sustainability	Professional development and incentives Sense of purpose and value
Theme 4: A change in perspective	The value of training on the distributed platform Faculty development for distance learning
Theme 5: Equipping a future workforce	Further expansion Potential influence on district health services Relevant and accessible training Rural pathways

during the phasing in of students at the site required persistent engagement between people from both institutions.

> "I thought these people will never come back because in the beginning it was such a struggle—people didn't want to become involved" (SC 5).

This presence and interaction provided the space for people to be more open to partnership development

> "Once we have had contact sessions with you guys [from Stellenbosch University] as well and we have done the training and stuff I think they have kind of seen how valuable the idea is as well so everybody is much more positive and they really want to engage in the things that we do." (SC 5).

Provision was made to support students academically and in terms of logistics with the construction of a learning center equipped with the necessary information and communication technology, which afforded further partnership development. The learning center

> "will benefit other people as well if they should have a need to but where students can actually go to a dedicated learning center and access new learning materials etc. So that is something new that is coming, and it is specifically related to this site." (HFM 1).

Communication

Communication, which was perceived to be open and accessible, was recognized as an important factor for the initial and sustained development across all elements of the partnership, such as academic, logistic and managerial aspects in terms of student training, University and hospital policies, and the comings and goings of students and staff:

> "so it's nice if there could be open communication the whole time because I don't think there will be something that we can say now already that this is going to be a problem, but as we pick up stuff we have to have open communication the whole time." (SC 5)

Clear communication channels, crucial for effective communication between multiple stakeholders, were not always maintained. The need to keep all parties informed was evident especially when it related to students' academic exposure.

> "The guidance we received because they have that little booklet with all the instructions and the rubrics and all those things so we know the students know exactly what they supposed to do and even how the assessment is being done so the guidance through that wasn't a problem." (HFM 1)

Although some clinical supervisors at DHS Hospital felt that communication regarding students' learning activities and the expectations of the University was helpful in preparing them as clinical teachers, this was not the case for all academic departments.

> "The communication channels particularly down to us because the students will have the information sometimes. But then we don't have the information. I think that we should also be included." (SC 6)

Having an on-site student support person, someone who is not responsible for academic supervision, was important not just for students, but also to alleviate the burden on supervising clinicians.

> "Supervision from the Ukwanda side for student well-being was really good. The speech therapist [X] was very *oppit* [with it] and always available for us to air concerns and responded to us very quickly and always kept us in the loop of what was happening and when things were happening." (SRS 4)

Communication relating to specific policies and procedures for student safety was perceived as inadequate:

> "Issues like what happens when they get sick, needle prick injuries what is the policies around certain aspects of the programme. Who is responsible if somebody get injured here? who do we phone, who do we report it to? You know that kind of thing that is not very clear." (HFM1)

Miscommunication and lack of communication could be mitigated by having a go-to person, which promoted improved communication between academic departments and supervising clinicians:

> "I know that [X] has got an open line, so he's quite happy to phone me. Uh, we've actually just spoken before this call. … so, I'm hoping that we are supporting, um, him and his team adequately." (HFM 10).

Some academic departments adapted their approach to address challenges with communication by using information technology apps to support students and clinicians:

> "We started a little WhatsApp group and said, 'You know just ask if you don't know'. … we established open communication with them to say, 'Your initial case studies; send it onto us if you are unsure if what you are feeding back is the correct thing to feedback to the students.' So ya we kept it very informal, but within a very robust, existing structure, if that makes sense?" (APM 8)

Phased Approach

University and health service staff, alike, perceived benefits to gradually phasing in student involvement at the training site, which allowed time for clinical staff to adjust to the demands of clinical teaching and to feel better prepared.

> "'How are we going to supervise the students and do your own job?' and then they gave training and everybody realized that you don't have to be with every student every hour of the day and everybody started thinking a lot about it." (SC 5).

> "I must say initially I was positive, but hesitant because you know you always think, 'It's normal' and I was wondering about the various departments and their lack of staffing etc. and will the students get a good academic, but I think at that point I wasn't 100% sure of what the programme was all about and even when I learned about it, it was still difficult to wrap my head around it, but now that I completely and fully understand it I am all on board." (SC 6)

Gradual phasing in of the students allowed for quality control measures to be implemented:

> "I like the idea of starting slowly, making sure that things are in place before we send students to a specific department or discipline in Upington where we are not sure what the quality of training is going to be." (APM 1)

Theme 2: Influence on the Health Service

The development of the clinical training site and the presence of the University in Upington was perceived to have an influence on the health care service, specifically influencing the workload of staff and the quality of care patients receive. Students were

> "extra help for the doctors … it helps them a lot. Some of the doctors get stuck, sometimes we are one or two doctors short and then it helps when they are in the ward." (NCS 8)

Workload

> "You see them discussing patients with the senior doctors and then they help with the drips and taking blood." (NCS 1)

The influence of the students' presence at the hospital on workload was mostly positive, with time taken engaging with students in the working environment providing opportunities for staff to interact differently with their patient loads.

Challenges in terms of time spent with students related mostly to administrative and mentoring activities, which were not necessarily part of everyday practice, but this balanced out further into the students' training when they were able to work more independently:

> "I must say the administration part and having to mentor them, it does take some time. So, I must say uh yes, we are a bit pressed for time here to get all the stuff done that we have to get done. I think we are short of staff, so I think that's also contributing to the problem… But then after that when they start to you know work more independently, they see some of these patients alone. So that does mean I had to see them anyway, so then that takes a bit of the patient load in the ward off of our backs." (SC 4)

In some instances, having students train at the hospital enabled additional services to be offered:

> "So, it is not just that somebody is going to take up all your time and you have to be there 24/7. It's going to be a bit more that we can reach patients that we wouldn't have maybe been able to reach otherwise." (SC 5)

For example

> "with the psychiatric patients they were very helpful … because … some of our doctors don't want to deal with the psychiatric patients." (NCS 8)

Specialist Outreach

Having the University engage with the hospital enabled specialist support for departments because of specific awards received from the Discovery Foundation to support specialist visits as well as specialist visits from Tygerberg academic departments every month to support student training.

> "Other programmes that started as a result of the partnership, for instance doctors that are coming in, the Discovery grant issue that pay for [a private internist's] visits so those things wouldn't have been initiated if the students weren't here." (HFM 1)

> "Their support from the doctors that have come from Tygerberg. This is something good." (SC 1)

However, not all clinicians could benefit from the perceived value that visiting specialists added because of their existing workload.

> "I normally only made one round on that day with them because I was very busy. It was a very bad thing because I wanted to be there all 3 days because then I know more or less what they were demanding." (SC 1)

Quality of Care

Having students train at DHS Hospital was seen to have a positive influence on the quality of care provided to the patients in the hospital. The thoroughness of the students' consultations also offered a more holistic understanding of patients' challenges and context, saving the clinician time. This was also recognized by staff not directly involved with student supervision.

> "The social part of it … so most of the time we get that information from the student because they've taken [a] thorough

history on the social impact of the child's life, uhm, so they go beyond the medical part of it to see what is wrong with the child maybe there's something wrong in the family that is causing the patient to be ill." (NCS 4).

This was perceived to be as a result of the time students spend with patients and the effort they put into their work. Improved quality of care was also seen to arise from the perceived increase in patient satisfaction, because

"sometimes the patient does not feel comfortable talking to the doctor … and this is where the students comes in … they give them that extra hearing, they lend an ear when like the doctor is only concerned about the wound and don't address the fears" (NCS 3).

"I feel like [having the students] it's improved service delivery" (SC 5)

"because the students have to be so on top of it, they have to be so perfect and diligent in what they do, that they give the best care that they can for the patients" (NCS6),

Their enthusiasm also drives them, so that

"they are eager to see what new implementations they can implement in order to improve the service the quality of service we are rendering." (NCS 5)

The thoroughness the students present in their work was also seen to be an important part of the quality of care offered.

"Their notes and so, they are very thorough. They do it the way it should be done." (NCS 8)

Students' contributions were described in terms of specific areas of input and assistance that went beyond dealing only with patients. Projects, research and different perspectives were all seen as valuable. An example of this was the quality improvement project undertaken by medical students:

"The little projects that the students do, you know, the quality projects, those projects also change certain dynamics within the hospital for instance the [medical] students were doing a project on triage systems. I mean that has a big impact on the way nurses and doctors have to function in the ER [emergency room] unit now." (HFM 1)

Projects students engaged in incorporated reviewing processes to improve patient satisfaction.

"If you [go] down to the hospital you will see one of the projects it was received so well [by] patients and everybody so the students contribute to the hospital and the dynamics of the hospital." (HFM 1)

Accountability

Clinical staff in DHS Hospital were driven to develop their own skills and knowledge in order to provide the best possible training to students:

"So, it forced me, at a personal level, to develop my skills, to study more, to upgrade my own knowledge space and I think that is exactly the same thing that it brought to the hospital. The doctors are now dealing with students that ask questions and it also forces them to spend time thinking about patients more than they would do normally." (PFM 1)

"Because when they go with to a patient I need to do everything perfectly and to the T, which is the way we should always do it, but it's good to have the students here to just keep you on your toes around patients and to keep you up to date. When they are asking you questions, you have to be able to answer them, so you have to do your own research." (NCS 6).

Some clinicians commented that the students' approach to patient care highlighted aspects they as clinicians may have lost along the way.

"At least the patients feel like someone is listening to them. And I think most of the time we all forget to communicate with the patient because we are all so focussed on how sick the patient is, and we forget that that person is a human with feelings." (NCS 3)

The students' presence at the hospital resulted in self-reflection of the clinical staff and a desire and drive to want to optimize their professional and clinical practices. This was not only evident at a personal level, but at a hospital systems level as well.

Having students conduct quality improvement projects as part of their training at the hospital was seen to be beneficial in terms of the accountability that was inadvertently imposed on the hospital by these projects:

"Because there is a project that the students put up and the students evaluate the project. So inadvertently they are evaluating us. That is the problem. There are now eyes and ears that were not here before they pick up things and they ask why you doing that? Forcing you to think about things and what you doing but also [saying] 'I don't think that thing was done correctly, the guideline says this' so it not only forces you to think about it but follow protocols that you have put in place and people have really not followed." (HFM 1)

Theme 3: Workforce Sustainability

Establishing a clinical training site at DHS Hospital also appeared to influence the local hospital staff in relation to professional development and job satisfaction and in this way also workforce sustainability.

Professional Development and Incentives

"My expectation I think was from the onset that the involvement of the faculty would bring opportunities first of all, opportunities of learning. Because we didn't look for money as a way of compensation but what I get is access to study material, access

to a library things like that, that for me is crucial you know and in monetary terms it actually translates into monetary terms because if I have subscribe to a journal it costs me some money." (HFM 1)

Certain learning opportunities became available to staff based at DHS Hospital with the development of the partnership, such as free access to the University's scientific library database, continuing professional development (CPD) opportunities and the possibility of postgraduate study.

"So when I have a professor coming from the faculty coming for the students, I can set up a teaching session with the doctors as a CPD activity and already I have a specialist in the field so the cost factor is reduced because I don't have to fly in somebody and pay for accommodation and all that which is usually the biggest cost in CPD activities." (HFM 1)

These professional development opportunities relate to potential improved staff retention and rural pathway development, which were not available before the partnership development.

"Doctors that want to specialize won't come here because it won't count anything toward the possibility of going and specialize so they will go to a bigger center where there is a possibility that they can get into a programme but if we can set up that kind of thing, it is an incentive for attracting more doctors to this side." (HFM 1)

Evidence of this was already visible with clinicians in Upington engaging in professional development opportunities:

"Me and Dr [X] from [XX Academic department] she is helping me … I have to write up cases and we do Skype interviews so she helps me, and we discuss it … because of her I will be able to do my diploma next year." (NCS 7)

"It will benefit some of the professionals here as well like if they want to go into some research or do a Masters or do something else to have that open door with the University as well." (SC 5)

The development of DHS Hospital as a training site is seen to have the potential to influence the future workforce of the hospital, and of the surrounding facilities that refer to it. There is a local vision to

"strengthen the site to the extent that we can accommodate more students in particular programmes which in the end, if the programme is running very well might attract future doctors to come to the hospital because now they know there is this association with the University of Stellenbosch." (HFM 1)

Sense of Purpose and Value

Having students at Upington offers a sense of purpose to the staff at DHS Hospital, who now felt responsible to teach a new generation of health professionals.

"I want to teach and I really also feel like because of the impact that my mentors had in making me a [XX] I am hoping to have a similar effect on a student, maybe not to be a [specific speciality], but to be a certain type of doctor, and students are also making me want to be better." (SC 6)

The process of site development

"boosts the morale of not only students but also the people working here to see these people, academics from the University coming down here and spending time with us." (HFM 1)

The engagement encouraged clinicians at DHS Hospital to value not only themselves, but also clinicians from other professional teams, promoting collaboration around patient care:

"I definitely think people are more attuned to people from other disciplines. So, it's like they're seeing everyone in a different light now that they have to be trainers and teachers. So, I think people are more open to teaching other people about their profession and the work they're doing. And also involving everybody in decisions being made. So, I think it's been a very positive experience." (SC 5)

Theme 4: A Change in Perspective

Despite initial concerns from students and Faculty staff regarding the adequacy of clinical training on the distributed platform there emerged a clear change in perception and a recognition of the potential value distributed training has in preparing a future workforce.

The Value of Training on the Distributed Platform

The notion of expanding the clinical training platform was daunting to some and it raised concerns about an increase in teaching load

"I am aware of the fact that the Department of [X] is very straining in terms of the teaching responsibilities and to add something more, which is 800 km away without the necessary support there, that's really my concern." (APM 6)

However, other staff saw the partnership and expansion of the clinical platform as having potential to not just lighten the academic workload for Tygerberg staff, but also improve the quality of training students were receiving:

"A secondary advantage is lessening the student burden on the platform at Tygerberg. … we all know that the current load on the platform at Tygerberg is too heavy. You can't have training with thirty students around a patient's bed. So, the more we can send students out, the less we have problems with over supply of students on the Tygerberg platform." (APM 1).

