

# Social determinants of health for the global aging population in pandemic and disaster environments

**Edited by**

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# Social determinants of health for the global aging population in pandemic and disaster environments

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# Editorial: Social determinants of health for the global aging population in pandemic and disaster environments

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## KEYWORDS

social determinants, health, global aging, disasters, COVID pandemic, systems approach, complexity

## Editorial on the Research Topic

[Social determinants of health for the global aging population in pandemic and disaster environments](#)

This Research Topic offers insights into various social determinants of health among older adults across the world, particularly in the context of pandemics and disaster environments. In this Research Topic, health is defined broadly, capturing physical, psychological, literacy, and healthcare services domains. Studies address health issues at individual, organizational, systems, and country levels using various research designs, including qualitative, quantitative, mixed methods, and systematic reviews. Locations pertain to both countries and continents, including the U.S., Europe (i.e., Spain and Ireland), Australia, Africa, the Middle East (i.e., Israel), and Asia (i.e., Hong Kong). The substantive scope of social issues, health, levels of study, research designs, and varied international locations speak to the relevance of pandemics and disasters to everyone, everywhere. The focus on older adults calls attention to the unique vulnerabilities of the global aging population.

The following is a summary of each of the 12 accepted articles, their research focus, and general relevance to the public health and aging field.

Castelyn's commentary leads this special topic with a call for leadership from a systems approach, which differs from a more conventional people-oriented approach. Moreover, she points to the benefits of a crisis leadership systems approach, especially when dealing with "wicked problems" or complex and messy scenarios where there is no obvious solution available, much like what the world has been dealing with from COVID-19. The crisis leadership systems approach goes beyond any one organization's boundaries to encompass multiple larger healthcare systems. This is what Castelyn refers to as a leader-centric approach since leaders from different levels and places cross boundaries and underscores that in crises this leadership takes a proactive stance to prepare for how to resolve such "wicked problems." She closes with six practical steps to achieve a systems leadership approach that incorporates "space" for paradoxes surrounding power, uncertainty, and conflict noting how these issues contribute to, not threaten, substantive action and progress. This systems leadership approach holds much promise for effectively providing necessary medical care to "forgotten" populations, especially older adults.



In the first research article, [Wilbur et al.](#) address the exacerbated vulnerability of having a disability, aging, or caregiving during COVID-19 in low- and middle-income countries (LMICs) through an observational study of the Hygiene Behavior Change Coalition (HBCC). Based on using a water, sanitation, and hygiene (WASH) checklist applied to 137 documents from HBCC grantees' interventions, the results indicated that having a disability, aging, and caregiving targets occurred but interventions did not ensure their participation in WASH infrastructure. The authors recommend more explicit targets with monitored actions to ensure benefits from intervention efforts and honor such vulnerable populations' inclusivity rights.

[Williams et al.](#) explored the effectiveness of targeted messaging around "self-isolation" and "social distancing" in Australia using an online survey of 3,300 adults aged 18+ through 80+. Analyses focused on comparisons across age in groups of 10 years. Results indicated that age differences existed in the correct understanding of messaging on these preventive behaviors as well as in the source of the messaging with older adults being more likely to get information from TV compared to younger adults. Regardless of age groups, messages were confusing and often perceived incorrectly with no clear pattern of enhanced understanding by either older or younger adults. Most concerning, though, were the findings that older adults may not have received needed medical attention because they misunderstood protocols to stay isolated and/or maintain social distancing.

[Guzman et al.](#) employed qualitative methods to explore 57 older adults' perceptions of how individual, social, and environmental factors intersected with their health and well-being during COVID-19 in 2021 from the Wellbeing, Interventions, and Support during Epidemics (WISE) study. Community-dwelling participants living in Ireland varied in their concerns, capabilities, and roles in society. Findings underscored how a one-size-fits-all approach based on chronological age did not suit them well. Implications include the need for adaptive strategies for the development of age-friendly interventions during such crises.

Using a mixed-method study design, [Yang et al.](#) focused on 109 home-based and community care services staff members in Hong Kong to implement and evaluate a risk management process and service enhancement for home- and community-based services in 2021 and 2022 during COVID-19. Both quantitative and qualitative results suggest that staff members' regular training, updated guidelines, and proactive phone calls to older adults all helped the quality of the services. Implications include the value of combining standard protocols with outreach efforts for community social services in general and especially during disasters.

[Shaked et al.](#) investigated how social and medical factors affected medical services use among 102,303 older adults during two periods in 2019 during the COVID-19 lockdown in Israel. Findings revealed how social factors strongly predicted reduced medical services use during both periods but medical needs were also reduced for those older adults with social supports. Implications suggest that older adults living in the community fare relatively much better—even well—when they have access to social support. Thus, governmental organizations need to allocate ample financial resources to ensure social support and services for vulnerable populations.

[Wang et al.](#) used the Survey of Health, Aging, and Retirement in Europe (SHARE) and Israel in 2017 and two

rounds during COVID in 2020 and 2021 to understand how psychological well-being is associated with hospitalizations and mortality from COVID. Based on 3,886 adults aged 50 years and older, findings indicate that lower psychological well-being independently increased the risks for hospitalization and mortality. Implications point to psychological risk factors for poor physical outcomes and suggest the need for further research and intervention.

[Cases et al.](#) also examined the risk for mortality among 175,497 older adults in long-term care institutions living in Catalonia during the period 2015 to 2022 using healthcare registries. A key aspect of the retrospective, observational study design included comparative analyses of pre-pandemic mortality with those deaths after COVID-19 began. Findings indicate excess relative mortality for older adults during all waves, especially the first with additional nuanced findings for crude compared to standardized mortality rates within this population-based study of those over 50 years of age. Implications point toward the importance of using relative mortality measures in such vulnerable settings.

[Nicklett et al.](#) delved into the particular health issue of food insecurity over time and COVID-19 among a sample of 2,413 older adults from 2018 through 2020 from the Health and Retirement Survey (HRS). Food insecurity in this study entailed measuring having enough money to buy food. Findings included a doubling of food insecurity in this time period. In addition, a lower risk for food insecurity occurred among higher-income and better-educated individuals but a greater risk occurred for Black and rural individuals. Additional factors that increased the risk for food insecurity in 2020 included being younger, living with a disability, and renting. Implications point to the need for policies addressing the disparities in vulnerability to food insecurity especially during disaster periods.

[Kibe et al.](#) also studied food insecurity but using multiple measures of food quantity relative to need in households. The authors also measured the food environment and related it and food insecurity to overall diet quality among 102 older African American adults in Los Angeles, CA. Food insecurity but not food environment was related to dietary quality as well as recommended fruit and vegetable intake. Implications point to the dire need for intervention in this vulnerable population of underserved older African American adults.

[Soo Oh et al.](#) examined post-acute care (PAC) utilization among 4,310 Nevadans living with Alzheimer's disease and related disorders (ADRD) with extremity fractures after hospitalization pre- and post-COVID (i.e., 2018–19 and 2020–2021, respectively). They studied two rehabilitation locations as outcomes, both institution- and home-based, and analyzed predictors, including age, gender, race, fracture location, comorbidity, rural location, and pay source. Findings indicated that Hispanic populations had lower utilization rates of rehabilitation facilities and care at home. Overall, utilization rates shifted from institution- to home-based care, which, in turn, increased the risk of the disability and caregiver burden. Implications suggested the need for more geriatric healthcare workforce education to target underserved communities.

[Lai et al.](#) conducted a qualitative inquiry into the perception of heatwaves, vulnerabilities, and preparedness among older adults and service providers in Hong Kong. Semi-structured interviews

included 46 older adults, 18 staff, and 2 district councilors. Findings indicated that older adults perceived increasingly hot weather but did not feel vulnerable. Staff and councilors described a lack of services in the community and education about heat threats to health. Implications point to the urgent need to take a systems approach to co-create a heat preparedness plan, improve community awareness, and buttress resources for protection especially for vulnerable older adults

In conclusion, the co-editors and I wish to thank all the authors, the reviewers, and the editorial board members for contributing to this Research Topic. Social determinants of health challenge healthcare systems based on their inherent complexity and require a coordinated effort across multiple global sectors. In editing this Research Topic, the authors call for further research, innovation, and critical thinking to learn from our past and prepare for our future.

## Author contributions

LL-S: Writing – original draft, Writing – review & editing. SL: Writing – review & editing. CC: Writing – review & editing. MM:

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## Conflict of interest

The authors declare that the research did not include any commercial or financial relationships that could be construed as a potential conflict of interest.

The author(s) declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

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# Age Differences in Preferred Methods of Obtaining and Understanding Health Related Information During the COVID-19 Pandemic in Australia

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Methods of communications and the nature of messaging are critically important in influencing public behavior. The COVID-19 pandemic has resulted in major disruptions to all aspects of life globally and has triggered multiple approaches of health messaging to the general public to communicate COVID-19 preventative measures. This study aimed to identify: (1) differences between age groups in the main avenues used by people to obtain COVID-19 related information; and (2) whether age and information sources were associated with correct interpretation of government messaging relating to how people understand or interpret the terms “self-isolation” and “social distancing.” An online survey was conducted in 2020. Participants were aged over 18 years and grouped into age group decades. Differences in sources of COVID-19 information were compared visually between age groups. Logistic regression was used to determine whether age and each of the various methods of communication of COVID-19 information were independently associated with correct response to the self-isolation, or the social distancing statements. There were 3,300 survey respondents 85% female; age sub-groups: 18–29 (7.4%); 30–39 (10.6%); 40–49 (17.6%); 50–59 (22.9%); 60–69 (25.9%); 70–79 (13.9%); and 80+ (1.7%). People accessed public health messaging information from a wide variety of sources that changed as they aged (e.g., older people were more likely to be exposed to COVID-19 information via television news programs and less likely via social media platforms). Age was frequently associated with whether the message key terms were interpreted correctly or incorrectly, but in some cases, it promoted more correct responses whereas in others, fewer correct responses. There was no difference between being exposed to COVID-19 information via mainstream media, compared with social media, or compared with Government sources of information, in terms of whether COVID-19 messages were interpreted correctly. In order to improve future public health messaging, there is a need for multiple avenues of communication to meet the needs and preferences across and within age groups. Further investigation is warranted into the clarity of the content and method of delivery of public health messages, to ensure optimal understanding of public health messages by vulnerable populations and across the community.

**Keywords:** COVID-19, comprehension, consumer health information, age factors, public health, communication

## INTRODUCTION

The COVID-19 pandemic has resulted in major disruptions to all aspects of life globally, since first detected in December 2019 (1–6). The disruptions have resulted from both the direct impact of the virus on the health of populations, especially vulnerable populations such as older people, people with disabilities, and first Nations people (7–9); and the added impact of government responses and restrictions imposed aiming to control spread and impact of the virus.

The nature of state and national responses in Australia and around the world have varied markedly, and changed substantially over time (10, 11). With changing health messages, it is imperative that key elements of messaging, such as changes in restrictions, changes to personal actions (e.g., differing advice regarding wearing of face masks in different environments) and the rationale for these public health responses are conveyed widely, quickly and clearly. There are many avenues for communicating these public health messages to the wider community, with some more likely to have better reach and viewing in differing segments of the community (12). Some of the common avenues for communicating these messages relating to the COVID-19 pandemic include regular (often daily) television media conferences by state and national politicians, television news programs, newspapers, social media (including Facebook, Twitter), and video (13, 14). How these public health messages are framed can also influence their reach and impact, with one recent study highlighting that the most effective methods of framing COVID-19 messages through the World Health Organization had doubled the engagement than the least well performing methods of framing messages (15).

Throughout the COVID-19 pandemic, evidence has highlighted that older people are at increased risk of experiencing severe symptoms of disease and of negative health outcomes, including increased hospitalization and a higher mortality rate (16–18). Therefore, knowing where people of different ages access their COVID-19 information and analyzing their understanding of that information is relevant and important, and it could save lives.