"We can't train more doctors here [Tygerberg], than we are training at the moment and we can't train the ones that we are training to be any better than they are if we don't make radical changes to the way that we're training, to the place that we're training, to the exposure that we give them. And in the end if we don't embrace these changes, we are setting ourselves up for failure in the future." (APM 4)

There were instances where academic programme managers questioned the value of training students away from centralized

specialist care due to the limitations in the specialist exposure the students would get in that discipline:

> "I went there together with a group of other clinicians from all the departments. And we saw a very nice hospital. And some of the functionality was a little bit challenged, but there were some disciplines that were doing really very well. And then others have not so … understaffed and under managed. And the exposure to certain cases was very limited. Most [X] cases were sent away to Kimberley [Specialist hospital 400 km away] and then also my impression was it wouldn't be a good place to train students in [X]." (APM 3)

But students commented that despite their own initial hesitancy toward learning away from the specialist academic hospital, from doctors who are not from their training institution, they realized that they are actually good doctors and saw the value of the training they were receiving:

> "It's difficult but I think to try to get out of the mindset of, you need Tygerberg tuts, you need this consultant to tell you this, otherwise you won't be a good doctor, cause I've learned from doctors here that are from universities that aren't like the best in the country, but they good doctors. So, and I would trust them." (MS2)

The change in perspective was also expressed by an academic coordinator from Tygerberg regarding her previous misconceptions about where students should be trained:

> "I think in terms of learning for me, it's probably exceeded my expectations in terms of what the students learn there. I don't know what I was expecting, but I feel like I am doing them a disservice by saying that, because they should trust that people at the district level know what they are doing. Our expectation going forward is that we will have more than the one [block]. We would like to develop the other 4 or other 3 strands of our fourth-year placements within Upington as well. So, I think that's the expectation going forward. … there are over-arching ideas that all 4 of the placements will be there, eventually." (APM 8)

Despite the challenges of understaffed departments and the concerns about clinical exposure, local supervising clinicians put it as follows:

> "I think it's a good thing that they are here … they are exposed to equipped hospitals that have everything and everything runs smoothly, and then they come here and see that we don't have everything. Uh we're short on staff, we have to think out of the box." (SC 3)

This was echoed by a Tygerberg counterpart:

> "I think the students have experienced maybe the true South African circumstances, as far as healthcare goes." (APM 4)

Faculty Development for Distance Learning

The expansion initiative was perceived to be a valuable testing ground for innovation and planning for a new MBChB curriculum that is currently being developed at the Faculty. Amongst other things, the renewed curriculum intends to provide early clinical exposure to the primary care platform and longitudinal distributed placements in the final year of training.

> "I think it is helping us is with the development and the thinking of the new curriculum. Because many of the things like the long distance learning and teaching activities, how we support people at those facilities, all of those things will help us to plan the new curriculum" (APM 5)

> "It has made us more aware of the need for electronic media and other blended online teaching methods. So, we've been doing lots of little bits of pieces, videoing this and that. And so on. But it is not, that was just interesting how we actually need to develop a whole online programme that would expose people to practical clinical material, how to examine a patient. That kind of thing." (APM 3)

Innovations from placing students in Upington for clinical training had ripple effects into other University programmes:

> "So, we are using Microsoft Teams for our postgraduate training. Whereas it all started with the Upington students." (APM 5)

There was not only new learning about distance education, but also around distance assessment and the feasibility of continuing to have exam processes that rely on a 'one size fits all' approach.

> "I think what we have been speaking about is the nature of our exam situation … we require an external examiner to be there and that … so, we are sitting with ideas around whether we should change the way in which we examine because of the practicalities thereof and the logistics. … we have a good exam process I don't see us changing that much, but what I think needs to happen is that we need to get support … to make our exam process feasible within a setting such as Upington." (APM 8)

Theme 5: Equipping a Future Workforce

An important aspect of continued engagement is exploring stakeholders' future vision for the Upington training site and the University's engagement with the Northern Cape. Arising from their experiences of the year spent in Upington, the medical students were very positive about the future possibilities and the potential the platform has to expand.

> "It can really become a good academic site, because there's a big hospital, there's a lot of things if you think all the resources you need are here … I think it can be an amazing place to send students to cause you're going to work as an intern in the essence of you're gonna be like independent, you're going to think for yourself and you're gonna learn to reason and all those things, but you're also gonna have someone to check on you and make sure you're on the right track." (MS 2)

Further Expansion

Dreams for further expansion included becoming an extension of a University and an example of a Northern Cape rural clinical school, which could model how rural training should be done. The benefit that this would bring more support was noted:

"I hope that this programme can continue you know and that eventually who knows we might have a satellite campus with accommodation and the proper support framework … who knows, the Northern Cape doesn't have a medical school so if we can have at least eventually a little support campus off site from the University whether it is affiliated to Sol Plaatjie University or Stellenbosch it's not really for me an issue as long as the support comes." (HFM 1)

This expansion was envisioned by both the staff of DHS Hospital and the specialist academic coordinators at Tygerberg.

"I think to see it grow. And to see something similar developing in Upington that we have in Worcester and the rural clinical school in Worcester. So essentially, a second rural clinical school in Upington." (APM 1)

"I'm hoping that Upington will go from strength to strength. And also, then become another model of how teaching can take place outside of the tertiary setting." (APM 5)

It was noted that achieving the dream of developing Upington into a major training hub would require ongoing faculty development.

"I think there should be a faculty development programme for the staff in Upington with regular sessions related to for example clinical training methodologies, and especially clinical assessment. Because the problem is always that you, when you start using people for training that has not been involved in training for many years, for example, these people need to be capacitated in terms of educational techniques, assessment techniques, these sort of things." (APM 1)

Potential Influence on District Health Services

Having the University invested in the site brought with it perceived opportunities for district level outreach, which had previously happened at a Provincial level, but had not been happening for some time. A district official saw the University's involvement in Upington as an opportunity to expand services to more remote communities,

"we have a very vast district … we would like the services to go to the most remote areas within the district and we as a department would be prepared to assist if it comes to a push for maybe transport so that they [the students] reach those very remote areas within the district because it is where we have a lot of challenges in terms of service delivery." (FGDM)

It was mentioned, however, that this form of learning and service delivery had not been utilized to its full potential yet since the students had little interaction with the district health services during their time in Upington. They expressed a desire to get more involved in the local district services and community outreach not only to benefit their own learning, but also to help support the existing services available.

"I feel we the only interaction we had was with one district clinic that we have asked and arrange with our clinicians to attend. I feel the hospital was a bit 'isolated' from the community in a sense. I feel our programme can be broadened to include more district clinics. The district physio is a comm serve with a very high workload. We as students can definitely help in this regard by being more hands and helping to see more patients in a shorter period of time. There is definitely a need for community projects within the district, and many opportunities for possible community blocks which was confirmed by the current district physiotherapist." (SRS 4)

Relevant and Accessible Training

The potential the Upington training site offers does not only include undergraduate health professions education, which stakeholders believe should be expanded in its scope, but also postgraduate training and research. The relevance and nature of the training was seen as a catalyst for envisioned programme and research opportunities across all academic domains.

"We are very, very excited about primary health care, district level care because we think that that prepares our students 100% for community service placements so we are very excited about that and for it to become the longitudinal placement like we have in Worcester and then I think continued involvement not only in clinical training, but undergraduate research and potentially post-graduate research as well within those environments because in my field at least we tend to be doing the research within the major cities like Cape Town or Pretoria or Johannesburg, but realizing that that's not rural enough in terms of health care service delivery within the public service. That's what we are excited about, I think as a continued involvement across all our domains." (APM 8)

The expansion of training offered to accommodate postgraduate education was viewed as a means to support local specialist competency in rural areas.

"A MO [medical officer] will come here knowing that they can stay here for the year and write their primary's, do their first year at this hospital and then if it is even necessary, go to Tygerberg and complete their registrar time there." (HFM3)

"Yes. I think I'm also hoping for more doctors you know, registrars to be sent to Upington, so then also our specialty departments can also be better." (SC 4)

"Having rotating registrars, having rotating specialists, having registrars train here actually and also having some staff going to Stellenbosch University to be registrars, also having more visits by the visiting specialists." (HFM4)

Rural Pathways

There is potential for the existing partnership to provide not only possibilities for training for existing clinicians but also reaching out to local people within the community to support rural pathways.

"The University can have a camp in Upington or in the Northern Cape to expose the [school going] students that otherwise don't get exposed to other health sciences because everyone wants to be a doctor, but they forget you can be a physio and an OT." (HFM3)

"I hope that we can open more to the people of the Northern Cape, maybe more training like primary healthcare you know make it more accessible for people who want to study… from our province." (FGDM)

"For the people of Upington and surrounding areas, our young generation if there is a possibility through the hospital or through the province to give them bursaries to go and study so that they can come back and plow back into their communities." (HFM4)

The potential the partnership had for improving rural pathway development in the province by recruiting potential students from a young age was expressed:

"Because of our partnership say to the University say - Listen here are 20 students from poor backgrounds, but they are from Upington or they are in surrounds and they want to study Health Sciences - So it's sort of like a gateway for them." (HFM3)

Some Faculty members envisioned the change that this approach to distributed training could have on the distribution of health care training in South Africa.

"I think the opportunity for increased exposure of our students to rural and semi-rural health care. And ja, I think in a, even more visionary sense perhaps. The improvement of quality of health care in Upington and surroundings. And, closer ties with the provincial government of the Northern Cape closer ties with especially the department of health of the Northern Cape Province. And then in strengthening those ties, the possibility of further expansion, of upgrading [the] platform in the Northern Cape. Not only in Upington." (APM 1)

"Then I suppose from the hospital's point of view and the province at least my vision and I hope that, that is true for the rest of the province and the hospital as well is that by getting students to work in the peripheral regions because of staff issues that in future it might also prompt students to go, 'Well, it's not so bad to work in a rural area or hopefully it's not so bad to work in Upington' and maybe as a … medical officer that would then see the need to come and assist and help and work here." (HFM3)

"Then with the students themselves … we are planting that seed of its okay to work here. Go off somewhere and post it, to their internship and then they apply to come back here for the year or for 2 years." (SC 6)

DISCUSSION

Our study findings highlight the value added to existing health services, workforce sustainability and health professions education when establishing a distant training site for undergraduate students in a resource limited and over-stretched rural health care system. The mutual benefit derived through collaborative engagement of the University and the health care system, the importance of multi-level engagement in the development of a distributed training site and factors which ensure the sustainability of the project are explored.

The findings of this study support the emerging evidence that undergraduate distributed clinical training for final year health science students can complement quality of care and help alleviate clinical workload in rural and resource constrained environments (8). Students are perceived to improve patient satisfaction, workforce competency development and community-based services in other rural and urban South African contexts (8) and despite the rapid nature of the Upington training site development and the distance of the site from the academic training institution, these positive outcomes are still evident from this study. The perceived effect that not only students, but also the partnership between University and hospital have on the existing health service is notable and speaks to the reciprocity that one endeavors to achieve as a socially accountable training institution (29).

Although there is growing evidence that rural exposure during undergraduate training in LMICs influences rural pathways (2, 30), the findings of this study suggest that collaborative engagement between universities and the health system can influence future workforce development and rural retention. This can be achieved not only by enabling undergraduate rural training, but through continuous professional and competency development of local health service staff, with the potential for postgraduate training, both of which have been shown to influence doctors' decisions to remain working in rural areas (31). The perceived value of visiting specialists from the training institution not only to support student learning but also contribute to professional competency development has an influence on workforce sustainability. Partnerships between academia and health systems resulting in postgraduate training opportunities and career development can make long-term rural placements more attractive to young ambitious professionals wanting to specialize, which evidence suggests is one of the deciding factors in rural retention (1). This requires a sustained committed relationship between academic institutions and health services.

Opportunities for students and academic staff to experience and witness the challenges of working in rural underserved environments, made possible through the collaborative partnership between SU and DHS hospital, had a potentially transformative effect not just on students, but also on academic programme managers who are specialists in an urban tertiary level hospital. The findings of this study demonstrate a positive change in some faculty members' perceptions and understanding of the value not only of distributed clinical training, but also of rural health care and its challenges. This demonstrates improved insight into health in context and the importance of relevant curricula not just for students but for professionals as well. Considering academic outreach as a model for socially accountable engagement and rural exposure for academic relevance not just for students, but for academics as well is worth further exploration.

The concept of responsive adaptability, one of the key principles of establishing distributed training sites (32), served as a basis on which much of the Upington development took place and is believed to have encouraged sustainability of the initiative during the expansion of clinical training in Upington.

The receptiveness of the broader community, but specifically the DHS staff in collaboratively creating a shared vision and strategy for each department was crucial and suggests this was not simply a theoretical notion, but a lived experience that was perceived by the stakeholders at a practical level, and accords with the literature on decentralized training (10). The findings of this study are consistent with the perception that the overall contribution students can make to a clinical environment is significantly more than the time invested in initial orientation and supervision, which is well-documented and evident in several contexts (33–35).

The value of ensuring sustainability of the rural training site was recognized by all stakeholders. Our data indicates that the development of the site was aligned with the five factors that influence the degree of sustainability of health-related programs identified by Scheirer (23). We have tabulated the perceptions of the stakeholders regarding the Upington expansion project in relation to the five factors influencing sustainability (See **Table 3**). Whether these initiatives are indeed sufficient to ensure sustainability of the newly developed site will need to be confirmed in follow up studies. However, there is no doubt that sustainability is a critical element in the successful implementation of rural pathways to train, develop and support health workers in LMICs (12), of which the Upington clinical training site represents an example.

The findings of this study must be interpreted with caution. The data is limited to the perceptions of three key groups of stakeholders involved in the development of the Upington training site and does not include the perceptions of community organizations or patients and their families. However, every effort was made to include a wide range of participants with varied perspectives on this project.

TABLE 3 | A summary of stakeholders' perspectives on the development of the Upington training site that relate to programme sustainability as described by Scheirer (23).

Five factors influencing sustainability	Findings
Being able to modify the project to suit the local environment	• Phased approach to engagement • Responsiveness and flexibility of learning activities • Aligning learning to DHS hospital needs • Gradual increase in student numbers • Intentional reflection on expansion project through a 5-year longitudinal study exploring the impact of site development
Having a champion at the project site	• Crucial identification and involvement of a local champion on site • Deliberate process of identifying champions at various levels within the health care system and Faculty • Clinician willingness to accommodate and train students at DHS Hospital
The project being aligned with the organization's mission and vision	• Collaboratively defining a joint mission and vision in the initial stages of development • Regular reflection on the process of engagement and the alignment thereof during the phased approach to engagement
Visible benefits to clients	• Interprofessional interactions at the facility promoting collaboration among departments • Improved staff morale • Perceived influence on quality of care and patient satisfaction due to student involvement • Increased access to reliable sources of information via University library • Opportunities for continuous professional development and the possibility of postgraduate programs • Contextual learning opportunities afforded to undergraduate students • New training opportunities at distributed clinical sites to accommodate the growing number of undergraduate students
Having support from stakeholders in other organizations	• External funding for visiting specialists to support service delivery in Upington • External funding awarded to support district level outreach and clinical training programs for staff • Stellenbosch University Network for Strengthening Rural Inter-Professional Education (SUNSTRIPE) engagement with continuous interprofessional and capacity development • Center for Health Professions Education faculty training workshops: train the trainer course

CONCLUSION

This paper presents evidence to consider the development of a new remote site for undergraduate clinical training as a strategy for developing rural pathways and influencing workforce sustainability in rural health systems. The challenges from this study are framed within the context of a stretched rural healthcare system, and the influence of this initiative on workforce sustainability and the contribution to rural pathways is explored. The process of site development, as perceived by the stakeholders may be transferable to other LMIC settings due to the challenging and resource constrained nature of the study environment. In particular, we have demonstrated the value of using a lens of health programme sustainability to review the process of learning site development. The need to rethink how and where the future workforce is trained, and how to support existing rural health care services through this process, is a critical element of developing sustainable rural training pathways in order to address the needs of LMICs and indeed all countries where inequity in health care provision is evident.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because they are still undergoing further analysis related to teaching and learning on the distributed training platform for the purposes of additional publications and feedback to stakeholders. Requests to access the datasets should be directed to Jana Muller (janamuller@sun.ac.za).

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Stellenbosch University's Faculty of Medicine and Health Sciences Human Research Ethics Committee. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

JM: lead author, involved in protocol development, data collection, analysis, and article write up. CR: primary co-author, involved in data management and analysis, and article writing. SH, JB, FC, and EdP: co-author involved in study from conception through to analysis and contribution to article. KD: co-author involved in data collection, data management and analysis, and contribution to article. IC: principal investigator and critical voice, involved in data analysis, and writing up of the final article. All authors contributed to the article and approved the submitted version.

FUNDING

The Upington Evaluation Project received a grant from the Stellenbosch University Fund for Innovation and Research in Learning and Teaching.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2021.601026/full#supplementary-material

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Public Health

ORIGINAL RESEARCH
published: 29 April 2021
doi: 10.3389/fpubh.2021.612035

A Curriculum for Achieving Universal Health Care: A Case Study of Ateneo de Zamboanga University School of Medicine

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Introduction: Universal Health Care requires equal distribution of a health workforce equipped with competencies appropriate for local population needs. While health inequities persist in the Philippines, the Ateneo de Zamboanga University School of Medicine (ADZU-SOM) in Zamboanga Peninsula – an impoverished and underserved region – has demonstrated significant success retaining graduates and improving local health statistics. This study describes the qualitative evidence of ADZU-SOM students and graduates having positive impacts on local health services and communities, and the contextual factors associated with the school's socially-accountable mission and curriculum that contribute to these impacts.

Methods: This qualitative study involved 41 one-on-one or group interviews conducted across seven participant groups (faculty, graduates, final-year students, health professionals, health workers, community members, community leaders). Gale et al's method for analyzing qualitative data in multi-disciplinary health research, WHO's "6 Building Blocks for quality health systems" framework and THEnet's social-accountability framework were used to organize and interpret data.

Results: Local community members, community leaders, and health staff consistently reported examples of ADZU-SOM students and graduate doctors developing health infrastructure and providing health education, health promotion, and disease prevention activities accessible to all population groups. Students and graduates suggested these impacts were due to a number of factors, including how ADZU-SOM's sandwich model of longitudinal community-engagement culminating in 10-months continuous community placement in the final year helped them develop a strong motivation for community service, the teachings and curriculum activities that focused on public health and the social determinants of health, and faculty's commitment and ability to operationalize ADZU-SOM's mission and values. Staff also reported impacts were driven by integration of regional and national health priorities as core curriculum, and involving local stakeholders in curriculum development.

OPEN ACCESS

Edited by:
Belinda Gabrielle O'Sullivan, University of Queensland, Australia

Reviewed by:
Nathanael Sirili, Muhimbili University of Health and Allied Sciences, Tanzania
Paul Fonken, University of Colorado Denver, United States

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Specialty section:
This article was submitted to Public Health Education and Promotion, a section of the journal Frontiers in Public Health

Received: 01 October 2020
Accepted: 30 March 2021
Published: 29 April 2021

Citation:
Guignona M, Halili S, Cristobal F, Woolley T, Reeve C, Ross SJ and Neusy A-J (2021) A Curriculum for Achieving Universal Health Care: A Case Study of Ateneo de Zamboanga University School of Medicine. Front. Public Health 9:612035. doi: 10.3389/fpubh.2021.612035

Conclusions: This study provides qualitative evidence that ADZU-SOM's curriculum content and immersive community placements are training a medical workforce that is strengthening local health systems and health infrastructure across all 6 WHO "Building Blocks for quality health systems." These findings suggest ADZU-SOM has managed to evolve a consciousness toward community service among final year students and graduates, adding evidence to the assertion it is a fully socially-accountable health professions institution.

Keywords: education, socially-accountable, curriculum, health workforce, medical

INTRODUCTION

The health workforce is the foundation of the health care system. While the World Health Organisation (WHO) estimates that an additional 18 million doctors, nurses and midwives are needed worldwide by 2030 to achieve universal health care (UHC), too few health practitioners currently practice where they are needed most (1). Increasing the total numbers of health workers is not sufficient; they need to be equitably distributed, possess the required competencies to address relevant local health needs, and be motivated and empowered to deliver quality care that is appropriate and acceptable to the sociocultural needs of the population (2). There is also mounting evidence that the health systems in which these workers practise must also deliver services equitably and efficiently if the health status of all population groups are to be improved; taking into account the additional core components of service delivery, health information systems, access to essential medicines, financing, and leadership/governance (3).

Workforce shortage, skill-mix imbalances, and maldistribution of human resource for health are some identified barriers to the successful implementation of UHC. Contributing to this barriers is the failure of Health Professional Education to adjust medical education to the changing conditions of the healthcare delivery system because of curricular rigidities, professional silos, static pedagogies, and insufficient adaptation to the local context (4).

Socially accountable health professional education (SAHPE) aims to address this workforce maldistribution and greater accessibility of health services in general through increasing the quantity (including distribution and retention), quality, and relevance of health care providers to their communities. "The WHO believes the social mission of health professional institutions should represent an opportunity to nurture public service ethics, professional values and social accountability attitudes required to deliver care that responds to community needs and population expectations" (2). The Global Consensus on social responsibility states that the added value of socially accountable schools is their commitment to ensuring that their students, graduates, research activities, and health care models improve the health status across all community population groups (5). For this to be achieved, the health curricula must address local needs and be grounded in competency-based learning, including how to engage effectively with local communities to address the social determinants of health (5). However, these are relatively new concepts. Evidence is required on what works, how and in what context, as very few studies in the literature look at the impact of this approach (6).

The Philippines suffers significantly from health inequities, with rural areas having poorer health and less health workforce (especially doctors) compared to urban areas. Although, child mortality is declining overall across the Philippines – a key indicator of health status – inequities in distribution across different economic strata is getting wider in rural locations (7). In addition to the urban-rural maldistribution of health professionals, almost 70% of Philippine doctors and more than 80% of nurses end up practicing overseas, further draining the health workforce (8). The medical education system in the Philippines is also greatly influenced by the western curricula. The system is discipline-based, teacher centered, and classroom lecture is the main venue and method of delivering teaching-learning activities. The focus primarily is on the disease and hospital-based individual care, resulting in a mismatch between competencies gained by health professionals and the needs of the population. This further leads to mismanagement of human health resources and reduced access to the healthcare system (9). However, against this national trend, the socially-accountable ADZU-SOM has had great success in graduate retention rates and distribution in local areas of need.

The ADZU-SOM was founded on a mission to serve the poorest and most isolated communities in Zamboanga Peninsula. The combined degree of Medicine and Public Health (MD-MPH) curriculum goal is to train physicians with the skills and priorities oriented toward social determinants of health, intersectoral collaboration, and community participation. The teaching-learning activities are structured around the local, regional, and national health priorities. The 12 impact programs of the Philippine Department of Health became the core content of its curriculum. During the first 3 years of the medical program, students spend 1 month at the end of every semester living and learning how to practice medicine in the community. In the final year, the entire year is spent in the rural community. The students learn to

Abbreviations: ADZU-SOM, Ateneo de Zamboanga University-School of Medicine; CHP, Community Health Plan; DOH, Department of Health; MHO, Municipal Health Officer; MD-MPH, Medicine and Public Health; SAHPE, Socially Accountable Health Professional Education; THEnet, Training for Health Equity Network; UHC, Universal Health Care.

use multi-sectoral collaboration and participatory approach to strengthen community capacity for health care development. While in the rural communities, students, community members and health authorities collaboratively design and implement health programs relevant to the community, as well as implement interventional research to solve real health needs. The post graduate internship is also unique; while conventional Philippines medical curriculums allot 90% of the entire internship in the hospital, ADZU-SOM students spend half the year in broader community exposure at rural health clinics, community hospitals and by undertaking community work.

Recent studies found more than 90% of ADZU-SOM students work in local Philippines communities (10); often practising in areas that never previously have had a doctor. This has resulted in a 55% increase in the number of Zamboanga Peninsula municipalities having a medical practitioner over the last two decades (8). In addition, ADZU-SOM's social accountability philosophy has been found to impact the practice choices of its graduates (11) and strengthen community health services across the Zamboanga Peninsula (12). Further, since the establishment of ADZU-SOM in 1994, the infant mortality rate in the region has decreased by approximately 90%, compared with a national change of only 50% in the same time period (8).

With the quantitative evidence of ADZU-SOM impacts on local communities and health systems being published previously, the aim of this case study is to describe the qualitative evidence of ADZU-SOM students and graduates having a positive health impact on local health services and communities, and the contextual factors associated with the school's socially-accountable mission and curriculum that contribute to these positive outcomes. This study is part of a series of multi-institutional collaborative research carried out by THEnet and its institutional partners to gather evidence on the outcomes and impacts of socially accountable transformative health professional education, and part of a larger THEnet project and framework to build evidence on how to produce a fit-for-purpose heath workforce (13, 14).

Setting: ADZU-SOM's History, Selection Processes, Curriculum, and Community Engagement Processes

Established in 1994, ADZU-SOM is a private, not-for-profit health professional institution with a mission to help provide solutions to the health problems of the people and communities of Zamboanga Peninsula, a remote region of the Philippines. During its establishment, ADZU-SOM was the only medical school in a region home to the 14 poorest municipalities in the country. Zamboanga Peninsula had a population of 3.4 million with 70% of the people living in rural areas, with two local provinces ranking 1st and 2nd in number of children with malnutrition and hunger, and an overall regional infant mortality of 75/1,000 livebirths (15). In addition, the average physician to population ratio was at 1:7,000 which was way below ideal, leaving 80% of the area doctorless and nearly 100 municipalities lacking medical attention (15).

ADZU-SOM has led the way in social accountability even before the term became more widely known (15). As a corollary, its establishment has made medical education more accessible to many prospective doctors who otherwise would not have the means to undertake medical education. Prior to its establishment, prospective students had to travel to other parts of the Philippines to pursue a degree in medicine, and frequently did not return.

In order to fully address the shortage of physicians across Zamboanga Peninsula, ADZU-SOM adopted a strong focus on social accountability, and in 2009, became a founding partner of the Training for Health Equity Network (THEnet) (www.thenetcommunity.org). Social accountability has been defined by Boelen and Heck (16) as: "The social obligation to direct education, research and service activities toward addressing the priority health concerns of the community, region, and/or nation the school has a mandate to serve. The priority health concerns are identified jointly by governments, health care organizations, health professionals, and the communities." Two key ADZU-SOM priorities that align with socially-accountable principles are a need to train doctors in the region in order to retain them, and to decrease the region's high infant mortality rate.

The student selection criteria prioritize equitable access for ethnic, socioeconomic, gender, and religious groups to ensure the local population is proportionally represented, and the students selected have a desire to serve their community. The selection process also includes a non-medical person (usually from the community) to provide a community perspective. Selection criteria for scholarships place greater weight on area of origin and family income than academic success. Socioeconomically disadvantaged students and those coming from remote/rural areas are given priority for scholarships. Approximately 30% of the students become scholarship holders.

The school was founded on a mission to provide solutions to the pressing health priorities of the people and communities of Zamboanga Peninsula; therefore, the local, regional, and national health priorities became the core curriculum and the focus of student learning. Given the region's needs, ADZU-SOM's curricular design is aimed to train physicians with the competencies oriented toward social determinants of health, intersectoral collaboration, and community participation. ADZU-SOM has a four-year postgraduate program, with competencies taught including: physician manager leader, physician clinician, physician teacher, physician researcher, and physician learner, physician professional, and socially accountable physician. Instructional activities are iteratively undertaken in the university, hospitals, private clinics, patient bedsides, and community posts. Total contact hours with patients are equally divided – half in clinics and university classroom settings with a problem-based learning model, and the other half allocated for learning and serving in community settings (refer **Figure 1**). Another unique feature of medical education at ADZU-SOM is the double degree offered—a degree in MD-MPH. This unique feature incorporates the learning process of the individual healthcare domain and the population healthcare domain of medicine into the curriculum (refer **Figure 2**).