There is existing evidence that there are some differences between age groups across the lifespan about how public health information is accessed and used in general (19). There are also differences in engagement when comparing different social media modes of disseminating public health information (20). However, there is relatively little research relating to differences between age groups and health messaging specifically relating to the COVID-19 pandemic. A large international survey ( $n = 17,287$ , 76% from the United States of America) identified differences in the impacts of COVID-19 between age groups (18–31; 32–44; 45–64; 65+), as well as differences in compliance with public health messaging regarding measures such as social distancing and self-isolation (lower compliance in younger age groups) (21). The paper reports different recommendations by age group to improve messaging by age group, but does not consider the avenues of public health messaging. A large web-based survey ( $n = 125, 508$ ) identified that respondents

over 65 years of age were more likely to have COVID-19-related concerns, engage in precautionary behaviors, such as wearing a face mask, and were less willing to return to previous activities they engaged in (22). Differences in health literacy between younger and older people have also been reported (23) that may influence interpretation, perception of relevance, and adherence to public health messaging. Therefore, there is a need to further investigate how people of different ages are sourcing and understanding such health-related messaging.

Burke et al. (24) found that during Hurricane Katrina in the United States of America in 2005, differences in age were found to be of importance for the use of television and radio warning messages. Therefore, there is a need to investigate whether this is still the case in a more recent significant public health event—COVID-19. Is there still a relationship between increasing age and information source being used? Or is there now more of a reliance on social media or other avenues of communication?

Twitter, for example, has been noted to be a source of misinformation in the past, such as during the 2014–2016 Ebola outbreak in West Africa, where Twitter was used to spread misinformation and false cures (25). During the COVID-19 pandemic, Twitter has also largely become an outlet for the spread of misinformation, with one study showing that Twitter posts with false claims propagate faster than other claims (26). Therefore, it is appropriate to investigate the extent to which people in Australia are using Twitter as a COVID-19 information source, and further, which other social media and information sources are being used? Are the information sources being used leading to further misinformation and confusion, or are the public health messages being interpreted as intended?

It was hypothesized that older people would prefer more mainstream media sources (newspapers, television and radio) and that younger people would prefer more social media sources (Twitter, Instagram, TikTok) and word of mouth. It was also hypothesized that there would be significant differences in people's understanding of social distancing and self-isolation according to their age and information source used, but to what degree (positively or negatively) was uncertain.

The findings of this research would inform future public health messaging, both during the COVID-19 pandemic and for future public health issues. It would inform relevant parties as to where people of different ages get their public health information from, and it would inform them of whether or not age is an important consideration when developing such public health messaging. There are also potential cost benefits, given that the knowledge of which information sources are being used by whom could lead to the production of less unnecessary messaging materials, and therefore reducing costs. The findings could also be used to inform future, more targeted messaging, particularly to certain age groups or users of a particular form of media.

To date, the issue of differences between age groups in preferred approaches to receiving COVID-19 public health messaging has received little research attention. This study aimed to identify: (1) differences between age groups in the main avenues used to obtain COVID-19 related information; and (2) whether age and information sources were associated with

correct interpretation of government messaging relating to self-isolation and social distancing.

## MATERIALS AND METHODS

This study utilized a cross-sectional design to survey issues related to knowledge, attitudes and preferred communication strategies of adult Australians related to the COVID-19 pandemic. The project was approved by Monash University Human Research Ethics Committee (project ID: 24040). The CHERRIES (CHecklist for Reporting Results of Internet E-Surveys) framework was used to guide the reporting of survey results (27).

### Participants

Participants had to be citizens or permanent residents of Australia and they had to be aged 18 years and over, in order to be eligible to participate in the survey. Participants were excluded if their provided postcode was not clearly from within Australia and if they did not answer the questions regarding age, social distancing and self-isolation

i.e., the most relevant questions to this analysis. These respondents were included in the study, but if they did not answer the relevant questions (age, information source, social distancing, self-isolation) then they were excluded from our analysis.

A priori power analysis was used to guide the sampling framework for this research. *Post-hoc* power analysis identified that if we wanted to compare responses between participants over the age of 60 ( $n = 1,312$ ) with those less than this age ( $n = 1,988$ ) on a dichotomous outcome, we have 80% power to detect an increase in proportion in the older adult group 0.05 assuming a baseline proportion in the younger adult group of 0.40 (i.e., 0.40 younger vs. 0.45 older).

The convenience sample of survey respondents were recruited through a range of promotional activities and modes, primarily social media, including Facebook advertising, Twitter, and Instagram (targeting Australians and age >18 years). The promotional avenues included a link to the survey, developed using Qualtrics® software (Qualtrics, Provo, UT, United States). Recruitment occurred in the early stages of the COVID-19 pandemic in Australia (April 1, 2020–June 3, 2020).

**TABLE 1 |** Sample demographics across age groups.

Age	Full Sample, $n$ (%) = 3,300 (100)	Under 30, $n$ (%) = 243 (7.4)	30–39, $n$ (%) = 351 (10.6)	40–49, $n$ (%) = 581 (17.6)	50–59, $n$ (%) = 757 (22.9)	60–69, $n$ (%) = 855 (25.9)	70–79, $n$ (%) = 457 (13.9)	≥80, $n$ (%) = 56 (1.7)
<b>Gender—<math>n</math> (%)</b>								
Male	476 (14.4)	37 (15.2)	23 (6.6)	53 (9.1)	103 (13.6)	140 (16.4)	99 (21.7)	21 (37.5)
Female	2,815 (85.3)	206 (84.8)	325 (92.6)	526 (90.5)	652 (86.1)	713 (83.4)	358 (78.3)	35 (62.5)
Non-binary/ Other	9 (0.3)	0 (0.0)	3 (0.9)	2 (0.3)	2 (0.3)	2 (0.2)	0 (0.0)	0 (0.0)
<b>Marital status—<math>n</math> (%)</b>								
Married/de facto	2,161 (65.5)	96 (39.5)	289 (82.3)	424 (73.0)	523 (69.1)	537 (62.8)	267 (58.4)	25 (44.6)
Widowed	188 (5.7)	0 (0.0)	0 (0.0)	9 (1.6)	20 (2.6)	53 (6.2)	80 (17.5)	26 (46.4)
Divorced	375 (11.4)	0 (0.0)	4 (1.1)	36 (6.2)	101 (13.3)	158 (18.5)	73 (16.0)	3 (5.4)
Separated, not divorced	119 (3.6)	0 (0.0)	11 (3.1)	23 (4.0)	35 (4.6)	35 (4.1)	15 (3.3)	0 (0.0)
Single or never married	394 (11.9)	138 (56.8)	41 (11.7)	78 (13.4)	61 (8.1)	59 (6.9)	16 (3.5)	1 (1.8)
Partner/not living together	22 (0.7)	6 (2.5)	1 (0.3)	4 (0.7)	3 (0.4)	4 (0.5)	3 (0.7)	1 (1.8)
Did not answer	41 (1.2)	3 (1.2)	5 (1.4)	7 (1.2)	14 (1.9)	9 (1.1)	3 (0.7)	0 (0.0)
<b>Low Income Household—<math>n</math> (%)</b>								
Yes	470 (14.2)	38 (15.6)	39 (11.1)	70 (12.1)	97 (12.8)	138 (16.1)	81 (17.7)	7 (12.5)
<b>Govt. Pension/ Payment—<math>n</math> (%)</b>								
Yes	848 (25.7)	49 (20.2)	40 (11.4)	75 (13.0)	72 (9.5)	240 (28.1)	327 (71.6)	45 (80.4)
<b>Have a chronic health condition—<math>n</math> (%)</b>								
Yes	1,450 (43.9)	81 (33.3)	102 (29.1)	213 (36.7)	315 (41.6)	436 (51.0)	263 (57.6)	40 (71.4)
<b>Employment status—<math>n</math> (%)</b>								
Full time	1,008 (30.6)	69 (28.4)	136 (38.8)	276 (47.5)	357 (47.2)	159 (18.6)	10 (2.2)	1 (1.8)
Part time	557 (16.9)	25 (10.3)	98 (27.9)	132 (22.7)	158 (20.9)	123 (14.4)	21 (4.6)	0 (0.0)
Casual	203 (6.2)	36 (14.8)	18 (5.1)	41 (7.1)	50 (6.6)	46 (5.4)	12 (2.6)	0 (0.0)
Self-employed	239 (7.2)	3 (1.2)	21 (6.0)	49 (8.4)	65 (8.6)	75 (8.8)	23 (5.0)	3 (5.4)
Unpaid	152 (4.6)	7 (2.9)	41 (11.7)	26 (4.5)	30 (4.0)	31 (3.6)	15 (3.3)	2 (3.8)
Looking for work	108 (3.3)	15 (6.2)	9 (2.7)	21 (3.6)	35 (4.6)	26 (3.0)	2 (0.4)	0 (0.0)
Retired	806 (24.4)	0 (0.0)	0 (0.0)	1 (0.2)	30 (4.0)	360 (42.1)	366 (80.1)	49 (87.5)
Student	140 (4.2)	83 (34.2)	23 (6.6)	16 (2.8)	12 (1.6)	5 (0.6)	1 (0.2)	0 (0.0)
Seeking employment	54 (1.6)	3 (1.2)	3 (0.9)	12 (2.1)	12 (1.6)	17 (2.0)	6 (1.3)	1 (1.8)
Other	7 (0.2)	0 (0.0)	2 (0.6)	0 (0.0)	1 (0.1)	4 (0.5)	0 (0.0)	0 (0.0)
Unable to work due to health	26 (0.8)	2 (0.8)	0 (0.0)	7 (1.2)	7 (0.9)	9 (1.1)	1 (0.2)	0 (0.0)

**TABLE 2 |** Factors (age and information sources) associated with correct responses to the questions regarding self-isolation.

Self-isolation means that you	Correct response (% correct)	Age Odds Ratio (95% CI)	News-paper Odds Ratio (95% CI)	TV Other Odds Ratio (95% CI)	FBF Odds Ratio (95% CI)	FBP Odds Ratio (95% CI)	Twitter Odds Ratio (95% CI)	Blogs Odds Ratio (95% CI)	Internet browsing Odds Ratio (95% CI)	Govt. app Odds Ratio (95% CI)	Govt. websites Odds Ratio (95% CI)	Workplace Odds Ratio (95% CI)	Friends & family Odds Ratio (95% CI)
Be the only person who lives at your place of residence	No (79.19%)	0.76 (0.71–0.82)	1.09 (1.00– 1.19)	0.85 (0.77– 0.94)		0.90 (0.81–1.00)	1.22 (1.01–1.47)	1.25 (1.03–1.52)					
Are not to let visitors into your house	Yes (96.45%)	0.73 (0.62–0.86)											
Are not to go out into the community for any reason	No (16.57%)	1.13 (1.05– 1.22)						1.31 (1.11– 1.56)		0.87 (0.78 – 0.96)			
Only go out into the community if wearing a face mask	Yes (9.75%)	1.12 (1.01 – 1.23)	0.89 (0.79 – 1.00)		0.86 (0.74 – 0.99)				1.45 (1.24–1.70)		0.84 (0.72–0.96)	1.13 (1.00– 1.27)	
Can go out into the community if purchasing food or other necessities, but only if you are wearing a face mask	No (84.52%)	0.89 (0.83–0.96)							0.87 (0.77 –0.98)		1.14 (1.01–1.28)		
Can go out into the community if seeking medical attention, but only if you are wearing a face mask	Yes (38.32%)	0.86 (0.82–0.91)							1.14 (1.04 –1.25)	1.11 (1.03–1.20)			
Can go out into the community if seeking medical attention. you can wear a face mask if you have one but do not have to if you do not have one	No (58.70%)	0.94 (0.88–0.99)						0.78 (0.68–0.89)				1.15 (1.07–1.23)	

Correct Answer = 1, Incorrect Answer = 0 CI, Confidence Interval; FBF, Facebook Feeds; FBP, Facebook Private; Groups Results only included in table when  $p < 0.05$  for each of Age or Information Source. Odds Ratio > 1 indicates increased likelihood of correct response TV News, Radio, Instagram, TikTok and Podcasts not included in this table as they were not statistically significant for these questions.

**TABLE 3 |** Factors (age and information sources) associated with correct responses to the questions regarding social distancing.