Fully-immersive, community-based service learning is a particular focus. During their short immersions in Years 1 to 3 (1 month per semester), students must develop a Community Health Plan (CHP) in collaboration with key stakeholders from

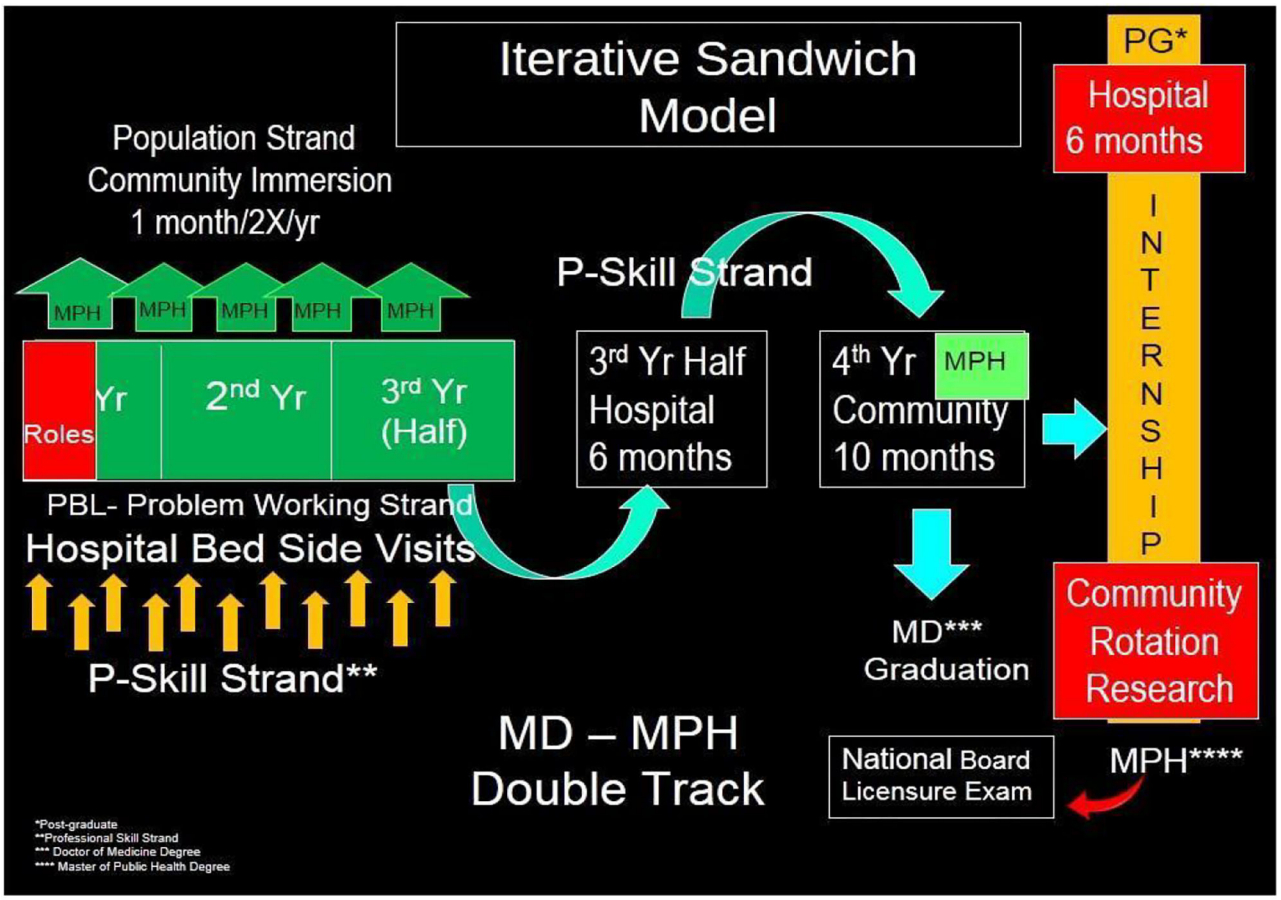

FIGURE 1 | ADZU-SOM's iterative "sandwich" model for hospital- and community-based clinical rotations.

a selected local community. In the initial immersion, students undertake a community survey together with community health volunteers (as there are no existing community data), then present the survey results to local community leaders. In collaboration with the community leaders, they prioritize the problems of the community to develop a fully detailed CHP. Then, during the 10-month community immersion experience in the 4th (final) year, the students fully implement this CHP in the selected community through intersectoral collaboration. Furthermore, students are required to implement individual interventional research projects aimed at providing solutions to the pressing health needs specific to the community they serve. By graduation, the CHP and the individual research project have both been completed, and the health problem should be resolving.

Community-based health research is also an indispensable part of ADZU-SOM's training of future physicians. Students are required to conduct not only research in an area of interest, but also undertake interventional studies to address problems in the community where they are assigned. These interventional studies not only contribute to the body of health knowledge but also improve the health status of the area. As of 2019, a total of 550 community-based health research projects have been completed by students, dealing with key issues like waste segregation/environmental sanitation, maternal and child health, culture and infectious disease – with all projects focusing on the national top 10 causes of morbidity and mortality.

METHODOLOGY

Study Design

Case study methodology was applied to enable an understanding of how and why the complex social phenomena of the SAHPE approach was effective, and to explore the impact of context on outcomes (17). Specifically, this case study links the training program and its implementation with program effects to explore the key factors contributing to social accountability for health professional schools, and to identify if ADZU-SOM students and graduates are having a noticeable impact on local health services and communities. Ethical approval for the study was obtained from the Ateneo de Zamboanga School of Medicine Ethics Review Committee and the Flinders University Human Research Ethics Committee (#7042) in Australia.

This study used a basic qualitative descriptive design (18) as the preferred qualitative method, given the desired outcome was the production of straight-forward descriptive summaries

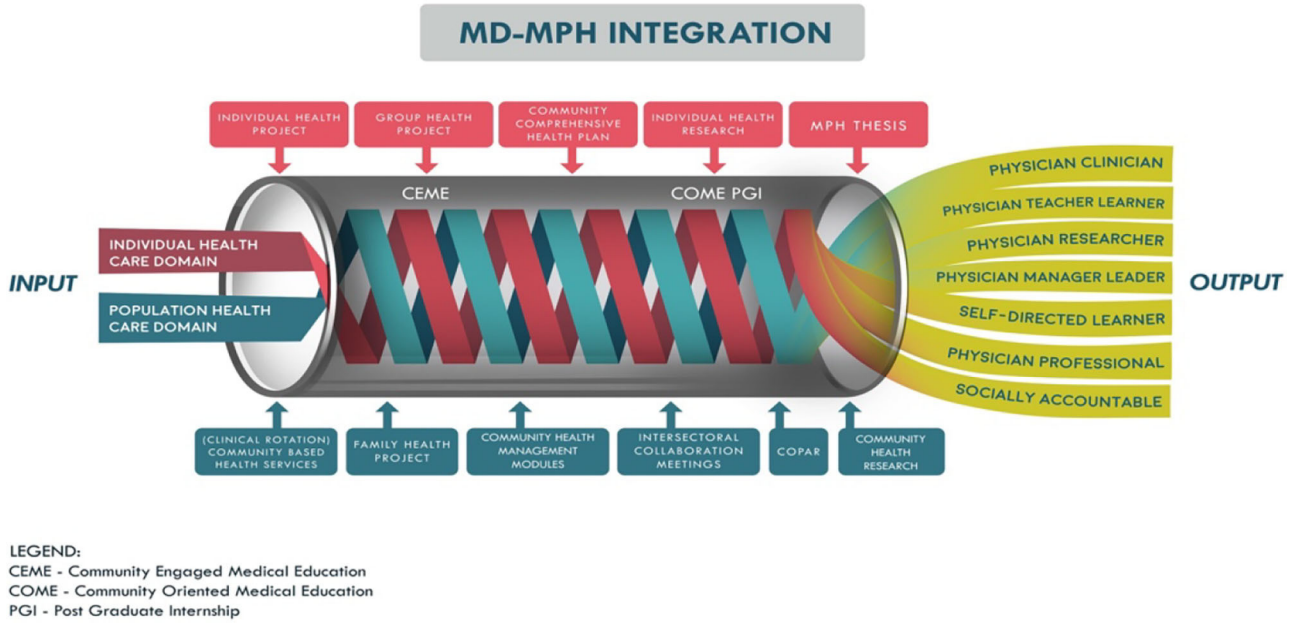

FIGURE 2 | ADZU-SOM's combined MD-MPH program.

of outcomes and activities - who were involved, what was involved and where activities and experiences took place. The seven stakeholder groups used in the purposive sampling strategy were chosen to obtain the range of cases deemed most rich in information for the purpose of achieving data saturation (19).

To improve construct validity, THEnet's social accountability Framework (13, 14), developed from the cumulative experiences of THEnet founding schools, guided the development of interview questions to provide a range of evidence showing participants' described impacts and if these impacts could be attributable to aspects of ADZU-SOM's curriculum "intervention."

Data Collection

Evidence of SAHPE outcomes and impacts was assessed *via* 41 interviews and/or focus groups across seven participant groups: academic/faculty (3 interviews), graduates (10 interviews), final year students (2 focus groups, 10 students), health professionals (5 interviews), community health workers (5 interviews), community members (5 interviews), and community leaders (3 interviews).

Using the THEnet Framework for social accountability (13, 14), the focus group/interview questions were developed around three key areas: (1) school social accountability values; (2) curriculum and faculty; and (3) community health services and needs. The questions were refined by the researchers through group discussion, and a comprehensive interview guide created to standardise the process of administering the questions across participant groups. A written consent was obtained per informant prior to the start of data collection.

The final year students were selected randomly from student lists, while the other participants were purposefully chosen to provide critical reflection and/or with corporate knowledge of the school. Participation was voluntary, with personal identifiable information replaced by codes to assure participant confidentiality and anonymity. A fellow student facilitated the focus group discussions to minimise the potential risk of students feeling vulnerable when sharing their experiences with academic staff.

The questions were piloted with the respective participants, and then modified for clarity and cultural appropriateness. The questions for community members were further translated into local dialects. Three rounds of interviews and/or focus groups occurred. After the first round of interviews, modifications led to questions being more open-ended and tailored to specific participant groups. A second round of interviews continued until data saturation was reached; that is, no new themes were identified (19). To enhance trustworthiness, a preliminary analysis of the data was undertaken to identify key concepts, then a third round of interviews asked more in-depth probing questions to confirm and further explore key findings as per "member checking" recommended by Lincoln and Guba (20).

Interviews and/or focus groups were conducted in community locations and faculty facilities. The interview questions were translated into the local Bisayan language for community member interviews, with the data later translated back into English. The data was recorded electronically for all participants, and transcription performed by the research team. After transcription, the original digital recordings (*via* mobile phone app or apple voice memos) were re-analysed for confirmation of content to cross-check with the data collector and researchers

to clarify comments where necessary, and to achieve group consensus on key understandings from the data. All gathered data in various forms was stored in a secure filing cabinet, while digital data collected were coded and secured in a password protected database.

Data Analysis

While the data was collected by a local team of ADZU-SOM researchers, the analysis was undertaken in partnership with a team of external THEnet-associated researchers with expertise in social accountability. To address internal validity, a matrix template for thematic analysis was developed using Gale et al's framework method for the analysis of qualitative data in multi-disciplinary health research (21), with an inductive approach then used to code and categorise the data into themes (20). The analysis of the interview and focus group questions was conducted locally and checked by two authors for investigator triangulation; differences were resolved through discussion. The team systematically reviewed the themes, and organized the evidence of student and graduate impacts on the general community using the key domains of THEnet's social-accountability framework (13, 14), while evidence of health service delivery impacts were organized using the WHO's "6 Building Blocks of Quality Health Systems" framework (3). This multi-faceted approach allowed interview data to be triangulated across the different participant groups and across the range of impact areas. To further ensure trustworthiness of the data, two authors not involved in the coding process then audited the analytic matrix, choice of quotes, and the thematic analysis, followed by asking an external educational expert to verify the validity of all analyses.

RESULTS

Philosophy and Values of the School

ADZU-SOM faculty were fully committed to and focused on realising their vision of addressing the health workforce needs of Zamboanga Peninsula. *"A group of doctors realized the need for physicians who would help in solving the many health problems of the region. The shortage of doctors was so evident during the time that an intervention was an immediate necessity."* The School's vision of bridging the health inequity gap in the region informs its mission and core values, and is accomplished through inter-sectoral partnerships with various stakeholders including the Department of Health (DOH), local government, and community stakeholders. Social accountability attributes that inform the School's values are: equity, quality, relevance, cost effectiveness social justice, community engagement and partnership, cultural sensitivity, mutual transformation, access to education, altruism, and responsiveness to community needs. "*Another factor that enabled the operation of a medical school is the faculty members' strong inclination to serve the society. During its founding years, all faculty believed in [the] vision of the school and members committed to teach pro bono…"* These values have been integrated into the governance and management of the School.

Transformational Learning

Curriculum Content

The school's curriculum was developed through a region-wide consultative process with key stakeholders. The most common regional and national causes of morbidity and mortality formed the core content of the curriculum. Two students commented:

> "*The curriculum has a great impact; not just attitude toward me but also on how I deal with other people. Personally when I got in the medical school, I had no idea that this was a community oriented school. This school changed my attitude and now I'm aware what my community looks like . . . . I did not [know] that there are types of community that really needs medical students to help them, inspire them to have a better community.*"
>
> "*The school's curriculum helped me change my perspective in community service and caring [for the underserved]. At first, I was just looking at community services as tiresome, and going to the community as something similar to a medical mission. But with the help of the school's curriculum, I was able to look at the situation in a holistic approach.*"

Community-Engaged Learning and Development

ADZU-SOM's community-engaged curriculum is one of its unique aspects. Through this immersion program, the ADZU-SOM accomplishes its vision of "experiential learning" through community service – one of the core values of the ADZU-SOM. Overall, students spend close to 50% of the 4-year program based in the community. To internalise this value, students are completely immersed in the community to actively enhance engagement with stakeholders in promoting public health through joint research projects and activities, with the ultimate goal being students staying and practicing in the community after graduation.