Social distancing means that you...	Correct response (% correct)	Age odds ratio (95% CI)	Radio odds ratio (95% CI)	TV other odds ratio (95% CI)	Facebook feeds odds ratio (95% CI)	Podcasts odds ratio (95% CI)	Govt. app odds ratio (95% CI)	Govt. websites odds ratio (95% CI)	Friends & family odds ratio (95% CI)
Should stay at home as much as possible	No (10.40%)	1.34 (1.22 –1.48)							
Should stay at home if feeling unwell	Yes (96.40%)	0.77 (0.66–0.91)							
should restrict your physical contact to just your family & friends	No (40.77%)	0.94 (0.89 –1.00)							0.87 (0.79–0.95)
Should stay 1.5 m away from other people at all times	No (7.70%)						0.84 (0.72–0.98)		
Should stay 1.5 m away from other people where possible	Yes (79.99%)		1.17 (1.06–1.29)			0.84 (0.74–0.96)		0.86 (0.78–0.96)	
Can't exercise outdoors	No (94.71%)	0.76 (0.66–0.87)		0.83 (0.69–0.99)			0.84 (0.72 –0.99)		
Can't exercise outdoors in groups of over 10 people, while staying 1.5 m away from these people while doing this	No (27.59%)	1.09 (1.02–1.16)		0.89 (0.82 – 0.98)					
Can only exercise outdoors with people who live at your residence	No (39.68%)	1.11 (1.05–1.18)			0.90 (0.83–0.98)				

Correct Answer = 1, Incorrect Answer = 0 Results only included in table when  $p < 0.05$  for each of Age or Information Source. Odds Ratio  $> 1$  indicates increased likelihood of correct response Newspapers, TV News, Facebook Private Groups, Instagram, Twitter, TikTok, Blogs, Internet Browsing and Workplace not included in this table as they were not statistically significant for these questions.

## Survey and Associated Procedures

The survey was developed by a large interdisciplinary team with expertise in health, primary care, ageing, and qualitative and quantitative research, that included this study authors. The overall survey involved an extensive data-set of 97 questions (see **Appendix 1** for questions relevant to this analysis) with a subset of the survey being utilized to address the aims of this study. Survey question items were developed in the following domains:

- i) Demographic questions, including age, gender, state, and employment categories (**Table 1**). Most relevant to this analysis, participants were asked to select their age bracket:  $< 30$  years, 30–39 years, 40–49 years, 50–59 years, 60–69 years, 70–79 years, and 80 years or more.
- ii) People's perceptions of the extent to which they had been exposed to information about COVID-19 in the previous month from a list of different information sources. Namely: Newspapers, Radio, Television - news programs, Television - other programs, Facebook feeds, Facebook private groups, Instagram, Twitter, TikTok, Online blogs, Podcasts, General browsing on the internet, Australian Government "Coronavirus Australia" App, Other webpages and resources specifically prepared by the Australian Government, Workplace, Friends and family, and Other sources (please specify). We asked

participants whether they had been exposed to COVID-19 information from each source on the following scale: Not at all, to a small extent, to a moderate extent, or to a great extent.

- iii) Participant knowledge of the concepts of social distancing and self-isolation related to COVID-19. We asked participants whether they agreed, disagreed or were unsure (Yes/ No/ Unsure responses) that examples we provided were included in these concepts. We drew examples from the definitions of these concepts adopted by the Australian Government and published on the Australian Government (28) and Prime Minister (29) websites at the time of the survey (**Appendix 2**). We also included examples of distractors (untrue) statements relative to the Australian Government definitions. Using these same definitions, Yes/ No/ Unsure responses were then converted into either correct or incorrect responses for data analysis (see **Tables 2, 3**).

The overall survey was estimated to take approximately 18 min (median time for completion). The survey utilized forced or requested responses to reduce missing data, although the respondents could exit the survey at any time (completed responses were saved to the time of exit). A brief explanatory statement at the start of the survey described the purpose of the survey, ethics committee



approval, participant anonymity, and indicated that proceeding with the survey indicated implied consent to participate. No incentives were offered for completing the survey. Respondents completing the survey were not identifiable.

## Data Collection

This was a completely online survey that was advertised through social media platforms and through local health and community networks. Participants accessed the survey online and the survey was completely self-administered. The data collection was fully automated using the Qualtrics® program. Participants completed the survey using their own phones or computers in their own locations. There was no central in-person data collection process undertaken.

## Data Analysis

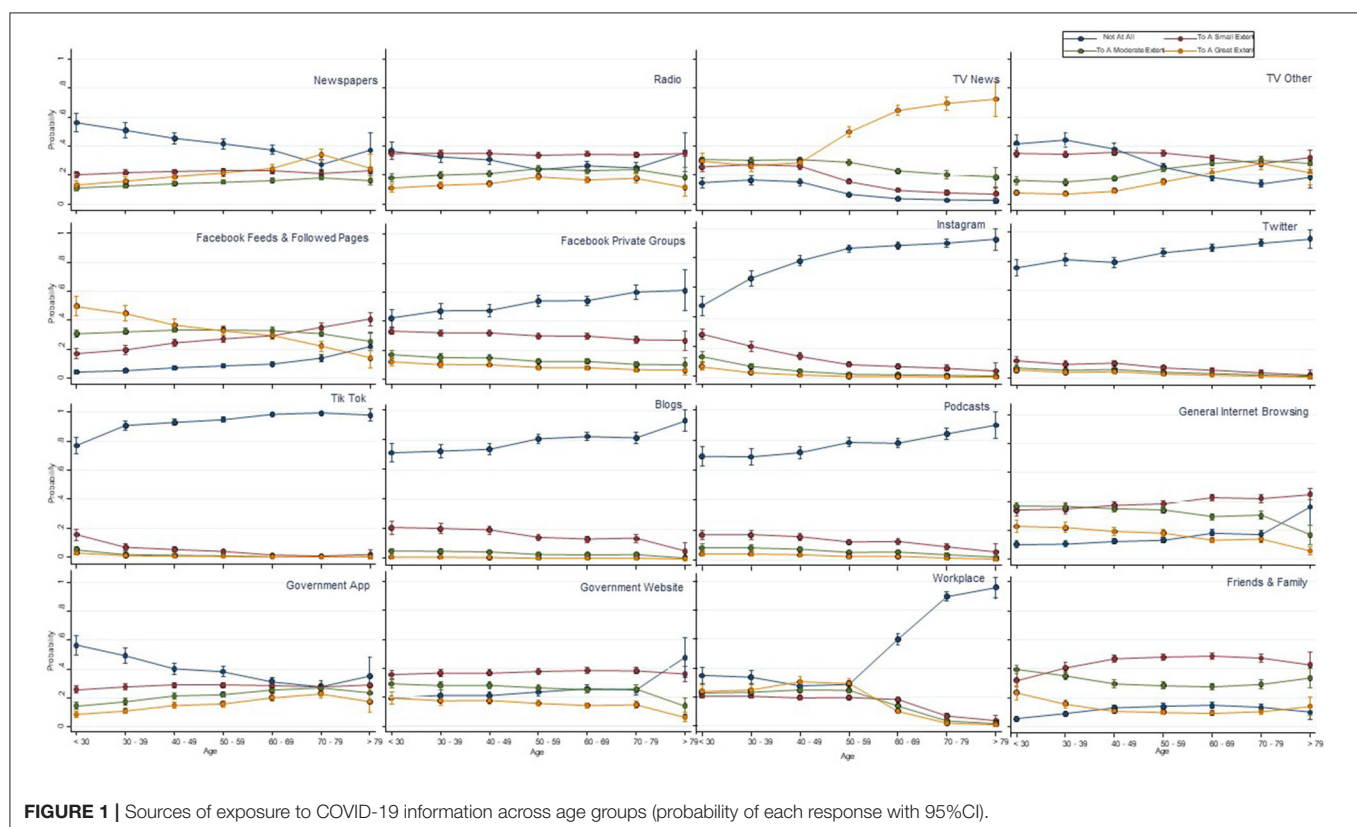
Survey data from the Qualtrics® program was downloaded as an excel file, and imported to Stata 15 (StataCorp, College Station, TX, United States), to analyse data. Descriptive statistics means and standard deviation, median [IQR] or frequencies (%) were used for describing the sample characteristics, depending on the nature of the question and data distribution. Frequency and percentage responses were used to report data relating to the survey questions of interest, with data broken down into the following age groups: <30 years; 30–39; 40–49; 50–59; 60–69; 70–79; and ≥80 years.

Responses to all questions relating to the aims were graphed comparing responses across the age groups. To address aim 2, logistic regression was used to determine whether age, and each of the various methods of communication of COVID-19 information (e.g., newspaper, television, radio, Facebook, Twitter, etc.) were independently associated with correct response to the self-isolation, or the social distancing statements. Statistical significance was set at  $p < 0.05$ . Results were expressed as odds ratios with 95% confidence intervals, where 0 = Incorrect response and 1 = Correct response (see **Tables 2, 3**).

## RESULTS

A total of 3,415 people responded to the survey; 95 were removed due to postcode errors where it could not be certain that the respondents were living in Australia. A further 20 respondents were removed as there was insufficient data provided in order to answer the research questions (did not respond to age, social distancing, self-isolation questions). Therefore, 3,300 respondents formed the full sample.

The 50–59 ( $n = 757$ , 22.9%) and the 60–69 age groups ( $n = 855$ , 25.9%) were the groups with the highest proportion of respondents, while the lowest proportion of responses were from the youngest (<30 years,  $n = 243$ , 7.4%), and oldest ( $\geq 80$ ,  $n = 56$ , 1.7%) sub-groups of the sample. **Table 1** reports the main sample demographics. Overall, 85% of respondents were female, 65% were married or de facto, and 43% reported having one or more



chronic health condition. The majority were in full time, part time or casual employment (53.7%) or were self-employed (7.2%) or retired (24.4%). There were a number of differences in the demographic profile variable between the different age groups.

There were some sources of information access that differed substantially between age groups and some that appeared similar between all groups (**Figure 1**). The main source of information with increasing levels of access by older age groups was television news from age 40 and above. Sources of information with lowest levels of access by older age groups included multiple social media avenues (Facebook, Instagram, Twitter, TikTok, blogs), podcasts and the workplace.

**Figures 2, 3** show the responses by age group and type of information access to various statements relating to the meaning of key terms of self-isolation and social distancing respectively. Visual analysis of these graphs for the self-isolation statements (reporting yes/no responses, irrespective of correct response) highlights increasing proportions of the three older age groups answering yes to statements that self-isolation means: (1) being the only person at your residence; (2) can go out for medical attention, mask optional; and (3) can go out for food if wearing a mask; and there was a small reduction in the proportion in older age groups answering yes to the social distancing statements of “Should stay at home as much as possible” and “Can’t exercise outdoors in groups”; and an increase in the proportion of the older age groups answering yes to “Should restrict physical contact to family and friends.” In several of the figures, particularly for the social distancing statement, the oldest age group (>79 years) appeared to respond differently to the trend of other age groups (e.g., can only exercise outdoors with people at your residence), although these differences just in this oldest age group should be interpreted with caution given the small sample size in that group (1.7% of overall sample).

**Tables 2, 3** show the results of the logistic regression for each question relating to both self-isolation and social distancing, with respect to age and each of the information sources. Age and information sources were included in the Tables if  $p < 0.05$ , represented as an odds ratio and with 95% confidence intervals. For these analyses, data were converted from yes/ no/ unsure responses into either correct or incorrect responses (as shown in **Tables 2, 3**). A score of 1 indicated a correct response and a score of 0 indicated an incorrect response. An odds ratio >1 indicates an increased likelihood of answering the question correctly with increasing age and conversely, an odds ratio <1 increased likelihood of answering the question incorrectly with increased age. The percentage of correct responses varied substantially for the various self-isolation (9.8–96.5% correct) and social distancing questions (7.7–96.4% correct). There was a significant association between age and correct responses in the majority of responses to the self-isolation and social distancing questions, but no clear overall pattern of being more or less likely to respond correctly (**Tables 2, 3**). Logistic regression results indicated significant differences for various information sources to the different social distancing and self-isolation questions, but again, there was no clear pattern relating to any specific information source and greater accuracy of responses.

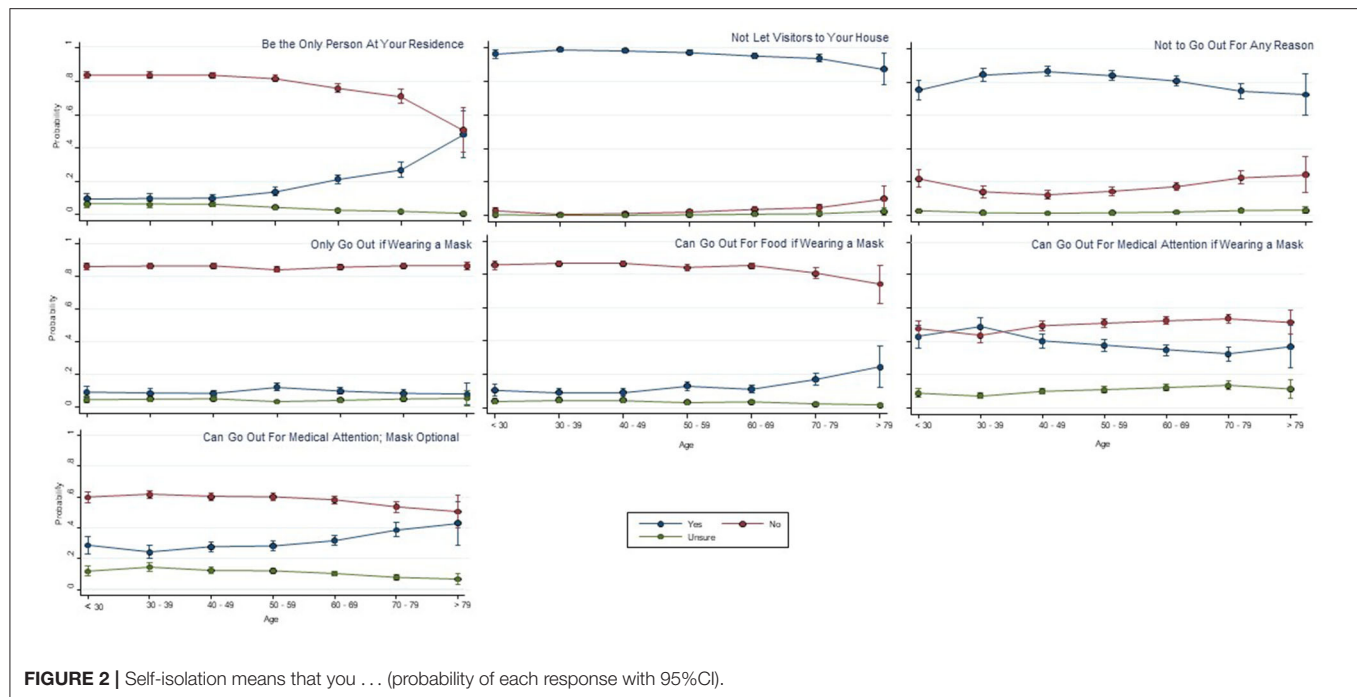
There was no clear trend in correct or incorrect interpretation based on whether people used traditional mainstream media (Television, radio, newspapers) compared with both social media (Facebook, Twitter, Instagram, TikTok) and Government sources (websites, app).

## DISCUSSION

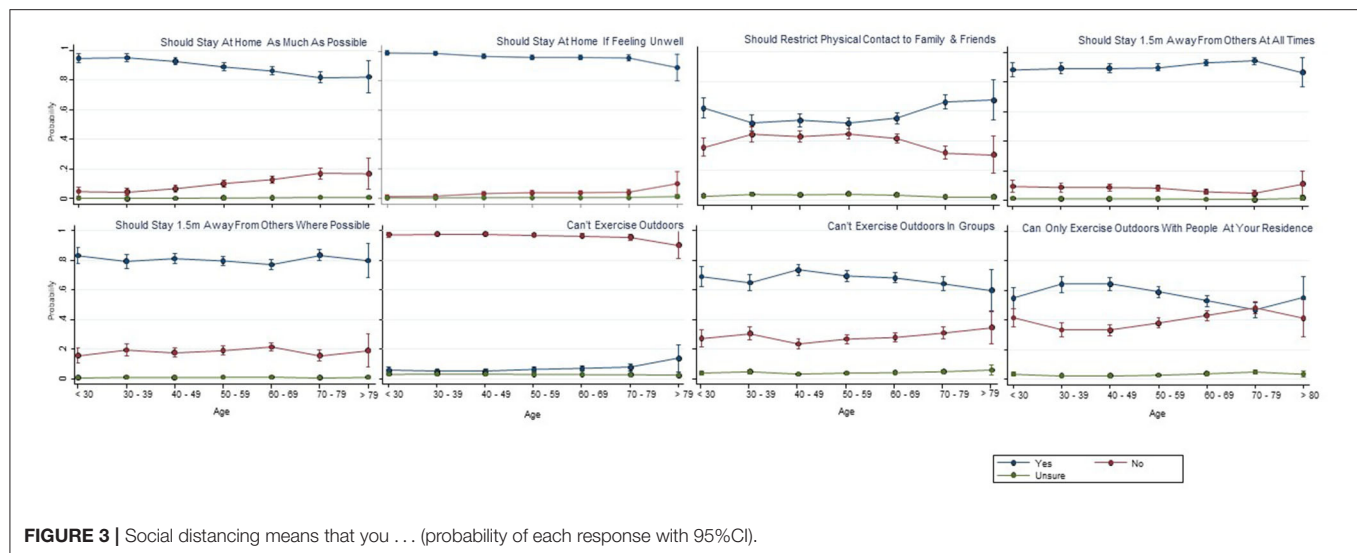
Public health practitioners and policy makers who want to communicate messages to middle and older age groups need to utilize television news programs, as this is where these people are getting the greatest amount of exposure to COVID-19 information. Older people have very little exposure to social media sources (e.g., Instagram, Tik Tok), therefore strategies to target older people should not focus on these social media options. For some social media, virtually no one was using them, despite the investment in using these media by public health officials. For example, Twitter was seldomly used by our participants, and yet, State Governments released daily updates on Twitter (30). However, there may be other considerations for this, such as low cost of constructing a daily Twitter post, that may also influence the decision by policy makers to use Twitter often. It is also important to have clear messages about what the public health instructions are, because the results from our investigation indicate that there was a large amount of confusion, and there did not seem to be a clear pattern as to whether older people were interpreting the messages any more or less correctly than younger people. Although there was confusion across the board, the areas that are arguably the most concerning are the concepts relating to people not leaving their homes for any reason, including for possible health concerns requiring medical attention. A potential issue with a large and often changing public health response such as COVID-19, is that there might be such a volume of new information and new instructions that are released, it may be unreasonable to expect that the public will be able to understand everything, and that the most parsimonious messaging approach is more likely to be needed.

Our research is concordant with previous literature in related fields that has investigated the use of television by older people as an information source for public health messaging. However, our study also indicates a lack of use of social media avenues by older people, and that people were generally confused by the messaging, regardless of their age or information source used. Similarly to our investigation, Burke et al. (24) found an increased use in television as age increased, during Hurricane Katrina in 2005. In contrast, they also found increased use of radio by older people, which was not evidently the case in our study. Similarly to our study, Moreno, Fuentes and Navarro (31) found that three of the four most commonly used information sources in Spain in 2020, were mainstream news media. Our study expands upon this by also investigating those people’s ages. In contrast, WhatsApp was the second most commonly used information source (31), which was not investigated in our study. However, similar WhatsApp messages might have been captured in this research when considering responses from friends and family. Concordantly with our study, Daoust (32) found that older and





**FIGURE 2 |** Self-isolation means that you ... (probability of each response with 95%CI).



**FIGURE 3 |** Social distancing means that you ... (probability of each response with 95%CI).

younger people's attitudes and behaviors were similar during the COVID-19 pandemic, with no clear pattern in relation to increased age.

Limitations of this research include the rapidly changing nature of living during a pandemic and the impact that may have had on changes in perceptions and behavior, and the ultimate relevance of the research findings. For example, it is possible that there has been a change in which information sources are most commonly used by different age groups since the survey was conducted in 2020. In addition, the interpretations of social distancing and self-isolation have likely changed and changed again, as different rules and lockdown restrictions have been

implemented and altered throughout the course of the COVID-19 pandemic. People may now have a greater understanding of what those terms mean, given that more time has now passed since the beginning of the pandemic. However, despite these factors, this research informs the importance of clarity of messaging at the very beginning of a pandemic or public health issue, regardless of whether there is a need to change the message thereafter. Furthermore, this research suggests the benefit of communicating any changes in the message (e.g., new lockdown restrictions) via a variety of sources, with consideration to people of different ages. In addition, given that the recruitment and the completion of the survey were done using technology (i.e., online

and through social media), there may have been issues with access and inclusion of some participants. Those who were unable to use and access information technology, the internet and social media and those with certain health conditions and disabilities that prevented them from accessing the survey, may have been inadvertently excluded from participating. An additional limitation is that the majority of respondents were female, which would have skewed any attempt at assessing differences in responses based upon gender. Furthermore, some items which had very low percentages of correct responses may have had issues with the wording or clarity of the question, resulting in some more cautious participants potentially selecting the more restricted (and therefore technically incorrect) response.

In this research, we have sought to understand how older people engage with and understand key concepts regarding COVID-19, however there are additional vulnerable population groups other than older people. These vulnerable groups might be defined by factors such as language barriers, socioeconomic disadvantage, a limited ability to access healthcare and health information, and the presence of health conditions. Further research is needed to understand how these other vulnerable populations access their COVID-19 information and general public health messaging.

## CONCLUSION

Overall, this research demonstrates that people prefer to get their public health messaging from a wide range of information sources, which change as they age, most obviously regarding the use of television news and various forms of social media. Age is a significant factor in whether that message is interpreted correctly or incorrectly, but that interpretation is not consistently more or less likely to be correct or incorrect with increasing age. Generally, both older and younger people were confused with their responses despite their information source used, evidenced by inconsistent correct and incorrect responses across the board, with no clear trend, which potentially speaks to the issue being the clarity of the message itself. There was no clear benefit of using one information source compared with any other. In order to provide benefit to future public health messaging, further research is needed on how to provide further clarity in how

that messaging is interpreted. Further investigation is warranted into the clarity of the content and the method of delivery of public health messages, with a consideration of the age of the intended audience, regardless of the information source that is used.

## DATA AVAILABILITY STATEMENT

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

## ETHICS STATEMENT

This study involving human participants was reviewed and approved by the Monash University Human Research Ethics Committee. Participants selected that they provided their informed consent at the commencement of the online survey to participate in this study.

## AUTHOR CONTRIBUTIONS

TH, CW, KH, and K-AB conceptualized and designed the study, designed the survey questions, and organized the recruitment of participants. CW and K-AB collated and prepared the raw data for data analysis. NW performed the data analysis, created the figures and tables and suggestions for revision were incorporated. NW and KH drafted the first version of the manuscript with input and guidance from TH and all other authors throughout. All authors provided critical review of the draft and suggestions for revision. All authors contributed to the article and approved the submitted version.

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## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2022.912188/full#supplementary-material>

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# The inclusion of disability and aging in COVID-19 hygiene behavior change interventions across low-and middle-income countries: A review using the COVID-19 Inclusive WASH Checklist

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**Introduction:** People with disabilities and older adults face a high risk of dying from COVID-19. Handwashing with soap and sanitizing surfaces were recommended to disrupt COVID-19 transmission. Yet, in many low-and middle-income countries (LMICs), these populations have inadequate access to water, sanitation and hygiene (WASH) and are not reached by public health campaigns. The Hygiene Behavior Change Coalition (HBCC) was set up to limit the spread of COVID-19 in LMICs. Twenty organizations working across 37 countries were funded to encourage populations to adopt recommended personal hygiene behaviors. This study aims to review the inclusion of disability, aging, and caregiving in HBCC grantee interventions.

**Methods:** A COVID-19 Inclusive WASH Checklist, which incorporates core concepts of human rights, was developed to support the inclusion of disability, aging and caregivers in interventions. The Checklist was applied to 137 documents submitted to donors within the HBCC fund to assess inclusion. Eligible grantee programme documents related to HBCC-funded projects were identified between August 2020 and January 2021. Feedback was provided to grantees recommending how to strengthen the inclusion of disability, aging, and caregiving.

**Results:** Most organizations identified people with disabilities, older adults and caregivers as target groups, but targeted activities to include them were scarce. Where efforts were made, immediate needs rather than rights were addressed. For example, the construction of accessible handwashing facilities featured more prominently than ensuring the participation of these groups. Examples of the coverage of core concepts in interventions included generating data with these groups and developing interventions accordingly. Limitations to inclusion were inconsistent organizational approaches, inability to monitor media campaigns, and inadequate coverage of disability and aging in donor's grant funding mechanisms.

**Conclusion:** To ensure these populations benefit from efforts, they must be explicitly identified as target groups, with assigned actions that are monitored; efforts must go beyond accessible WASH services to ensure the meaningful participation of these groups. The COVID-19 Inclusive WASH Checklist supports this but requires further testing to assess its appropriateness and effectiveness.