A graduate commented that placement in communities and service learning contribute to community development: "*During our community exposure, we were asked to develop a CHP* [Community Health Plan]. *My duties as MHO (Municipal Health Officer) are quite similar to my community immersion. In many ways, the community immersion prepared me for this job.*"

Another graduate commented, "… *with the community exposures we had we were trained and we were able to understand the whole process from assessment, planning, which agencies to approach and coordinate with, whom to ask for help, and then we were tasked to implement and evaluate the process*."

Final year students also had similar opinions, but admitted that developing a CHP was not an easy task. One student mentioned it was "*difficult to implement community health programs but then it is still possible given the skills and knowledge we have acquired*."

SAHPE Contribution to Health System Strengthening

Health Workforce

The ADZU-SOM's strong focus on community-engaged medical education which provides training where students learn rural health competencies through transformational learning and service-learning has contributed to the retention of graduates

in underserved areas. A graduate shared *"Initially it was not my ambition to be a doctor, this changed during my community exposures. I learned so many things, initially, I thought I was going to change the community, however, it was the community that changed me, it changed my purpose, perception, and beliefs about being a doctor. I am here not merely for the monetary gain but to serve. I am now employed and serve in the same community where I was assigned as a medical student."*

Furthermore, increasing graduate retention strengthens the health system by providing increased access to physicians and to basic health services. (Summarized in **Table 2**).

To date, the ADZU-SOM has produced a total of 425 board-certified physicians since it began. Out of the total, 96% practice in the Philippines, with 63% practicing in the Zamboanga region, 39% in rural and remote areas, and 11% in armed conflict areas. This may have contributed to the data reported by the Philippine Statistics Authority between 2003 to 2017 showing significant improvements in the proportion of births attended by skilled health personnel by 38.4–71.1% in the Zamboanga Peninsula.

Health Service Delivery

The impact of graduates and students from ADZU-SOM on strengthening the health system was evidenced by community health professionals, who described many instances of positive change in local health systems. Examples of positive change included the development of a referral system, increases in health workforce resulting in increased service utilization, increases in out-patient consultations, and more births occurring in health facilities rather than elsewhere (summarized in **Table 1**). Including local, regional, and national health priorities as the core content of the curriculum ensures that the services provided to the community are relevant and essential.

It was also noted by health professionals in local facilities that ADZU-SOM graduates and students had good communication skills and were approachable and confident in dealing with patients. The many community-based health promotion projects and increased infrastructure provided through advocacy from the graduates and students were also valued. Many of these health service delivery system strengthening activities also have system-wide effects that encompass the WHO "6 Building Blocks of quality health systems" (3).

Access to Essential Medicines

Through the community engagement program embedded in the curriculum, medical students collaboratively work with the community to provide various health services and essential medicines. A barangay health worker mentioned "*They provided our complete sets of medical equipments for the health station including medicines, towels, and scissors. The medicines are replenished to have continued supply."* Providing access to essential medicines especially to the underserved population decreases out-of-pocket expenditures and contributes to better health outcomes.

Leadership and Governance

The WHO states that governance and leadership include ensuring strategic policy frameworks exist and are combined with effective oversight, coalition-building, regulation, attention to system design, and accountability (3). The ADZU-SOM contributes to strengthening the health system through leadership and governance by collaborating with local community leaders and stakeholders in identifying and seeking solutions to address the problems in their respective communities. Several projects implemented in the community involve supporting local leaders in drafting local community policies to reinforce existing laws and ensure the sustainability of programs and projects.

Financing

To strengthen health systems, funds should be sufficiently appropriated for health without the risk of financial hardship (3). The ADZU-SOM students through the community engagements work with the local leaders to collaborate with government and non-government agencies to raise money to fund local projects that include building infrastructures and procurement of essential equipments.

Health Information System

Collection of accurate health information is needed to create evidence-based interventions as well as to ensure that these interventions are effective. Together with community residents and volunteers, students gather health and health-related community data (such as social information and social determinants of health data) early in their community immersions. This data serves as a guide for the community in identifying needs and is used in the creation of programs to address the identified needs.

Community Impact - Meeting Health Needs Through Research Intervention Studies

Community leaders, community health workers, and community members also confirmed ADZU-SOM graduates and students had a significant impact on their communities through their public health action research and community development projects (summarised in **Table 2**).

In particular, community leaders appreciated ADZU-SOM's strategy of community immersion. According to a local leader, the ADZU-SOM "*is the only medical school which extended its services here in Zamboanga Del Sur. It was with great joy that I was asked to prepare three areas for the medical students because they can help a lot. The chosen barangays* [village/small local community] *were so happy to receive them because there were students to guide them on health. ADZU-SOM brought joy and help. … Ateneo de Zamboanga University School of Medicine is the only school that reached out here.*" In a separate interview, another local leader echoed this appreciation: "*They [students and graduates] contributed a lot for the welfare of the patients."*

The data suggests that ADZU-SOM accomplishes its vision through instilling community-oriented values in students as a result of service learning and community-engaged immersion. The following student quotes capture this:

> "*The school's curriculum and the impact of community service was life changing. Before I entered medical school, I am a kind of person*

TABLE 1 | AdZU-SOM student and graduate impacts on local health service delivery using the WHO's "6 Building Blocks for Quality Health Systems" framework (3).

WHO six building blocks of health system impact areas	Sample quotes	Improvement in health indices
A. HEALTH WORKFORCE		
Increased health workforce		
Employment of qualified physicians in remote areas	*We lived in poor, underserved areas; for the past four years, I've been working in Alicia, and [sic] Molave, and Kabasalan; I can put to practice what (I learned) when I was a medical student.*	Empathy with community stakeholders
	We are able to customize programs and identify their problems and then we are able to bring applicable programs and interventions there, similar to what was previously said, we are more on the promotion and prevention [programs] that is fit to a specific area	Health services coverage extension
	Pangutaran(Island) is three hours away from Jolo, Sulu (Province) by boat. Prior to my assignment, the people did not have a physician. Now they don't have to travel to access health services.	
B. HEALTH SERVICE DELIVERY		
Building functional health facilities	*"They facilitated improvement and renovation of our health center"*	Infrastructure development
Development of additional health services		
1. Procurement of funds for hospitals and health centers. Pre-natal services and immunization	*Brought health services to the islets; it's like a mobile clinic where we did medical consults, vaccination, prenatal consult, health teaching circumcision; minor OR, if possible..."*	Health services coverage extension
2. Providing health services to remote areas *via* mobile clinics. Lying-in services/new born care	*"The RHU [Regional Health Unit was transformed] from OPD to 24 h service– to maximize services: 24 h lying in, Newborn Care. Medical students go on duty."*	Health services coverage extension
3. TB DOTS program	*"They will look into our assigned area and joined us in examining patients under the NTP [National Tuberculosis Program]."*	Health services coverage extension
	"There were many TB cases here before but now, there are no new cases."	
4. Issuing of death certificates in remotes areas	"*For instance, for medico-legal cases, where death certification is needed people will have to travel to Pagadian and spend 180 Php just to get a signature. Now we can issue it from here*."	Health services coverage extension
5. 24 h availability of primary healthcare services	*".... as much as possible we offer 24/7 service to cater the needs of the community."*	Health services coverage extension
6. Smoking cessation counselling program	*We had meetings with the medical students on smoking cessation, alcohol drinking, and other vices.*	Community health program development
C. ACCESS TO ESSENTIAL MEDICINES		
Provision of medical equipment and supplies		
Provision of free medicine and contraceptive implants	*"They provided us complete sets of medical equipments for the health station including medicines, towels and scissors. The medicines are replenished to have continued supply."*	Increased in medical facilities and supplies
D. LEADERSHIP & GOVERNANCE		
Partnerships		
Collaboration with local leadership and other stakeholders for the institution of health-related programs	*"I was able to help them. If they needed something from the community we were also there to support them. We helped them in the feeding program/cooking show [demonstration], we supported in the activities and work to be done."*	Improved partnerships with local leaders
	"They [Medical Students] also joined Municipal Council sessions and brought up concerns and needs like waste segregration and disposal, toilet sanitation. And they are also open to suggestions.	
Relationships		
Good rapport with local leadership and non-government organizations	*Apart from the fact that we have gone to a place where few if not no doctors have gone like in the farflung areas. We have help the community learn what their full potential as a community and what resources they might have use for the community to expand their resources and to become a better community.*	Improved partnerships with local leaders
	[The medical students] are industrious; here in the rural community, they endure it just to reach the children who needs help.	

(Continued)

TABLE 1 | Continued

WHO six building blocks of health system impact areas	Sample quotes	Improvement in health indices
Creation of local community policies on health	*There is a solid waste management in [barangay] Mirangan, parents were encouraged to segregate biodegradable and non-biodegredable waste because of the local policy. Penalties were imposed especially to 4Ps members.*	Improved local accountability through policies and reinforcement of policies
E. FINANCING		
Procurement of funds for hospitals and health centers. Pre-natal services and immunization	*"Brought health services to the islets; it's like a mobile clinic where we did medical consults, vaccination, prenatal consult, health teaching circumcision; minor OR, if possible..."*	Increase budget allocation/raising funds for health
Applied automatic enrolment to the National Health Insurance program for indigent patients	*"We practice no balance billing in the hospital."*	Improved financial risk protection and coverage for vulnerable population
F. HEALTH INFORMATION SYSTEM		
Regular collection of community data on health	*"…assessing, monitoring, and recording patients under the NTP [National Tuberculosis Program]."* *"We did house to house survey in search for malnourished children, we recorded their weight monitored them, and fed them."* *"We were able to gather baseline data that can be utilized by the barangay and the local government, I think that is a benefit that the barangay* [village/small local community] *got when we were assigned there."*	Timely recording and reporting of health data

that I only care about myself and my family, I don't care about the community… an introvert kind of person. But when I got to medical school, life doesn't revolve around in just four corners. I saw the bigger picture. It was life changing."

A graduate working as a Municipal Health Officer (MHO), shared a similar experience: "*The community exposure [has impact on the attitude toward the community] because when you are in the hospital your focus is on the disease but when you are in the community, you also consider why the disease exists, why the referral was late – some factors not directly related to health, social factors that come into it. You can see a much bigger view.*"

DISCUSSION

This case study contributes to the understanding of SAHPE in the Philippines context, and describes qualitative evidence to support previous quantitative evidence of ADZU-SOM students and graduates having an impact on local health services and communities (10–12). Three key factors emerged as contributing to the SAHPE at ADZU-SOM: (1) the faculty commitment to the school's vision and their ability to operationalise its values, (2) a transformative, community-engaged, experiential learning approach, and (3) students and graduates contributing to a skilled local health workforce and provision of more services. The findings suggest that ADZU-SOM accomplishes its vision through instilling community-oriented values in its graduates and students as a result of service learning and community-engaged immersion.

The findings strongly supports and explains quantitative studies describing impacts of ADZU-SOM students and graduates on local health systems (10–12). Many examples of strengthening "service delivery" (**Table 1**) were given by community leaders and health workers across all the WHO's recommended "6 Building Blocks of quality health systems" (3). In addition to these health service actions, there was much evidence (**Table 2**) of ADZU-SOM students and graduates having impact on patients and members of the general community by promoting their use of healthcare services, and their knowledge and use of health protective and health promoting behaviours.

The 2013 WHO World Health Report (1) states "the goal of universal health coverage is to ensure that all people obtain the health services they need – prevention, promotion, treatment, rehabilitation and palliation." The findings in **Tables 1**, **2** describe student-led activities in treatment, prevention, promotion, and health infrastructure activities undertaken in ADZU-SOM's final "internship" year in rural communities – communities that are specifically chosen for having the greatest health needs. The benefits from having a significant number of treatment, prevention and health promotion activities occurring simultaneously in areas of great need and delivered by a significant student workforce trained in public health, community development and the key health issues of that community, cannot be understated.

While the extra investment of running a socially-accountable, community-based medical training program can be considered well-balanced by the positive community health outcomes resulting from students' and graduates' public health and health infrastructure projects, implementing community-based medical training has its challenges (22). Resistance from governing bodies, health professional education sectors and especially conventional medical schools was experienced toward ADZU-SOM's innovative curriculum involving intensive community engagement; this resistance delayed the school's achievement of

TABLE 2 | ADZU-SOM student and graduate impacts on the general community using Training for Health Equity Network's (THEnet) Social Accountability Framework (13, 14).