#### KEYWORDS

COVID-19, disability, aging, caregivers, hygiene, water and sanitation

## Introduction

Fifteen per cent of the global population has a disability, meaning a “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, 2). In 2020, an estimated 727 million people were aged 65 years and over globally (3) (“older adults”), of whom approximately a third have a disability (1). An estimated 190 million people rely on informal and professional caregivers for assistance (4). Moreover, many people providing care to others during the COVID-19 pandemic are older adults (5–9).

People with disabilities, older adults, and older adults with disabilities are at a higher risk of COVID-19 (10–12). Seventeen per cent of the United Kingdom population has a disability but constituted 60% of COVID-19 deaths, and over 90% of deaths are among people aged 60 years or older (13). A recent scoping review of 58 articles, mainly from high-income countries, found COVID-19 infection rates were higher for people with disabilities living in residential care settings, which authors attribute to the crowded environment (12). These excess risks have important implications for COVID-19 control strategies as people with disabilities, older adults, and older adults with disabilities make up a large proportion of the global population.

During the COVID-19 pandemic, social distancing, wearing face masks and personal hygiene measures, such as handwashing with soap and water and keeping surfaces clean, were recommended to disrupt COVID-19 transmission routes (14–16). These activities can present challenges for people with disabilities, older adults, and older adults with disabilities: social distancing is challenging for people who rely on caregivers; face masks inhibit lip reading; and many are unable to avoid touching contaminated surfaces, such as assistive technologies and products. Furthermore, public health campaigns are often not inclusive or accessible (17), and these groups often face barriers to attending healthcare services (e.g., inaccessible transport and health facilities, financial constraints, and negative attitudes) (17, 18). These issues may be further exacerbated in resource-constrained low-and middle-income countries (LMICs) (17, 18).

More specifically, people with disabilities, older adults, and older adults with disabilities face a range of barriers to accessing and using water, sanitation, and hygiene (WASH) facilities and services, which are vital for disrupting COVID-19 transmission (15, 16, 19–22). These barriers intensify during emergencies (23, 24). These include inaccessible water points, handwashing and bathing infrastructure (19, 21, 22, 25, 26), limited water quantity (7) and the ability to afford soap (5, 6, 18, 27, 28). Additionally, caregivers might not prioritize the WASH needs of the individual they support or may not be informed about how to do this effectively (26, 29, 30). Caregivers may also face difficulties transferring information about COVID-19 preventative measures to individuals they support (31, 32).

In accordance with basic human rights principles, people with disabilities, older adults, and older adults with disabilities must be included in all COVID-19 responses (2, 33–35). For instance, the United Nations (UN) recognizes that the human rights to water and sanitation are essential for realizing all other human rights. The UN Convention on the Rights of Persons with Disabilities (CRPD) includes Article 11, stipulating that all humanitarian responses should include people with disabilities (2, 36). Yet a review of 23 global guidance documents on WASH and COVID-19 revealed that only one-third referenced people with disabilities (aging was not part of the study) (37).

In early 2020, Unilever and the Foreign, Commonwealth & Development Office (FCDO) launched the £100 million Hygiene Behavior Change Coalition (HBCC) to mount a rapid response to contain and limit the spread of COVID-19 in LMICs. The HBCC aims to reach up to a billion people, raising awareness and changing behavior, to ensure people wash their hands regularly with soap and disinfect surfaces. Twenty-one organizations were funded to deliver interventions in 37 countries across Sub-Saharan Africa, South Asia, East Asia and Pacific, Latin America, Middle East and North Africa regions. Projects ran from April 2020 to June 2021; activities included the distribution of hygiene products, such as hand soap and sanitisers, installing handwashing facilities at public locations, holding handwashing demonstrations, and running social, digital and mass media campaigns that promoted handwashing with soap, maintaining social distancing, respiratory hygiene,



and surface cleaning. At the request of FCDO, the International Center for Evidence in Disability (ICED) at the London School of Hygiene & Tropical Medicine delivered a seminar on the importance of including disability and aging in HBCC-funded projects in April 2020.

## Methods and materials

### Study aims and objectives

This study aims to explore the inclusion of disability, aging, and caregiving within HBCC grantees' efforts to prevent COVID-19 transmission in low- and middle-income countries (LMICs).

Specific study objectives were to: (1) develop a COVID-19 Inclusive WASH Checklist to support the inclusion of people with disabilities, older adults (aged <60 years), and their caregivers in hygiene behavior change projects to prevent COVID-19 transmission, (2) apply the checklist to HBCC grantees' programme documentation to understand the number of organizations that targeted people with disabilities, older adults, and caregivers in their interventions, (3) explore the core concepts of human rights considered within these organization's approaches and score the quality of these commitments, and (4) identify examples of the coverage of core concepts in interventions, and limitations faced in achieving inclusion.

In this article, we present the development of the COVID-19 Inclusive WASH Checklist and how it was applied to review HBCC grantees' programme documents (objectives 1 and 2) before documenting the results of that review (Objectives 3 and 4).

### Developing the COVID-19 Inclusive WASH Checklist

A COVID-19 Inclusive WASH Checklist, which incorporates human-rights principles, was developed and finalized after review by WASH and disability specialists at the LSHTM.

The purpose of the COVID-19 Inclusive WASH Checklist was: 1) to enable the systematic analyses of included materials of inclusion of people with disabilities, older adults, and caregivers and 2) to provide practical guidance for WASH practitioners wishing to ensure people with disabilities and older adults benefit from COVID-19 responses (38). The checklist can be applied during the planning, design, monitoring and evaluation of projects, and recommendations can be made to enhance inclusion throughout the project cycle.

We define inclusive WASH as 'a process which addresses the barriers to accessing and using WASH services faced by people vulnerable to exclusion, including people with disabilities,

older adults, people living with chronic illness, women, girls, transgender and non-binary people' (30).

### Search strategy

The search strategy was developed to identify peer-reviewed studies and gray literature documents relevant to WASH, disability, and COVID-19. The review included all countries but was limited to papers published after 2010 written in English. Searches were conducted in July and August 2020 across two online databases: Global Health and PubMed through Ovid SP, and gray literature was gathered through Google Scholar, Google, and Twitter and discussions with WASH and disability specialists. Search terms were created to capture four main concepts: WASH, disability, aging, and COVID-19.

### Inclusion/exclusion criteria

Eligible papers included technical briefs, guidance notes, frameworks, toolkits, blogs, primary research, research reports, conference papers, and commentaries. No exclusion criteria were set for the world region. Papers published before 2010 [when the UN recognized the human right to safe drinking water (36)] and non-English documents were excluded. Papers were required to consider WASH service provision during humanitarian emergencies, including COVID-19, for people with or without disabilities and/or older adults, and COVID-19 responses for people with disabilities and/or older adults.

### Study selection and description of papers

Papers identified through the search were exported to EndNote version X9, duplicates were removed, and papers were screened against the eligibility criteria. Fifty-one papers were identified (peer-reviewed  $n = 3$ ; gray literature  $n = 48$ ). The authors then shared these papers with WASH practitioners. They asked them to identify those they had used and which were most helpful in guiding the inclusion of disability and/or aging in their practice, thus narrowing down the focus from general WASH papers to those supporting the inclusion of disability and aging. The following five were identified through the two stage-screening processes.

1. *The EquiFrame framework*, adapted for WASH and disability, assesses the extent to which 21 core concepts of human rights are included in WASH policies and guidance documents (39). Each "core concept" of human rights has key questions and key language to support consistent analyses and scoring of policy content (39). The EquiFrame framework includes a quality of commitment score of 1 to 4: 1 = concept only mentioned; 2 = concept mentioned and explained; 3 = specific policy actions identified to

- address the concept; 4 = intention to monitor concept was expressed.
2. *The normative criteria to specify the right to water and sanitation* (40, 41). These criteria include non-discrimination, participation, availability, quality, acceptability, accessibility, and affordability.
  3. *Key actions for disability-inclusive WASH and COVID-19* (42). This checklist includes 14 steps to ensure disability is factored into WASH and COVID-19 responses. They include involving people with disabilities and their representative organizations, addressing gender and disability issues and advocating for inclusive WASH responses to COVID-19.
  4. *Key tool: Equity, non-discrimination and inclusion in WASH checklist* (43). This checklist covers 15 activities identified to ensure everyone benefits from WASH interventions. Actions range from conducting a situational analysis to providing subsidies for people unable to pay for water and sanitation services.
  5. *Steps to ensuring people with disabilities, older adults, older adults with disabilities and their caregivers are included in all COVID-19 hygiene promotion programmes* (44). Fourteen recommended actions are to be applied throughout the total programme cycle. This cover conducting rapid reviews of the WASH-related barriers and challenges experienced by these groups, providing advice on how to keep support structures and assistive products clean and being evidence-driven.

## Development of the checklist's guiding principles and suggested activities

The EquiFrame, adapted for WASH and disability and which identifies core concepts of human rights, was used as the basis of the COVID-19 Inclusive WASH Checklist. However, as the adapted EquiFrame does not specifically relate to COVID-19 or aging, the content was mapped across the remaining four documents to make it relevant for COVID-19, WASH, disability and aging. Consequently, the EquiFrame 21 core concepts of human rights were reduced to 15. Core concepts were omitted if the content was absent within the above resources (numbers 2–5). Those excluded were *Liberty, Autonomy, Privacy, Contribution, Cultural responsiveness, and Prevention*.

As the lead author is an academic focusing on disability and WASH, with practical experience in designing, delivering, and evaluating inclusive WASH interventions, she developed “guiding principles” to meet the core concepts and “suggested activities” to support their achievement. A color-coded grade is included in our checklist based on the EquiFrame framework quality of commitment scoring criteria. An additional score of

zero (the core concept was not mentioned) is included (see above). The Checklist was reviewed by co-authors, academics at the LSHTM working in WASH, and disability and WASH practitioners. Any suggested revisions were discussed and incorporated into the Checklist.

**Supplementary material** contains the COVID-19 Inclusive WASH Checklist. The checklist is presented twice, firstly in relation to disability and secondly to aging. Attention to caregivers is integrated into “suggested activities” under the disability and aging components, but the Family resource and Family support core concepts focus on caregivers.

**Table 1** includes an example of *Non-discrimination* from the COVID-19 Inclusive WASH Checklist. **Table 2** provides examples of project activities and how they would be scored against the core concept, *Non-discrimination*.

## Identification of HBCC grantee documents for review using the COVID-19 Inclusive WASH Checklist

A search strategy was defined to identify relevant documentation submitted to Unilever (who then shared them with the FCDO) by the HBCC grantees. The search was conducted between August 2020 and January 2021. All documents submitted by grantees to donors were made available to the researchers.

Eligible programme documents for review had to relate to the HBCC-funded programmes explicitly. Included materials were funding proposals, project overviews, work plans, Theories of Change, progress reports, media and communication content, results frameworks, and budgets. Documents were excluded if they were published before the HBCC funding call or if they did not relate directly to the HBCC-funded projects. Organizational policies, such as counting user protocols, safeguarding and child protection, and recruitment, were excluded, as were the Curriculum Vitae of project staff. **Table 3** presents the included materials.

## Applying the COVID-19 Inclusive WASH Checklist: Data extraction and analysis

We pilot-tested the COVID-19 Inclusive Checklist on two documents and revised it to address identified limitations. The revised Checklist was then applied to 137 eligible documents related to HBCC-funded projects. To ensure reliability and validity, two authors independently reviewed the content of included materials to identify the coverage of core concepts and then scored each reference. Any discrepancies were discussed before agreeing on final scores.



TABLE 1 Example of core-concept non-discrimination, against disability, from the COVID-19 Inclusive WASH Checklist.

Core concept	Guiding principles	Activity #	Suggested activities	Disability				
				0 = Core concept not mentioned	1 = Core concept only mentioned	2 = Core concept mentioned and explained	3 = Specific programme target and actions identified to address the core concept	4 = Actions and targets monitored and evaluated, with results presented against core concept
Non-discrimination	Intervention support the rights of people with disabilities with equal opportunity in accessing WASH services	1.1	Persons with disabilities are considered an 'at risk' group					
		1.2	Persons with disabilities included as a target population					
		1.3	Have a separate budget line for every activities related to disability, including staff capacity development, outreach for people unable to leave their home or who are self-isolating, and all other related programme and policy activities					
		1.4	Identify ways of engaging people with all types of impairments at all stages of COVID-19 programmes, from planning to evaluation					
		1.5	Ensure all impairment groups and genders are represented in Organizations of Persons with Disabilities					
		1.6	Work with community leaders, Organizations of Persons with Disabilities and disability service providers to identify households that include a person with a disability					
		1.7	Actively seek to include people with different impairments, ages, genders, and their caregivers					

TABLE 2 Examples of project activities and how they would be scored against non-discrimination for disability.

Score	Non-discrimination core concept example	Corresponding activity in Table 1
0 = Concept was not mentioned	No content	N/A
1 = Core concept only mentioned	We will target vulnerable populations (e.g., people with disabilities)	1.2
2 = Concept was mentioned and explained	Of the 100,000 people targeted, approximately 15,000 people experience some form of disability.	1.2
3 = Target and actions identified to address the core concept	Work with Organizations of Persons with Disabilities to identify up to 15,000 people with disabilities.	1.2, 1.6
4 = Actions and targets monitored and evaluated against core concept	In collaboration with Organizations of Persons with Disabilities, we identified 15,000 people with a disability	1.2, 1.6

TABLE 3 Included materials.

Document type	N=	%
Proposal and project overview	37	27
Workplan	11	8
Results framework	11	8
Budget	5	4
Media and communication content	16	12
Monitoring report	57	42
Total	137	100

Each reference to a core concept that scored 3 or 4 (*Specific programme target and actions identified to address the concept*, and *Actions and targets monitored and evaluated, with results presented* respectively) were considered “high quality.” The following excerpt from a programme document is an example of the core concept, *Access*, because it provides sign language interpretation on television and therefore provides hygiene information in accessible formats for people with disabilities. As it includes specific actions (sign language interpretation), it is awarded a quality of commitment score of 3.

*“Mass media (TV, Radio & SMS) – [organisation’s name] aired on Citizen TV to tap into its high reach and affinity during the reporting period, under the social inclusion agenda, we supported sign TV with content co-produced with the station to reach people living with disabilities, namely deaf persons.” (Access, scored 3, referencing disability).*

For each included document, we captured the number of times each core concept was mentioned, the total score across these and the average score. We then captured the number of references made to each of the 15 core concepts and the average score awarded across all documents. These are presented in this article.

## Ethics statement

As the inclusion of disability and aging was not part of the donors’ funding criterion, HBCC grantees may not have factored this into their original aims and objectives. To acknowledge this, our feedback and advice to grantees about improving the inclusion of disability and aging in their projects was confidential and was not shared with donors. Grantees could decide if they had the resources to implement the recommendations or not, and this was not monitored by the authors of this study or the donors. To maintain confidentiality, grantees’ names are omitted in this article.

## Results

### Coverage of core concepts against disability and aging and their quality of commitment scores

People with disabilities were explicitly identified as target groups within 18 organizations (90%), compared to 17 (85%) for older adults and 16 (80%) for caregivers of people with disabilities or older adults. Table 4 presents the frequency of each core concept referenced across all 137 documents (total references %) and the score awarded to each (average score).

Table 4 shows that of the 591 references to core concepts across all documents, 375 (63%) were made to disability and 216 (37%) to aging. Across disability and aging, most attention was given to *Non-discrimination*, *Individualized services*, *Access*, *Quality*, and *Family resource*. The most neglected core concepts across disability and aging were *Entitlement/affordability*, *Family support*, and *Accountability*. However, between these, several core concepts were referenced minimally across all documents, especially to aging (e.g., *Capability based services*, *Coordination of services*, *Integration*, and *Family resource*, which received one reference against aging).

TABLE 4 Frequency of references to core concepts and average scores across all documents, and the comparison between disability and aging.

Core concept	Disability (n = 375 References)			Aging (n = 216 References)			Proportion of total references to disability and aging (n = 591)	
	Total references (n=)	Total references (%)	Average score	Total references (n=)	Total references (%)	Average score	Disability total (%)	Aging total (%)
Non-discrimination	88	23%	1.4	61	28%	1.3	15%	10%
Individualized services	61	16%	1.8	34	16%	1.5	10%	6%
Entitlement/affordability	2	1%	1.0	2	1%	1.0	0%	0%
Capability based services	9	2%	2.0	1	0%	1.0	2%	0%
Participation	12	3%	1.3	3	1%	1.0	2%	1%
Coordination of services	7	2%	1.4	1	0%	1.0	1%	0%
Protection from harm	15	4%	1.8	4	2%	1.5	3%	1%
Integration	6	2%	2.0	0	0%	0.0	1%	0%
Family resource	31	8%	1.6	31	14%	1.5	5%	5%
Family support	0	0%	0.0	1	0%	3.0	0%	0%
Accountability	0	0%	0.0	0	0%	0.0	0%	0%
Capacity development	14	4%	1.5	9	4%	1.3	2%	2%
Access	74	20%	1.7	38	18%	1.3	13%	6%
Quality	50	13%	2.3	31	14%	1.7	8%	5%
Efficiency	6	2%	1.5	0	0%	0.0	1%	0%
Total	375	100%		216	100%		63%	37%

All core concepts, bar *Family support* (aging), were given a low-quality average score of 1 or 2, meaning that, on average, they were not assigned specific activities or monitoring mechanisms. *Family resource* and *Family support* specifically focus on the inclusion of caregivers. Though the former was referenced frequently against disability and aging, the average score was low quality (Disability 1.6, Aging 1.5). *Family support* was the only concept to receive a high-quality score (aging 3.0), but this is from one reference across all documents, so it is not a strong indication of the quality of commitment. Figure 1 presents the average score awarded to references to core concepts in relation to disability and aging.

## Examples of how organizations included disability, aging, and caregiving in their hygiene behavior change interventions

Several examples of how organizations included disability, aging, and caregiving in their interventions were identified during the review process. In Syria, the following quote is taken from an organization's programme document, which shows that they target caregivers with their hygiene behavior change messages whilst also recognizing that caregivers are

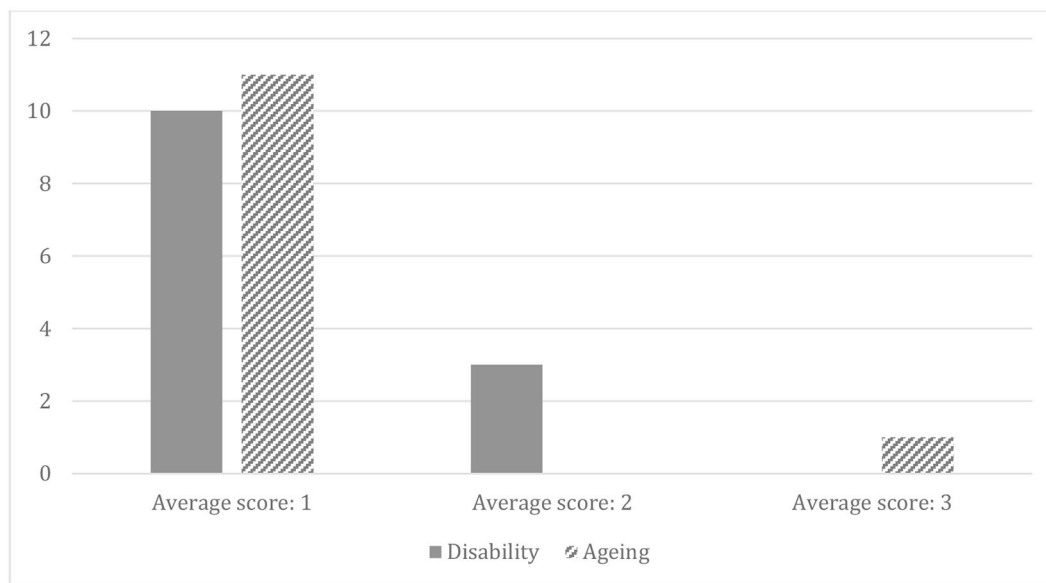
often older adults. Therefore, this relates to the *Family resource* core concept.

*"In overcrowded, multi-family, multi-generational households, older people frequently provide childcare while parents go out to work (particularly as schools are currently closed). This makes shielding or isolation impossible but offers an additional audience for messages focused on carers."* (Family resource, aging).

Within the same project, community volunteers were also trained to adapt hygiene behavior change activities to suit the needs of people with different impairments. This is an example of *Capacity building* in relation to disability as frontline staff were trained to understand disability-inclusive WASH.

In Fiji, an organization collaborated with the Pacific Disability Forum during project design to ensure hygiene behavior change messages were accessible to people with visual and hearing impairments. This is an example of *Capability-based services* as the organization partnered with Organizations of Persons with Disabilities to ensure the programme's activities include people with disabilities.

*Individualized services* were referenced frequently in project documents across disability and aging. In Sierra Leone, one organization provided hygiene and menstrual hygiene kits to households that included people with disabilities (*Individualized*



**FIGURE 1**  
The average score awarded to references to core concepts across disability and aging.

services and Access). Safety issues related to using handwashing facilities in public settings were also considered (*Protection against harm*). The following excerpt from a programme document shows that the organization recognized that disability and gender intersect to increase marginalization and designed activities to mitigate that.

*“Hygiene and menstrual hygiene kits will supply soap, buckets with taps, water storage containers and sanitisers for the most vulnerable households, including female carers and people with disabilities, to promote frequent handwashing and hygiene practices.”* (Individualized services, disability).

In Sri Lanka, Zambia and Nigeria, organizations constructed handwashing facilities accessible for people with mobility impairments, thus showing consideration for aging and disability. This activity contributes to achieving the guiding principle for the *Individualized services* core concept: “Intervention supports the rights of people with disabilities/older adults with individually tailored WASH services to meet their needs, choices and impairment so that they can carry out COVID-19 protective measures.”

In Myanmar, an organization conducted a rapid assessment to gather information about the experiences and requirements of older adults and people with disabilities (*Quality*). Data were collected across demographics, knowledge, practices, and information needs. These were used to develop a hygiene behavior change campaign and identify key messages and dissemination platforms. The organization also used the Washington Group Short Set of

questions to classify disability and over 60 years for aging (45) (*Quality*).

## Limitations faced in achieving inclusion

A key limitation to including people with disabilities, older adults, and caregivers in HBCC interventions was that there was no specific encouragement from donors to be inclusive apart from the seminars delivered to HBCC grantees and donors through this review. FCDO state that their funding should be disability-inclusive (46), but proposals and reporting formats did not explicitly encourage or require the inclusion of disability and aging within interventions. For instance, disaggregated data was requested for gender, refugee / internally displaced person status, and rural and urban location, but not for disability or aging. Through this study and the broader evaluation of the HBCC funding [documented separately (47)], the donor reporting templates were revised in September 2020 to ensure organizations could document the inclusion of people with disabilities, older adults and caregivers in their projects, as well as disaggregate data across these groups. This change led to a greater breadth of data provided.

Few organizations systematically applied access and inclusion across all projects in the funding portfolio, meaning the inclusion of disability and aging was not mainstreamed across the whole organization. For instance, some organizations carrying out similar interventions in multiple countries reported the production of Braille/large print materials in

only one or two locations or the construction of physically accessible facilities in a small number of places. Furthermore, few organizations included people with disabilities and older adults, or organizations representing these groups, in planning or monitoring activities (*Participation* and *Capability-based services*).

Efforts to monitor the effects of mass media campaigns on the hygiene behaviors of people with disabilities, older adults or caregivers were absent (*Quality*), but organizations requested support to do this. In monitoring reports, assumptions were made that generalized messaging impacted everyone who accessed them. However, without targeted market research, this assumption could not be verified.

## Discussion

Our study aimed to explore the inclusion of disability, aging, and caregiving within HBCC grantees' efforts to prevent COVID-19 transmission in LMICs. We noted several key results that will be discussed in relation to existing literature to demonstrate how this study contributes to current discourse.

Most HBCC grantees identified people with disabilities and older adults as target groups. This demonstrates that stakeholders are aware of the importance of ensuring COVID-19 WASH interventions are inclusive. However, the quality of commitment scores across all groups was low. Three other studies explored the inclusion of disability in WASH-related policies and guidance documents from Nepal (48), Cambodia and Bangladesh (39), and globally within the COVID-19 pandemic (37) by applying similar methods to those used in our study. Across all these studies, our review notes the most significant number of low-quality average scores. This indicates that these populations, who face a high risk of dying from COVID-19, may not have benefited equally from the HBCC-funded interventions.