Public health action research and community development		
Impact areas	**Actual quotes (in translation)**	
	Community health workers	**Community leaders/members**
Health promotion projects		
1. Hypertension	*We have a schedule, we conduct health teachings on diabetics and hypertensive patients*	*[The medical students] helped me a lot especially on hypertension, we exercised. Prizes were given to encourage [participation among] community members and senior citizens.*
2. Immunization	*[Medical students] conducted health teachings on... immunization of children.*	*Parents were well-informed on topics like immunizations and check ups*
3. Childhood nutrition	*[The medical students] taught and gave information on follow up check-ups and ways to address malnutrition.*	*[The medical students] taught us proper nutrition.*
4. Breastfeeding	*The medical students] taught mothers how to breastfeed.*	
5. Sanitation	*[The medical students] conducted health teachings on... environment and sanitation.*	*There is a great decline now-a-days in dengue since people are more knowledgeable on sanitation and eradication of mosquito breeding places.*
Provided leadership for community development projects and Infrastructure development		
1. Toilet construction facilitation	*[The medical students] constructed a toilet; toilets are important so that children will not get sick. They were able to construct the toilets with the help of the community people and the barangay council.*	*...households were provided with sanitary toilets as one of the students' [health] project as well as teachings [on sanitation/cleanliness]*
2. Construction of projects	*[The medical students] initiated construction of a freedom stage.*	*[The medical students] can help the community, they can make projects. There was a time, they made [facilitated] the construction of a bridge over a river; like now, it is raining [hard], the water level goes up, people can still cross the river.* *The health center was in bad condition. [The medical students] contributed to repair it through carpentry work and painting.*
3. Community livelihood projects	*Vermiculture and vegetable gardening managed by the barangay council*	*Livelihood projects on mat-making and nata de coco still continue to exist.*
4. Solid waste management	*[The medical students] taught us a lot especially on solid waste management, biodegradable and non-biodegradable segregation.*	*[The medical students] made a big impact. I learned important information on health and waste disposal.*

national accreditation. Permission to operate was only granted through constant dialogue, discussions, and lobbying with regional and national stakeholders. In addition, the paradigm shift inherent in a community-based program demanded retraining of ADZU-SOM faculty; with many clinicans having no formal training in teaching. The ADZU-SOM had to create faculty development programs to address these demands in in collaboration with local and national partner institutions and networks, to address these demands. Lastly, the admission criteria of preferentially selecting students coming from low-income bracket families needs constant financial support. For example, the average cost of one student per semester is P172,000 (∼US$3,440), and the average price associated with running the community engagement program per year is P900,000 (∼US$18,000). To support these core curriculum components, ADZU-SOM has had to continuously challenge and recruit local benefactors to invest in the medical program.

As a major positive of ADZU-SOM's service learning model involving extensive community placements, students participate in community development projects throughout their training, as well as receive a good understanding of the key health issues in local rural communities. This helps students consolidate their learnings of how public health and the social determinants influence the health of individuals and the overall community. In addition, students contribute to community development by implementation of their own community health plan involving health promotion, intervention and rehabilitation activities developed collaboratively with community members. From Year 1, ADZU students are assigned to a community where they will do a significant portion of their training; returning to the very same community during the entirety of their course. This strategy strengthens ties between students and community members, and gives students greater community exposure and repeated opportunities to understand the importance of their work and local cultures.

Given that improving both coverage of services and access of all community members to health services across all communities lies at the heart of the WHO health system strengthening strategy, the study findings support previous evidence that key health system factors are being enhanced across Zamboanga Peninsula by ADZU-SOM students and graduates. The study findings show that ADZU-SOM students and graduates have dramatically broadened the range of health services (programmes, interventions, goods) to local communities, and have extended access of these to wider population groups; thus contributing to the concept of universal

access to health benefits. These findings also highlight how partnerships between health professional education institutions, communities, and local health systems can contribute to **social equity** – as there can be no health equity without social equity.

LIMITATIONS

ADZU-SOM faculty conducted the focus group discussions, interviews, and report auditing; there were no external evaluators present in the sessions. While the authors feel this was not problematic for this study, this does present opportunity for bias. However, the internal evaluator was experienced in qualitative methods, and offered strength in terms of relevant understanding of local contexts, while triangulation with researchers external to the school minimised potential investigator bias.

There were also challenges translating from English to Bisayan and other local dialects. However, as the Filipino language does not always have the same meaning in English due to regional linguistic contexts, the internal evaluator employed a local person to check the analysis and conclusions. This approach also provided more data richness and a more balanced view of the situation; thus further enhancing the validity of this project's conclusions.

While individuals were selected for interviews based on their experiences, expertise and job position, it cannot be assumed they represent the opinions of the whole group. Similarly, the authors also acknowledge that the findings of this study may not apply directly to other community-engaged medical programs, although it is expected that the key principles would be similar.

CONCLUSIONS

ADZU-SOM is an innovative medical school whose curriculum has pioneered an innovative approach to their challenging environment – long before the concept of social accountability was defined – by combining competency and problem-based instruction with experiential learning in the community, and having a curriculum that is responsive to both the needs of communities and sensitive to the social and cultural realities of Zamboanga Peninsula. ADZU-SOM has educated many students to become competent, fit-for-purpose doctors who now comprise the bulk of the medical workforce in Zamboanga Peninsula and surrounding island provinces. In addition, final year medical students also constitute a significant component of the health service delivery in communities served by ADZU-SOM. The findings suggest this community-based student workforce is having noticeable impacts due to a number of factors, including student motivation for community service, and training in public health and the social determinants of health.

The study findings suggest that ADZU-SOM has managed to evolve a consciousness toward community service among its final year students and graduates, adding evidence to ADZU-SOM's assertion that it is a fully socially-accountable health institution. This evolution, however, may not be solely ascribed to its curriculum, but also to the commitment of faculty and to the school's vision of working in partnership with local communities to bridge the health gap in Zamboanga Peninsula and neighbouring regions.

The findings also suggest ADZU-SOM students and graduates are strengthening local health systems across the WHO's recommended "6 Building Blocks of quality health systems" by developing health infrastructure and providing health education, health promotion and disease prevention activities accessible to all population groups; thus fulfilling the concept of universal access to health resources.

Overall, these findings provides empirical evidence that SAHPE schools can produce students and graduates capable of implementing key WHO health system strengthening strategies that lead to significantly improved health services and health equity in medically underserved areas, and over time, to achieving the sustainable development goals and Universal Health Coverage.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation. Data may be made available upon request.

ETHICS STATEMENT

This study involving human participants was reviewed and approved by the ADZU-SOM Ethics Review Committee and the Flinders University Human Research Ethics Committee (#7042) in Australia. All participants provided their written informed consent to take part in this study.

AUTHOR CONTRIBUTIONS

All authors of this manuscript have contributed substantially to the conception and design of the study, the acquisition, analysis and interpretation of data, drafting and revising the manuscript critically, and giving final approval of this version to be published.

FUNDING

This work was supported by the Atlantic Philanthropies who have funded the Training for Health Equity Network (THEnet; Grant No. 0003), *via* Resources for Health Equity, to conduct an impact study of SAPHE in the Philippines (www.atlanticphilanthropies.org/grantees/resources-for-health-equity).

ACKNOWLEDGMENTS

We would like to thank students, staff, and community members for their participation in this research. We would also like to thank and acknowledge comments from this manuscripts THEnet internal reviewers, Robyn Preston from James Cook University, and Amy Clithero from the University of New Mexico.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

APPENDIX

Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349–357.

You must provide a response for all items. Enter N/A if not applicable

No. item	Guide questions/description	Reported on Page #
Domain 1: Research team and reflexivity		
Personal Characteristics		
1. Interviewer/ facilitator	Which author/s conducted the interview or focus group?	Halili, S.
2. Credentials	What were the researcher's credentials? E.g., PhD, MD	Halili, S. PhD Woolley, T. PhD Ross, S. MDR Reeve, C. PhD Neusy, AJ DTM&H Cristobal, F. MD-MHPEd Guingona, M. MD-MPH
3. Occupation	What was their occupation at the time of the study?	Halili, S. Dean of Graduate Studies AdZU-SOM Woolley, T. Evaluation Coordinator, JCU Ross, S. Project Manager, THENet Reeve, C. Rural General practitioner-JCU Neusy, AJ-Senior Director, Co-founder THENet Cristobal, F. Dean AdZU SOM Guingona, M. Faculty, AdZU SOM
4. Gender	Was the researcher male or female?	Male and Female
5. Experience and training	What experience or training did the researcher have?	Halili, S- Fulbright Research Fellow and FAIMER Fellow
Relationship with participants		
6. Relationship established	Was a relationship established prior to study commencement?	Halili, S. is an active faculty of the AdZU-SOM and provides mentorship and consultation in research
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g., personal goals, reasons for doing the research	Written consent was obtained prior to the data collection, with the consent form also indicating the objectives and purpose of the research.
8. Interviewer characteristics	What characteristics were reported about the inter viewer/facilitator? e.g., Bias, assumptions, reasons and interests in the research topic	Limitations, page 11
Domain 2: study design		
Theoretical framework		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g., grounded theory, discourse analysis, ethnography, phenomenology, content analysis	Methodology, study design, page 6
Participant selection		
10. Sampling	How were participants selected? e.g., purposive, convenience, consecutive, snowball	Methodology, data collection, page 6
11. Method of approach	How were participants approached? e.g., face-to-face, telephone, mail, email	Face-to-face, methodology, data collection, page 6
12. Sample size	How many participants were in the study?	Methodology, data collection, page 6
13. Non-participation	How many people refused to participate or dropped out? Reasons?	N/A
Setting		
14. Setting of data collection	Where was the data collected? e.g., home, clinic, workplace	Methodology, data collection, page 6
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	Fellow student facilitating FGD, methodology, page 6
16. Description of sample	What are the important characteristics of the sample? e.g., demographic data, date	Methodology, data collection, page 6
Data collection		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Methodology, data collection, page 6
18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	Methodology, data collection, page 6
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	Methodology, data collection, page 6
20. Field notes	Were field notes made during and/or after the interview or focus group?	N/A
21. Duration	What was the duration of the interviews or focus group?	1 h 30 min–2 h
22. Data saturation	Was data saturation discussed?	Methodology, data collection, page 6
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	Methodology, data collection, page 6
Domain 3: analysis and findings		
Data analysis		
24. Number of data coders	How many data coders coded the data?	Three data coders

Continued

No. item	Guide questions/description	Reported on Page #
25. Description of the coding tree	Did authors provide a description of the coding tree?	Methodology-Data Analysis, page 6
26. Derivation of themes	Were themes identified in advance or derived from the data?	Methodology-Data Analysis, page 6
27. Software	What software, if applicable, was used to manage the data?	NVivo
28. Participant checking	Did participants provide feedback on the findings?	Methodology, data collection, page 6
Reporting		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g., participant number	Results, page 7–10
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Yes
31. Clarity of major themes	Were major themes clearly presented in the findings?	Yes
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	N/A

frontiers in Medicine

BRIEF RESEARCH REPORT
published: 13 May 2021
doi: 10.3389/fmed.2021.594695

Factors Associated With Working in Remote Indonesia: A National Cross-Sectional Study of Early-Career Doctors

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Background: Doctor shortages in remote areas of Indonesia are amongst challenges to provide equitable healthcare access. Understanding factors associated with doctors' work location is essential to overcome geographic maldistribution. Focused analyses of doctors' early-career years can provide evidence to strengthen home-grown remote workforce development.

Method: This is a cross-sectional study of early-career (post-internship years 1–5) Indonesian doctors, involving an online self-administered survey on demographic characteristics, and; locations of upbringing, medical clerkship (placement during medical school), internship, and current work. Multivariate logistic regression was used to test factors associated with current work in remote districts.

Results: Of 3,176 doctors actively working as clinicians, 8.9% were practicing in remote districts. Compared with their non-remote counterparts, doctors working in remote districts were more likely to be male (OR 1.5,CI 1.1–2.1) or unmarried (OR 1.9,CI 1.3–3.0), have spent more than half of their childhood in a remote district (OR 19.9,CI 12.3–32.3), have completed a remote clerkship (OR 2.2,CI 1.1–4.4) or internship (OR 2.0,CI 1.3–3.0), currently participate in rural incentive programs (OR 18.6,CI 12.8–26.8) or have previously participated in these (OR 2.0,CI 1.3–3.0), be a government employee (OR 3.2,CI 2.1–4.9), or have worked rurally or remotely post-internship but prior to current position (OR 1.9,CI 1.2–3.0).

Conclusion: Our results indicate that building the Indonesian medical workforce in remote regions could be facilitated by investing in strategies to select medical students with a remote background, delivering more remote clerkships during the medical course, deploying more doctors in remote internships and providing financial incentives. Additional considerations include expanding government employment opportunities in rural areas to achieve a more equitable geographic distribution of doctors in Indonesia.

Keywords: rural health services, physician practice, low- and middle-income countries, health workforce maldistribution, career choice, professional practice location

OPEN ACCESS

Edited by:
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Reviewed by:
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Martin Igbokwe, Obafemi Awolowo University, Nigeria

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Specialty section:
This article was submitted to Family Medicine and Primary Care, a section of the journal Frontiers in Medicine

Received: *14 August 2020*
Accepted: *26 March 2021*
Published: *13 May 2021*

Citation:
Putri LP, Russell DJ, O'Sullivan BG and Kippen R (2021) Factors Associated With Working in Remote Indonesia: A National Cross-Sectional Study of Early-Career Doctors. Front. Med. 8:594695. doi: 10.3389/fmed.2021.594695

INTRODUCTION

More than 90% of the population in the Asia Pacific region live in low- and middle-income countries (LMICs). Of these, nearly two-thirds reside in rural areas. Many of these countries have fewer than one doctor per 1,000 population (1). This, compounded by significant geographical maldistribution of doctors, means that the doctor-to-population ratios in some rural or remote regions is 10–75% lower than in urban areas of the same country (2–6). As doctor shortages negatively affect access to care, the World Health Organization (WHO) has recommended policies to increase health-workforce supply in rural and remote areas around four key dimensions: (1) educational, including interventions aimed at the medical training phase; (2) regulatory, including mandated rural postings and expanding the authorities of rural health workers; (3) financial incentive provisions; and (4) personal and professional supports, including strategies to provide various living amenities and facilitate professional development of the rural health workforce (7).

Studies highlight successful rural pathway initiatives in increasing rural doctor supply, that expand from medical student selection processes, offering rural medical training, and extend to providing exposure to rural clinical settings (8–13). Selection of at least 25% of medical students from a rural background and providing at least a year of rural clinical training during medical school have been successful in increasing the proportion of doctors working rurally in Australia (9, 10, 14–16). Thailand's comprehensive strategies to recruit medical students from rural regions, clinical clerkships in rural settings and provide scholarships tied to compulsory return-of-service, have jointly led to higher rural doctor retention (17, 18). China's rural-oriented tuition-waived medical education (RTME), which combines targeted recruitment of medical students from rural areas and obligatory rural service at the end of the qualification, was associated with a 12% increase in the number of rural physicians within 4 years (19).