A consistent finding across studies which explore inclusive WASH is that caregivers are not recognized for the critical support roles they often play in supporting people with disabilities and older adults with WASH and maintaining personal hygiene (21, 26, 30, 49–51). Our study found a greater emphasis on caregivers (*Family resource*) than in other studies (37, 39, 48). As noted above, though this indicates an awareness of caregivers' importance, this attention did not translate into clearly articulated actions for this group, meaning they were also unlikely to benefit extensively from these efforts.

These findings indicate that even though HBCC grantees understand the importance of inclusion, many struggled to mainstream it across their portfolio of funded projects. This chimes with a recent gap analysis that aimed to inform inclusive humanitarian responses; it noted that the operationalisation of inclusion is difficult to achieve, especially at the start of a humanitarian crisis, even though guidance exists (52).

We found that the attention to specific core concepts across disability and aging was similar. However, the total number of references made to individual core concepts was limited, particularly about aging, which was woefully low. Across this and other similar studies, *Individualized services* and *Access* are referenced consistently highly, whilst *Participation*, *Capability based services*, and *Accountability* receive little attention (37, 39, 48). Some may think this unsurprising because many governments, organizations, and institutions aim to increase access to WASH services, particularly in an emergency setting. Yet, for WASH services to be appropriate, acceptable, and sustainable, they must ensure the meaningful participation of target groups in the design, delivery, monitoring, and evaluation. People with disabilities, older adults, and organizations representing these groups must hold leadership roles with decision-making responsibilities. By tackling social exclusion, marginalization, and structural inequalities and improving access to WASH services, organizations can support people with disabilities, and older adults to increase their confidence, have greater control over resources, and better equip them to demand their rights to water and sanitation. This is in line with "Building Back Better," which is the humanitarian strategy aimed at increasing people's resilience to future disasters (Priority Area 3 and 4) (53, 54).

In our results, we highlighted examples where HBCC grantees were incorporating disability, aging, and caregivers in their programmes, such as gathering data from target groups, analyzing it to understand requirements and designing appropriate interventions, and applying an intersectional lens in their analysis and intervention design. In the second phase of this study, a mixed-methods evaluation will be conducted to explore the inclusion of people with disabilities, older adults, and caregivers in HBCC-funded projects in Kenya, Indonesia, Zambia, Sierra Leone, and Bangladesh. Examples of promising inclusive-WASH practices will be documented in greater depth so that other development and humanitarian actors can integrate them into their interventions (47).

We also noted consistent challenges faced in mainstreaming inclusion in HBCC interventions. Of note was that funders' documentation templates did not encourage the explicit inclusion of people with disabilities and older adults. After the second quarter reporting formats were adjusted to incorporate disability and aging systematically, project documentation gained higher quality commitment scores. This suggests that reporting formats make a difference in sign-posting organizations to consider designing interventions with specific populations in mind. The FCDO has a Strategy for Disability Inclusive Development, which includes minimum standards for disability inclusion across all of its work (46). Additionally, humanitarian sector guidelines emphasize the importance of including people with disabilities and older adults in interventions, such as the Sphere Handbook (53) and Core Humanitarian Standards (55). Therefore, all donors funding humanitarian efforts should incorporate these.

Since completing this review, the FCDO and Unilever released a second HBCC funding stream in which the inclusion of disability and aging in interventions is a key criterion. They have also stipulated that all grantees must use the COVID-19 Inclusive WASH Checklist in their programme cycle, from design to evaluation.

Finally, organizations found monitoring and evaluating mass media hygiene behavior change campaigns difficult. Much can be learnt from existing literature, including the Behavior Centered Design (56, 57) and evaluations of mass media campaigns of anti-drug, alcohol and smoking campaigns (58–60). These studies gathered process monitoring data to understand the extent to which the campaign was delivered as intended and exposure of the target groups to the campaign and conducted outcome and impact evaluations. HBCC grantees could use such methods to assess their hygiene behavior change campaigns.

## Implications for future research and practice

To systematize inclusion within WASH interventions, all donors should sign-post the inclusion of people with disabilities, older adults, older adults with disabilities and caregivers in all documentation, from calls for proposals to monitoring, reporting and evaluation. They should also include disability and aging within the funding selection criterion. This would encourage organizations to explicitly consider inclusion within their WASH programmes, including COVID-19 WASH responses.

Though the COVID-19 Inclusive WASH Checklist provides practical guidance on incorporating disability, aging, and caregiving in interventions, further research in different settings is required to assess if the checklist effectively supports inclusion during COVID-19 and future humanitarian responses.

## Review strengths and limitations

A key strength of this study is that we developed and applied a structured tool, the COVID-19 Inclusive WASH Checklist, to analyse document content. To ensure transparency, we assessed data independently and compared results before finalization. We supported organizations to improve inclusion during the intervention by providing individualized feedback and recommendations. Another strength is that the donors encouraged and facilitated reflection and learning to enhance the inclusion of people with disabilities and older adults in COVID-19 WASH responses.

Some limitations must be considered when interpreting the study results. For instance, organizations might not have fully documented their inclusive approaches due to a lack of

sensitivity to inclusion issues in standard reporting mechanisms. We did not interview any HBCC grantees separately to gather additional information. This will be addressed in the mixed-methods evaluation that will explore the inclusion of disability, aging, and caregiving in HBCC-funded projects in a greater-depth (47).

## Conclusion

This study demonstrates that the inclusion of disability, aging, and caregiving within HBCC grantees' efforts to prevent COVID-19 transmission in LMICs was not consistently achieved. To ensure these populations benefit from efforts, people with disabilities, older adults, and caregivers must be explicitly identified as target groups. Specific programme targets and actions must be determined to address a wide range of core concepts; progress toward achieving these must be monitored, evaluated, and reported on. While ensuring that WASH services can be accessed and used by these groups, ensuring their meaningful participation in all stages of the programme cycle is equally essential. The COVID-19 Inclusive WASH Checklist provides practical guidance about including people with disabilities, older adults, and caregivers in COVID-19 hygiene behavior change efforts. Still, it needs further testing to assess its appropriateness and effectiveness.

## 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.

## Author contributions

JW: conceptualization, methodology, data curation, supervision, project management, coordination, administration, funding acquisition, writing—review and editing, and visualization. JW and LW: investigation. JW, LW, and SF: writing—original draft preparation and manuscript review. All authors have read and approved the manuscript.

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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.

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2022.1024850/full#supplementary-material>

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# Perception of extreme hot weather and the corresponding adaptations among older adults and service providers—A qualitative study in Hong Kong

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**Background:** Extreme hot weather events are happening with increasing frequency, intensity and duration in Hong Kong. Heat stress is related to higher risk of mortality and morbidity, with older adults being particularly vulnerable. It is not clear whether and how the older adults perceive the increasingly hot weather as a health threat, and whether community service providers are aware and prepared for such future climate scenario.

**Methods:** We conducted semi-structure interviews with 46 older adults, 18 staff members of community service providers and two district councilors of Tai Po, a north-eastern residential district of Hong Kong. Transcribed data were analyzed using thematic analysis until data saturation was reached.

**Results:** It was agreed upon among the older adult participants that the weather in recent years has become increasingly hot and this led to some health and social problems for them, although some participants perceived that hot weather did not have any impact in their daily lives and they were not vulnerable. The community service providers and district councilors reported that there is a lack of relevant services in the community to support the older adults in hot weather; and there is generally a lack of public education regarding the heat-health issue.

**Conclusions:** Heatwaves are affecting older adults' health in Hong Kong. Yet, discussions and education effort regarding the heat-health issue in the public domain remain scarce. Multilateral efforts are urgently needed to co-create a heat action plan to improve community awareness and resilience.

## KEYWORDS

extreme heat, older adult, health inequalities, adaptation, climate change

## 1. Introduction

Against the backdrop of global climate change, extreme weather events will become more frequent, intense and last longer (1). Luo and Lau (2) showed that in the Southern China region, from 1980's to 2010's, there has been significant increase in the frequency of heat wave (+0.19 events per decade), heat wave days (+2.86 days per decade) and the duration of the longest heat wave (+0.38 days per decade). Locally, the Hong Kong Observatory (HKO) has reported that the numbers of hot night (highest night-time temperature >28°C) and very hot day (highest

daytime temperature  $>33^{\circ}\text{C}$ ) have been respectively on the rising trend. In 2021 alone, Hong Kong has recorded 61 hot nights and 54 very hot days, both hit the record high since 1884 (3). In 2022, the first very hot weather warning (VHWW) in the year was issued on 29 April, 2022, which was a record earliest date for such warning. Moreover, Hong Kong's unique mountainous topography has limited the development of its land, resulting in only around 24% of its territory being developed (4). High-rise buildings are thus concentrated in urban areas; the ventilating airways from the sea to the inland areas are blocked to different extents, exacerbating the urban heat island effect (5).

Extreme hot weather brings negative impacts on people's health and wellbeing (6, 7). In Hong Kong, it has been reported that extreme hot weather events are related to higher risk of adverse health outcomes such as mortality (8, 9), asthma hospitalization (10) acute myocardial infarction among patients with diabetes mellitus (11), all-cause accident and emergency department visits (12) and suicide deaths (13). Moreover, the impact of extreme hot temperature could be more serious for the vulnerable groups in the population. Older adults aged over 65-year-old are more prone to heat-related illnesses than younger age groups (14–16). Their ability of thermoregulation has become less effective following the natural aging process. For example, their ability to control vasodilation to increase blood flow to the skin could be deteriorated. Their decreased sensitivity to thirst could lead to dehydration amid very hot weather. Previous studies have found that the heat-related mortality rate of the older adults has increased globally by more than 53% in the past two decades (17). Several studies projected that the heat-related mortality rate would continue to rise when considering the current rising trends of temperature and aging population (18, 19). In a local study, Wang and colleagues (20) observed 2.53% and 5.33% increases in mortality risk for older adults suffering from a single hot night and five hot nights respectively. When the older adults suffer from two hot days and three hot nights consecutively, their daily mortality risk rises by 5.87%. The older adult's ability to perspire could also be hindered by common medications for chronic diseases such as beta blockers and anticholinergics (21, 22).

Given the health impact brought by extreme hot weather, it is therefore important for individuals to take appropriate adaptive response to minimize the health risks. It was shown that proper actions in response to weather warning might help mitigate the adverse outcomes among the older adults (23). In the health decision-making literature, individuals are often expected to go through cognitive processes that involve weighing risks for consequences against the benefits of taking actions. Grothmann and Patt (24) posited that there are two important cognitive factors involved—risk perception and perceived adaptive capacity. Risk perception measures how an individual perceive the risk of whether a certain event could happen and hence ultimately drives relevant adaptive behaviors. This process involves judging how likely one is exposed to the extreme weather conditions, how harmful such conditions would be to things that one has reason to value (e.g., health), and how one weighs these risks over other priorities in life. This has also been previously theorized in health behavior models that predict behavioral changes, such as the health belief model (25) and the protection motivation theory (26). On the other hand, there are two dimensions for adaptive capacity. First, subjective adaptive capacity concerns how people perceive the resources at their disposal. Gardner and Stern (27) suggested with empirical data

that people often perceive little control over global and regional environmental problems. The other dimension concerns, objectively, the social resources available (28). Adger (29) argued that the capacity of individuals to adapt to climate change “is a function of their access to resources,” corroborating that social determinants have a substantial influence on behaviors conducive to health (30, 31). For instance, in the case of the 1995 Chicago heat wave, socioeconomic resources had substantial impact for older adults to adapt to the impact of hot weather, partly through the ownership and utilization of cooling devices (32). A more recent study in Brazil showed that less developed cities showed stronger associations of heatwaves and all-cause hospitalizations (33).