Studies also emphasized the importance of intervention beyond medical education to recruit more doctors working rurally. The initial job upon graduation has been found to be critical in influencing work turnover among doctors in India (20). Internship, as a physician's first job, has potential to sustain the rural pathway of medical education. Doctors with an internship in non-metropolitan areas were more likely to practice in the same areas subsequently (21, 22). Compulsory or voluntary rural postings in Chile and the Philippines, mainly targeting junior doctors, also have potential to influence future practice locations of medical graduates (23).

This study focuses on Indonesia, a country with 1 doctor for every 4,300 people (24), substantially below the WHO recommendation of 1 per 1,000 (25). Eleven per cent of Indonesia's population resides in 122 government-defined remote districts (26). On average, remote districts have a doctor-to-population ratio of 1 per 6,180 population, and a doctor-to-area ratio of 1 per 170 km^2, which contrasts with non-remote districts which are much better supplied, having average ratios of 1 doctor per 4,150 population and 1 doctor per 20 km^2 (24). Besides the limited infrastructure and lack of health facilities, such geographically imbalanced distribution may be influenced by the decentralization systems that give district governments the authority to hire and fire health workers (27, 28).

As of 2020, Indonesia had 88 medical schools—59% of which are privately owned—producing around 10,000 graduates annually. Undergraduate medical education in Indonesia involves 3–4 years of basic medical science (mostly in a classroom setting) and 1–2 years of clerkship or clinical placements in teaching hospitals and the community. After completing medical school, doctors complete a one-year-long medical internship which involves them practicing under supervision in hospitals and primary healthcare facilities (29). This mandated year of internship was introduced in 2010 in selected districts, then rolled out nationally in 2014. Upon completion of the internship, doctors can obtain registration to practice as a general practitioner without any further training required. An additional 3–5 years of post-graduate fellowship is required to pursue other specializations. These fellowships are mostly located in teaching and teaching-affiliated hospitals in urban areas.

In Indonesia, strategies to improve the geographic distribution of doctors have been implemented since the 1980s. Two are ongoing. The first is an opt-in post-internship rural program with a financial incentive (referred to as the "rural incentive program"). The programs run for 1–2 years with the possibility of extension, and are managed by either the national government (*Nusantara Sehat,* with an average 100 places annually) or district governments (*Pegawai Tidak Tetap*/*PTT* or voluntary contractual employment, annual national number of places undocumented). *Nusantara Sehat* requires doctors to be unmarried and younger than 35 years. It provides doctors with around IDR11,000,000 (USD782) of monthly income from the national government, while the PTT doctors' monthly incomes vary from IDR4,000,000 to IDR20,000,000 (USD284-1422). These incomes are higher than the base salary for government-employed doctors of IDR2,700,000 (USD192) (30). The second strategy is the expansion of the medical internship program to include more districts for intern postings. This has resulted in 46% of interns being deployed to rural districts, and 14% to remote districts (29).

There are some early signs that geographic distribution of doctors has improved since these strategies were implemented. From 2014 to 2018, the doctor-to-population ratio in Indonesia's remote districts increased from an average of 1 per 7,060 to 1 per 6,180 population, reflecting remote-population growth of 4% and a 19% increase in the number of remotely located doctors (31, 32). However, the factors that specifically relate to better geographic distribution remain under-researched. While location of origin has been revealed as one of the reasons for doctors working in rural or remote Indonesia (33, 34), no study has explored the association between location of undergraduate education and subsequent work. Dasman et al. (35) reported that poor experience during rural internship demotivated young doctors from continuing to work in rural areas (35), yet, the study was limited to one Indonesian province.

This paper addresses the evidence gap by investigating factors associated with Indonesian doctors working in remote districts. The focus is on doctors within 5 years post-internship, as this is a period when the Indonesian government uses strategies to improve doctors' geographic distribution. In addition, location choices made at the key formative early-career stage may impact subsequent work location preferences (20, 36). Understanding these factors would inform future design of effective policies and programs.

MATERIALS AND METHODS

Study Participants and Ethics

A cross-sectional nationwide online survey was administered to Indonesian early-career doctors who, at the time of data collection, were at post-internship years 1–5. Because surveys among physicians generally have low response rates, especially when done online (37, 38), we invited the entire cohort of medical graduates who completed their internship between 2015 and 2018 to participate (referred to hereafter as the "MoH internship population"), offering vouchers in a raffle to improve participation. The email invitations to participate in the survey were sent by the Indonesian Ministry of Health (MoH), which holds medical graduates' contact information collected at the time of internship application. The survey was anonymous, administered using Qualtrics™ and in the Indonesian language, with informed opt-in consent from all participating doctors. Ethics approval for the survey was obtained from the Monash University Human Research Ethics Committee, approval number 16922.

Data Collection

Survey questions were drawn from national-scale medical workforce surveys in other countries, including Australia's MABEL survey (Medicine in Australia: Balancing Employment and Life) (39), the Community Service Officers Exit Survey in South Africa (40), a medical students survey in China (41) and several LMICs surveys (42, 43). These were adapted to the Indonesian context, based on a comprehensive literature review that specifically sought to hypothesize factors associated with rural practice in the Asia-Pacific LMICs context.

The survey questions, wording, and structure were extensively discussed and revised by the research team of experienced rural health workforce researchers. The team also consulted with 2 Indonesian MoH staff with experience in medical workforce and 3 Indonesian academics in health workforce policy, to inform the brevity and accuracy of the survey, relative to the research question. Two survey pilots were conducted in December 2018 to January 2019, and May 2019, with volunteer early-career Indonesian doctors. Pilot feedback was used to further refine the survey instrument, including reducing the length—from 48 to 34 questions—and rewording some questions. The final administered survey (see **Supplementary Material**) covered: undergraduate training and internship; location of upbringing; current and past work experiences; and demographic characteristics. The survey was online for 5 weeks between August and September 2019, and extended for 2 weeks in October 2019.

Statistical Methods

We used summary statistics to describe respondent characteristics, and multivariate logistic regression to estimate associations between a range of factors of interests (independent variables) and the key outcome (dependent variable) which was "currently working in remote district". Remote districts referred to those classified as underdeveloped by Presidential Regulation 131/2015, based on measures of geographic characteristics, socioeconomic status, human resources, built infrastructure, fiscal capacity, accessibility, and vulnerabilities to natural disaster (44). On average, remote districts have significantly worse doctor-to-population and doctor-to-area ratios than do non-remote districts. Remote districts are also targeted for affirmative policies, including for allocation of special funds and targeting of educational and health programs (45, 46).

To further explore the effects of locational independent variables—including location(s) of the doctors' upbringing, medical school, medical clerkships and internship—non-remote districts were further classified into rural and urban. Non-remote districts were classified as rural if they had at least 50% of residents living in rural villages, while the remainder were classified as urban (47). The use of this urban-rural taxonomy is widely-applied in Indonesian studies, with rural areas more likely to have poorer health service quality and utilization (48, 49). In total, there are 122 remote districts, 264 rural districts, and 128 urban districts in Indonesia (**Figure 1**).

Location of upbringing was classified based on the response to the question "In what province, district, and sub-district did you live the longest up to the age of 18?". Medical school location was based on the response to "In what medical school in Indonesia did you complete your basic medical degree?" For clerkship location, respondents were asked to list up to three sites (province and district) where their clerkships were based. These locations were coded as remote, rural or urban.

Respondents were asked whether they were participating in specific workforce programs (*Nusantara Sehat*/*PTT*/company doctor/others). Those in *Nusantara Sehat* and *PTT* were classified as "currently in a rural incentive program" and others as "currently not in a rural incentive program." We also collected information on: previous post-internship work in any rural or remote location (*Nusantara Sehat*/*PTT*/Others), whether they were government employees (Yes/No), gender (Female/Male/Other), and relationship status (Unmarried/Married with children/Married with no children).

StataIC-v13 (StataCorp) was used for all statistical analyses. We performed univariate analyses to investigate associations between the outcome and each of the factors of interest. To identify potential collinearity, univariate regression was also performed between the factors of interest; those with weak association with the outcome (p-value > 0.05) were excluded in the multivariate model, except for age. Missing responses were categorized as "unknown" to retain them in the final modeling, which used listwise deletion. To investigate sample representativeness, data on gender, medical school type,

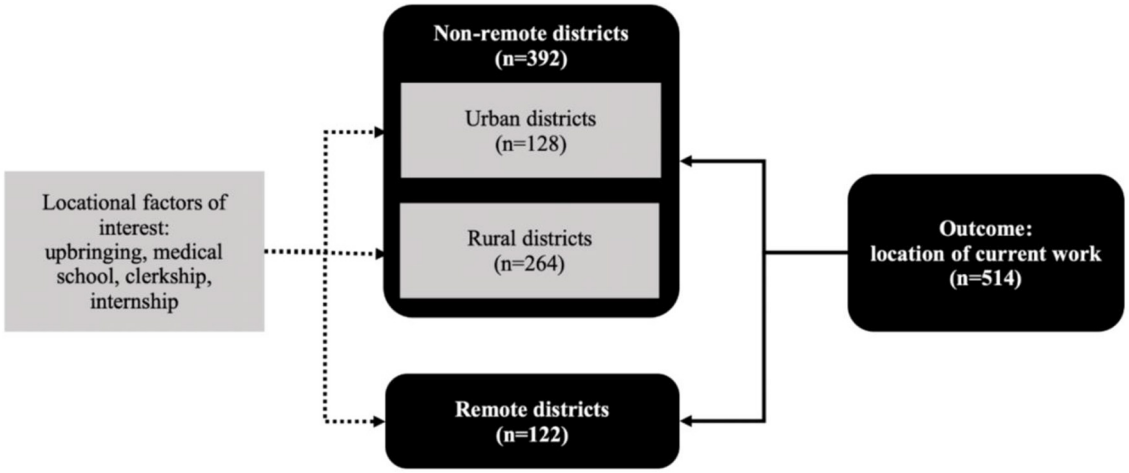

FIGURE 1 | Classifications of outcome and locational factors of interest.

internship location, and *Nusantara Sehat* participation of the respondents were compared with aggregate data on the MoH internship population.

RESULTS

Respondent Characteristics

Of 31,510 emails sent to the MoH internship population, 17,981 were opened (57% contact rate). The email announcement and WhatsApp announcement yielded 5,199 responses downloadable via Qualtrics (29% of the contact rate), with 4,432 responses (25% of contacted respondents) from doctors who had completed their internship between 2015 and 2018 and who provided information on their internship location. The number of responses meets the minimum of required sample estimation with the known proportion of doctors working in remote districts 7.5%, total MoH internship population 31,510, 95% confidence interval and 0.01 precision (minimum sample size 2,459). Compared to the target population, survey respondents were representative by gender (61.8% female, survey respondents; 63.2% female, MoH internship population). The proportion of respondents who graduated from private medical schools (47.1%), and who completed internships in remote districts (11.6%), were slightly lower than for the MoH internship population (51.3 and 14.6%, respectively). The proportion of surveyed respondents participating in *Nusantara Sehat* (2.6%), however, was higher than that of MoH internship population (1.5%).

Of 4,432 respondents, 3,176 were working as clinicians at the time of the survey, and were included in analyses. Of these, 8.9% were working in remote districts when surveyed. Excluding unknown or missing information, 61.8% of respondents were female, 53.4% were unmarried, and the age range was 24 to 38 years (mean 27.7, SD 3.2). Doctors with a remote upbringing, remote clerkship, or remote internship, comprised 4.6, 2.5 and 11.9%, respectively of respondents (**Table 1**). More than half of the respondents were within 24-month of completing internship, while 21.6% mentioned that they had worked in a rural or remote location before commencing their current work.

Predictors of Remote Work Location

Of those who grew up in remote districts ($n = 145$), 58.7% were practicing in remote districts, compared to 5.6 and 5.7% of those growing up in urban and rural districts, respectively. Out of 378 doctors undertaken a remote internship, 22.5% were working in a remote district when surveyed (**Table 1**).

Multivariate logistic regression showed that doctors working in a remote district were more likely to: be male (OR 1.5, CI 1.1–2.1); be unmarried (OR 1.9, CI 1.3–3.0); have grown up in a remote district (OR 19.9, CI 12.3–32.3); have a clerkship in a remote district (OR 2.2, CI 1.1–4.4); have undertaken an internship in a remote district (OR 2.0, CI 1.3–3.0); be enrolled in the rural incentive program when surveyed (OR 18.6, CI 12.8–26.8); and be a government employee (OR 3.2, CI 2.1–4.9). Strong associations were also found between previous post-internship work in any rural or remote district (OR 1.9, CI 1.2–3.0) and past participation in a rural incentive program (OR 2.0, CI 1.3–3.0) with current work in remote districts. Univariate analyses showed no association between working in a remote district and age, years of post-internship, or medical school location. The odds of working in a remote district were similar for married doctors with children and those without children. An association between attending a public medical school and remote work was evident in the univariate model but was not significant in the multivariate model (**Table 2**).

DISCUSSION

To our knowledge, this is the first national quantitative study exploring factors associated with doctors' work locations in remote districts in Indonesia. Nine percent of early-career

TABLE 1 | Sociodemographic characteristics of respondents.

Characteristics	Groups	Number of respondents (%)	% working in remote districts
Age (years)	27 and less	1,542 (48.6)	9.2
	28 and over	1,401 (44.1)	8.3
	Unknown/other	233 (7.3)	9.9
Gender	Female	1,791 (56.4)	6.7
	Male	1,085 (34.1)	9.2
	Unknown/other	300 (9.5)	9.6
Marital–parental status	Married–with 1+ child	878 (27.6)	4.9
	Married–without children	488 (15.4)	6.5
	Unmarried–with or without children	1,567 (49.3)	9.8
	Unknown/other	243 (7.7)	8.6
Upbringing location	Urban district[a]	2,222 (70.0)	5.6
	Rural district[b]	803 (25.3)	5.7
	Remote district[c]	145 (4.6)	58.7
	Unknown/other	6 (0.2)	0
Medical school location	Urban district[a]	3,041 (95.7)	7.8
	Rural district[b]	130 (4.1)	10.7
	Unknown/other	5 (0.2)	0
Medical school type	Private[d]	1,516 (47.7)	6.3
	Public[e]	1,655 (52.1)	9.2
	Unknown/other	5 (0.2)	0
Clerkship location[f]	Entire clerkship spent in urban districts[a]	1,557 (49.0)	8.2
	Any clerkship time in rural districts[b]	1,327 (41.8)	6.1
	Any clerkship time in remote districts[c]	78 (2.5)	27.8
	Unknown/other	204 (6.7)	8.4
Internship location[g]	Urban district[a]	1,429 (45.0)	5.4
	Rural district[b]	1,369 (43.1)	6.4
	Remote district[c]	378 (11.9)	22.5
Time since internship completion (months)	Up to 12	658 (20.7)	8.7
	13–24	1,043 (32.8)	8.4
	25–36	841 (26.5)	7.8
	37–48	558 (17.6)	6.2
	More than 48	58 (1.8)	8.3
	Unknown/other	18 (0.6)	5.0
Currently in government employment[h]	Yes	551 (17.4)	10.8
	No	2,625 (82.6)	7.3
Current participation in a rural incentive program[i]	Yes	396 (12.5)	41.2
	No	2,780 (87.5)	4.2
Previous post-internship work in rural or remote locations	None	2,355 (74.2)	5.3
	Yes, in incentive program[i]	280 (8.8)	24.7
	Yes, not in incentive program[j]	369 (11.6)	10.9
	Unknown/other	172 (5.4)	8.9

[a] *Urban districts are non-remote districts that have 50% or less of population living in rural villages, according to Head of Central Bureau of Statistics Regulation 37/2010.*
[b] *Rural districts are non-remote districts that have more than 50% of population living in rural villages, according to Head of Central Bureau of Statistics Regulation 37/2010.*
[c] *Remote districts are those defined as isolated, border or island districts according to Presidential Regulation 131/2015.*
[d] *Private medical schools are those funded by a private or non-government organization.*
[e] *Public medical schools are those funded by the government.*
[f] *Clerkship or clinical rotation is a phase in the undergraduate medical course, usually in the final year(s) of study, in which students are under supervision and do not have full authority to treat patients. In Indonesia, clerkships take 1.5–2 years. During the clerkship, medical students are placed in teaching hospitals or affiliation hospitals, in accordance with their medical school's regulations. For example, one medical school may allocate the entire clerkship to one hospital's pediatrics department, while another may distribute the clerkship across more than one hospital.*
[g] *In Indonesia, internship completion is required for medical graduates to obtain registration as a doctor. Interns have full authority to treat patients.*
[h] *Government employment of doctors with a long-term (lifetime) contract, whether during candidature or at the official stage (Calon Pegawai Negeri Sipil [CPNS] or Pegawai Negeri Sipil [PNS]).*
[i] *Rural incentive programs include Nusantara Sehat and PTT. Incentive amounts may vary.*
[j] *Refers to any work experience in rural or remote locations outside the Nusantara Sehat and PTT programs. The participants may or may not have received additional financial incentives.*

TABLE 2 | Odds ratio of working in remote districts ($n = 3,176$).

	Respondent characteristic	Univariate logistic regressions		Multivariate logistic regressions	
		OR-crude	95% CI	OR-adjusted	95% CI
1	28 years-old and over	0.89	0.69, 1.15	0.92	0.66, 1.30
2	Male	1.47*	1.13, 1.90	1.51*	1.09, 2.10
3	Marital status (Reference married with 1+ child)				
	Married without children	1.41	0.90, 2.21	1.16	0.66, 2.04
	Unmarried–with or without child	2.21**	1.58, 3.08	1.94*	1.27, 2.97
4	Upbringing location (Reference urban district)				
	Rural district	0.96	0.69, 1.34	0.87	0.59, 1.29
	Remote district	24.87**	17.05, 36.28	19.94**	12.32, 32.28
5	Medical school located in rural district	1.47	0.86, 2.52	Excluded	
6	Public medical school	1.68**	1.30, 2.17	1.32	0.96, 1.82
7	Clerkship location (Reference entire clerkship in urban district[1])				
	Any clerkship time in rural district	0.72**	0.55, 0.95	0.84	0.58, 1.20
	Any clerkship time in remote district	4.63**	2.79, 7.67	2.17*	1.07, 4.40
8	Internship location (Reference urban district)				
	Rural district	1.11	0.82, 1.49	0.84	0.58, 1.20
	Remote district	4.87**	3.55, 6.67	1.96*	1.29, 2.96
9	Time since completing internships (Reference up to 12 months)				
	13–24 months	1.01	0.73, 1.42	Excluded	
	25–36 months	0.93	0.65, 1.33		
	37–48 months	0.80	0.53, 1.20		
	More than 48 months	1.13	0.47, 2.74		
10	Currently in government employment	1.39*	1.03, 1.88	3.23**	2.14, 4.87
11	Current participation in a rural incentive program	26.40**	18.90, 36.91	18.56**	12.84, 26.83
12	Previous post-internship work in rural or remote locations (Reference no rural or remote post-internship work)				
	In rural incentive program	5.66**	4.13, 7.75	1.99*	1.32, 3.01
	Not in rural incentive program	2.20**	1.55, 3.13	1.90*	1.22, 2.96

*p-value ≤ 0.05, **p-value < 0.001.
The unknown category was included in the analysis; no strong association found hence these are not shown.

doctors surveyed (up to 5 years post-internship) were working in remote districts. This compares to 11% of Indonesia's population who live in these areas (26). Critically, our study identified factors strongly associated with working in remote districts. These include growing up in a remote district; undertaking a remote clerkship during medical school; undertaking a remote internship; working as a government employee; participation in a rural incentives program; being male; unmarried; and previously having worked in any rural or remote area. The first three of these listed factors are all rural pathway factors, suggesting that workforce strategies which select students into medical school from remote areas, train them in those rural and remote locations and then employ them in rural and remote locations immediately upon graduation are key to Indonesia's future remote medical workforce.

Strong relationships between doctors' intentions or actual work in rural areas and rural background, location of secondary schooling, and having a spouse or family living in a rural area have been widely recognized by many previous LMIC studies in the Asia Pacific (3, 4, 41–43, 50–59). Importantly, this research is the first quantitative evidence confirming such strong associations with Indonesian doctors' actual work locations. Our study is also the first to show that, of all the factors of interest, a remote upbringing has the strongest association with remote practice—increasing the odds of remote practice by a substantial 20 times. In contrast, there was no difference in the odds of remote work between doctors who grew up in urban and those who grew up in rural areas. This suggests that exposure to remote places during training, and perhaps to specific remote regions with which doctors may already have a connection, may be effective strategies to encourage remote work choices (60, 61). According to our findings, remote students are proportionally underrepresented in Indonesian medical schools, comprising <5% of students. Without intervention, it is possible that the already low proportion of students who come from remote areas could reduce over time, as has happened, for example, in the United States (62). Given these circumstances, policies and programs that support recruiting undergraduate medical students from remote districts, specifically, are recommended.

Doctors who participated in remote clerkships as medical students had twice the odds of working in a remote district compared to those who only had urban clerkships. This finding indicates that existing evidence, drawn from other countries, of associations between rural clinical placements and rural work preference is relevant for Indonesia (10, 14, 63, 64). This is the case even though Indonesian medical students are assigned by

their medical school to rural and remote clerkships; students in many other countries can self-select into these clerkships (64, 65). Given this evidence, increasing the number of remote hospitals and health services which are affiliated with Indonesian medical schools and expanding the number of remote clerkship training weeks during medical school may further improve remote medical workforce outcomes.

Our findings are consistent with other evidence of a positive association between having completed rural internships and subsequent rural work (21, 66, 67). In Indonesia, there are a limited number of internship positions in urban-located hospitals. This forces some interns to choose between doing rural or remote internships or delaying their internship in the hope of getting an urban internship in a subsequent round of internship allocations. The financial assistance for interns' salary provided by the MoH is higher in remote posts, and non-financial support such as, supervisor training and program standardization are also provided (68). This program needs to be expanded to increase the number of doctors working in Indonesian rural locations. Other countries may consider investing in rural internship program as a part of the rural pathway to strengthen efforts to build rural medical workforce.

We found that the opt-in *Nusantara Sehat* and *PTT* incentive programs are positively associated with current work in remote Indonesia, consistent with earlier studies demonstrating that opt-in rural incentive programs help address rural doctor shortages (23, 69). We also found that doctors who had ever participated in those programs were more likely to be currently working in remote districts. This suggests that the rural experiences gained through the *Nusantara Sehat* and *PTT* programs could be an important part of a pathway to rural practice. This extends beyond the internship year, since these programs are associated with subsequent rural work even after the program incentives are no longer being received.

The strong association that we identified between being a government employee and practicing in remote districts is interesting. Although the positions for government employment are equally available in remote and non-remote districts, the competition may be tougher in the non-remote districts. Further, working in remote areas as a government employee may provide an additional advantage for priority access to scholarships for non-general practice training, for early career doctors wanting to be a specialist. Other evidence has shown that the opportunity for government employment is an incentive for doctors to work in remote locations (70). Indonesian government employees are more likely to be eligible for continuing education scholarships, which are very attractive to medical graduates (71). Also, government employees are permitted to earn additional income from second or third jobs, which is similarly attractive (58, 72, 73). These findings suggest that the longer-term success of stand-alone strategies such as rural incentive programs at the early-career stage could be consolidated by simultaneously increasing opportunities for government appointments in the hardest-to-staff remote locations, or by expanding private job opportunities in remote areas. Concern that government employees with second or third jobs may provide a lower quality of service in government health facilities needs to be managed (74, 75).

Our findings indicate that district governments could have a greater role in developing a home-grown medical workforce—an important highlight for a decentralized nation like Indonesia. Since a remote upbringing has the strongest association with remote work for early-career doctors in Indonesia, remote-district governments could facilitate the entry of local students to medical school, by establishing collaborations with the schools, or providing bonded scholarships. Such collaborations could extend to nominating their district hospitals as sites for clerkships and internships. Remote-district governments could also prioritize government employment for doctors. However, support from the national government should be continued, especially in attracting more doctors to rural and remote locations with its rural financial incentive program and the nationwide internship program.

This study is exploratory and could be extended through ongoing research. First, further research could explore aspects of rural "place" classifications at a more nuanced level, rather than the binary outcome (remote/non-remote) used in this study. Second, the association between duration or design of any rurally-enhanced program and doctors' subsequent work location should be explored in more detail. This includes considering whether a longer duration of clerkship or internship experience, or whether longer exposures in community settings, are more strongly associated with remote or rural workforce outcomes, as has been shown in other countries (76, 77). Third, exploring elements of the internship program that may be more strongly associated with remote practice after the internship would provide more information for future program improvement. Fourth, understanding the long-term retention of doctors in remote areas beyond the internship or rural financial incentive program is essential to identify further efforts required to increase sustainability of the remote medical workforce. It is possible that for retention, working conditions and ongoing training or up-skilling opportunities become imperative (78).

We acknowledge some limitations in this study. This was a self-administered survey with retrospective recollection of details about past characteristics including geographic locations, hence, self-selection and recall bias may occur. As the invitation to the survey was announced through email and online platforms, clinicians not regularly using them may have been under-represented amongst respondents. As described in the Results section, several characteristics of the doctor population were assessed for representativeness. Respondents participating in *Nusantara Sehat*, one of the rural incentive programs, were overrepresented, which may have led to overestimation of its association with remote practice. However, the odds ratio was high (18.9) with a small p-value ($p < 0.001$); thus, a type-I error is unlikely in this case. Public medical school graduates were also overrepresented. However, in multivariate analysis this characteristic showed no association with remote practice, and thus did not affect interpretation of the results. Finally, this study did not adjust for other predictors of rural preference found in other studies such as job-related factors (i.e., quality of relationships with colleagues, access to specialist consultations, health facility infrastructure and equipment) (79–81), and locational factors (i.e., access to transportation, socioeconomic development, population density, and health insurance coverage) (82–85).

CONCLUSION

Our study identifies strong associations between working in remote districts and multiple factors related to rural training pathways (selection, rural training and exposure, professional support, and type of employment). These results indicate that building the Indonesian medical workforce in remote regions could be facilitated by investing in strategies to select medical students with a remote background, delivering more remote clerkships during training, employing more doctors in remote internships, and providing financial incentives for remote work. This would require establishing a more extensive network of remote clerkships for medical students by broadening medical school networks with affiliated-teaching hospitals and community practices. Additional policies include expanding highly sought-after government employment opportunities in rural and remote areas. These strategies are strongly tied to the issue of developing a connected rural pathway to "grow your own," consistent with the 2010 WHO global policy recommendations about increasing access to health workers.

DATA AVAILABILITY STATEMENT

The data presented in this article are not readily available because they are subject to the requirements of the Monash University Human Research Ethics Committee that they cannot be shared publicly. Requests to access the datasets should be directed to Likke Prawidya Putri: likke.putri@ugm.ac.id or likkepp@gmail.com.

ETHICS STATEMENT

This study was reviewed and approved by the Monash University Human Research Ethics Committee. Informed opt-in consent was given by all participants in accordance with the requirements of the study's ethics approval.

AUTHOR CONTRIBUTIONS

LP, DR, BO'S, and RK designed the study. LP analyzed the data and wrote up the initial draft. DR, BO'S, and RK guided the analysis and interpretation of the results, and drafting of the paper. RK was the principal supervisor overseeing the study. All authors contributed to the article and approved the submitted version.

FUNDING

The research was funded by LPDP (Endowment Fund for Education) Indonesia and the Monash University Student Support Fund. The first author received a PhD scholarship from LPDP Indonesia.

ACKNOWLEDGMENTS

The authors thank dr. Maxi Rein Rondonewu, DHSM, MARS, dr. Mawari Edy, M. Epid, Tumpal Pardomuan Hendriyanto, S. Kom, M.Sc (PH), and Ananta Dwi Saputra, S. Kom from BPPSDM MoH and Dr. dr. Andreasta Meliala, DPH, M. Kes, MAS from Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada for support in conducting this survey. We also thank the survey participants for their time and sharing their experiences.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fmed.2021.594695/full#supplementary-material

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