Although older adults are considered as more vulnerable to heat-related illnesses, previous studies showed that older adults or the general population seldom perceived so. In a population-representative cross-sectional survey of older adults in Australia, Hansen and colleagues (34) reported that, when asked whether the older adults concern their health amid a heatwave, only 3 to 6% of the respondents reported that they did. Around 30% said they were not concerned at all in the case when a heatwave is coming. Abrahamson and colleagues (35) conducted semi-structured interviews with 73 older adults in the UK and found that few respondents considered themselves either old or at risk of suffering from the effect of heat; most also claimed that they have taken appropriate steps to mitigate the impact of heat. A recent systematic review by Vu and colleagues (36) echoed that many older people surveyed in Australia, UK, USA and Canada were not aware of their susceptibility to hot weather. In eastern China, a cross-sectional study also reported that the older adults and the lower educated were less likely to perceive hot weather as a health threat (37). A recent population-based telephone survey in Hong Kong showed that about half of around 1,000 respondents recognized that climate change posed as a health risk (38). However, risk perception and behavioral adaptations in the older adults, and the view from frontline service providers, were seldom assessed in the local context. Therefore, in this study, we would like to address the following questions:

- What are the perceptions of the older adults in Hong Kong toward hot weather and what measures are they taking in the face of it?
- What are the current services provided by elderly service providers, particularly the community centers, that targeted at helping the older adults to survive the hot weather?
- What are the possible enablers and barriers and facilitators for those services and measures?

## 2. Materials and methods

### 2.1. Setting

This study consists of two parts. In the first part we examined the perceptions of the older adults toward hot weather and their adaption strategies through focus group discussion. And in the second part, we assessed the perceptions from the point of view of frontline service providers—the problems or barriers they face during heatwaves.

In the first part of the study, older adults, were recruited from two public housing estates of Tai Po district in Hong Kong: Kwong Fuk Estate and Tai Wo Estate. Tai Po is located northeastern of New

Territories in Hong Kong. This district has the total population of 316,470, accounting for 4.3% of the total population of Hong Kong. The proportion of the population aged 65 or above is 18.5%, which is similar to the Hong Kong average of 19.6%. Tai Po was one of the districts of the second phase of the New Town development in Hong Kong which started in 1979. This district comprises residential and industrial areas to create a self-contained district. Tai Po is also well-known for its natural landscapes, surrounded by the mountain ranges on the north, west and south, and fronting Tolo Harbor on the east. Kwong Fuk Estate and Tai Wo Estate are two of the eight public housing estates in Tai Po, providing home to some 23,000 population. The former consists of eight residential buildings completed in 1983, while the latter consists of twelve residential buildings completed in 1989. Therefore, the two estates were chosen on the basis that they represent typical settings of residential districts of Hong Kong with a wide variety of community facilities having been built in close proximity to the housing estates, ranging from shopping malls, community centers, recreational facilities, and open space.

In the second part, participants were the community service providers and district councilors, who were recruited from the community centers or through bulk email. In Hong Kong, the District Council serves as the interface between the Government and the community and coordinate activities in the provision of services and facilities at the district level. Community support services for the older adults are mainly coordinated under the Social Welfare Department. There are two types of community centers, namely Neighborhood Elderly Center (NEC) and District Elderly Community Center (DECC). Both NEC and DECC provide comprehensive services to facilitate older population to age-in-place, whereas NEC are at the neighborhood level and DECC are at the district level. There are 171 NEC and 41 DECC in Hong Kong as at mid-2022 (39, 40).

## 2.2. Ethics

The study was approved by the Survey and Behavioral Research Ethics Committee of the Chinese University of Hong Kong (ref: SBRE-20-799) and the Institutional Review Board of the University of Hong Kong /Hospital Authority, Hong Kong West Cluster (ref: UW22-304). All participants provided informed consent to participate in the study. Demographic information was collected prior to the start of focus group. Participants were advised that they were free to refuse to answer any question and could withdraw from the study at any time. All identifiers were removed from the transcripts and questionnaires and replaced with pseudonyms.

## 2.3. Participants

We used purposive sampling of participants for the current study with the following selection criteria. Purposive sampling is widely used in qualitative study to recruit information-rich participants who are knowledgeable about the neighborhood and the phenomenon under study (41). The first part of the study included older adults who (1) were aged 60 or above, (2) were Chinese origin, (3) resided in one of the two housing estates (Kwong Fuk Estate and Tai Wo Estate) in Tai Po for at least 1 year, and (4) able to communicate verbally in

Cantonese. Recruitment efforts included flyers, referrals from elderly centers, and word of mouth. The second part of the study included service provider or social workers, who had at least 1 year experience working at the NECC or DEC, as well as district councilors in the Tai Po district.

## 2.4. Data collection

There were eleven focus groups, consisting of eight focus groups for older adults and three focus groups for community service providers/district councilors, all of which were conducted in the community centers near the given housing estates between May and July 2021 and online platform in July 2022. Each focus group had 4–8 participants and lasted for approximately 60–90 min. All focus groups were audio recorded and transcribed verbatim.

A semi-structured question guide was created for facilitators to use when conducting focus groups. The focus group interviews with the older adults began with broad questions regarding how participants described hot weather in Hong Kong, the impact of hot weather on their daily lives, the adaption strategies they used under the hot weather and also the factors in the social environment that facilitate or hindered adaption. For the focus group interviews with community service providers/district councilors, we asked whether there have been existing programmes or coordinated community efforts regarding extreme heat, what the way forward is and what potential barriers they foresee.

## 2.5. Data analysis

Data analysis followed a thematic analysis approach involving key stages of organization, reduction and refinement (42). Initially, four researchers independently read each transcript to familiarize with the entire dataset and generated an initial list of codes that were relevant to research aims. These codes were then categorized into the potential themes. Initial codes and the potential themes were discussed among the four researchers in order to ensure similarities and to review the emergent themes and refine codes. This process of reviewing themes and recoding data continued until all three researchers reached the agreement regarding the emergent themes and coding schemes. Data saturation was reached when no new themes emerged from the data (43).

# 3. Results

## 3.1. Participants

A total of 46 older adults, 18 staff members of NGOs and 2 Tai Po district councilors joined our focus group interviews. The characteristics of the older adult participants were shown in Table 1.

## 3.2. Key findings

We grouped findings from all participants into five main themes: (1) Perceived impact of hot weather, (2) Adaptation appraisal, (3) Enabling social environment, (4) Perceived barriers to adaptation to



**TABLE 1** Demographic characteristics of the older adult participants (*n* = 46).

Characteristics		<i>n</i>	%
Age	50–59	1	2.2
	(mean: 68.61; range 50–85)	27	58.7
	70–79	15	32.6
	80 or above	3	6.5
Gender	Female	35	76.1
	Male	11	23.9
Education level	Primary or lower	15	32.6
	Secondary	30	65.2
	Tertiary or above	1	2.2
Marital status	Single	2	4.3
	Married	34	73.9
	Widowed	7	15.2
	Divorced/separated	3	6.5
Housing type	Public housing	32	69.6
	Subsidized sales flat	6	13.0
	Private permanent housing	8	17.4
Number of years living in Tai Po	<10 years	2	4.3
	10–19 years	4	8.7
	20–29 years	5	10.9
	30–39 years	32	69.6
	40 years or above	3	6.5
Living arrangement	Living with spouse only	22	47.8
	Living with children only	2	4.3
	Living with spouse and children	11	23.9
	Living alone	10	21.7
	Living with others (e.g., domestic helper)	1	2.2
Employment	Retired	41	89.1
	Homemaker	4	8.7
	Unemployed	1	2.2
Monthly personal income <sup>#</sup>	<HK\$2,000	20	43.5
	HK\$2,000–3,999	16	34.8
	HK\$4,000–9,999	6	13.0
	HK\$10,000 or above	3	6.5
	Refuse	1	2.2
CSSA holder*	Yes	2	4.3
	No	44	95.7
Perceived financial sufficiency	Insufficient	9	19.6
	Tight/enough	32	69.6
	More than enough	4	8.7
	Very sufficient	1	2.2
Self-rated health	Poor or fair	28	60.9
	Excellent, very good or good	18	39.1

<sup>#</sup>HKD\$1 = USD\$0.13.

\*CSSA: comprehensive social security assistance (a social welfare in Hong Kong that provides supplementary payments to residents who are not able to sustain themselves financially).

hot weather, and (5) new services that could be implemented. We presented the illustrative quotes for each theme in [Table 2](#).

### 3.2.1. Theme 1: Perceived impact of hot weather

#### Theme 1.1–Changing pattern of hot weather

It was generally agreed among the participants that summers in Hong Kong are becoming increasingly hotter and arrive significantly earlier than one or two decades ago (Quote (Q) 1 and Q2, [Table 2](#)).

#### Theme 1.2–Physical health

Some of the older adults expressed that the increasingly hot weather is affecting their physical health. Symptoms such as poorer sleep quality, headache, dizziness and racing heart were sometimes experienced when they went outdoor during summertime (Q3 to Q6). Notably, universal masking intervention during the COVID-19 pandemic has exacerbated the discomfort brought by extreme heat (Q5).

#### Theme 1.3–Mental health

Hot weather also affects mental health—some of the participants reported that they feel more irritable when the temperature is hot (Q7 and Q8).

#### Theme 1.4–Reduced social activities

Some participants reported that they inclined to go out less to avoid heat in hot summer. In such a way, they felt that this situation reduced socialization with friends and relatives (Q10) and physical activities in the outdoor areas (Q9 and Q11).

#### Theme 1.5–Not concerned about hot weather

However, some participants felt that the increasingly hot weather does not have much impact on their health or daily activities (Q12). A district councilor quoted from the older adults whom he came across in his duties, saying that they felt the cold in winter could lead to respiratory diseases, while the heat in summer is less relevant to health (Q13). Another community worker reported an episode of home visit in a hot summer, and his client did not seem to be bothered at all (Q14).

### 3.2.2. Theme 2: Adaptation appraisal

For the older adults who found that the increasingly hot temperature bothers them during summertime, they came up with various solutions to deal with the situation. Here, we grouped the solutions into indoor and outdoor ones. Generally, the participants were aware that there are strategies that they can adopt to stay away from heat and staying indoor during extreme heat is usually more advisable.

#### Theme 2.1–Indoor strategies

When the participants stayed home, they would employ strategies that could improve ventilation, such as opening the windows and turning on fans (Q15 and Q16). They would also use methods to cool themselves directly, such as bathing (Q17). Some participants suggested that they increased hydration during the heat (Q18). Air conditioners have been mentioned as a way of cooling, despite the older adults used it more sparingly (discussed more in Theme 4).

## Theme 2.2–Outdoor strategies

When the participants needed to go outside, some of them reported that they make plans to avoid the heat. For instance, they chose to go out at a time of the day when the heat is less intense, i.e., early mornings or late evenings (Q19). They would reduce the number of times that they need to go out by, say, group several days' of grocery shopping in 1 day. Some of the participants were adept at planning routes between two points through which they could enjoy shaded walkways (Q20). They also plan what to pack in their bags during extreme heat, mainly portable fans, umbrella, towels and a bottle of water (Q21). Despite of the measures they prepare for outdoors, a staff member of NGO reported that some older adults whom they serve preferred to stay in air-conditioned malls during most of the daytime in summer, while some of them would prefer to go to local community centers (Q22).

### 3.2.3. Theme 3: Enabling physical and social environment

#### Theme 3.1–Accessible public space with cooling features

Participants were generally satisfied with the outdoor environment of the Tai Po district, in particular the parks and greenery that are available to them to seek shelter from heat where there is good ventilation (Q23 and Q24).

#### Theme 3.2–Housing design

Views varied on the design of the buildings in which the live. Some opined that the so-called “hash-shaped” (it is actually a double-tower design resembling two hollow squares joining at one corner of each square) design of their building facilitated ventilation such their homes are much cooling than outside (Q25). Participants who resided in Y-shaped towers, which have semi-enclosed public areas inside buildings, had mixed opinions—some said they feel good ventilation while some disagreed (Q26 and Q27). Participants also agreed that the orientation of the buildings matter for good ventilation because directly facing the sunlight during the day builds up heat in the flat (Q28 and Q29) (Photos of the façade of the buildings in [Supplementary material](#)).

#### Theme 3.3–Channels to access hot weather information

Regarding information about hot weather in the public domain, the participants were aware of the hot weather warning issued by the HKO. Most of them received the information regarding hot weather from radio and television channels (Q30 and Q31) and they are generally satisfied with information about hot weather in the public domain.

### 3.2.4. Theme 4: Perceived barriers to adaptation to hot weather

#### Theme 4.1–Economic concern

The opinions on the use of air conditioners as a cooling strategy at home have been mixed. On one hand, the participants agreed that air conditioners are indispensable tools that bring optimum thermal comfort; on the other hand, the costs for electricity have been a concern for most of them given they were all retired with very limited income. Consequently, they adopted various other strategies to limit its use. For example, they only use air conditioners when most of the household members are present, a way what they claimed

to be more “cost-efficient” (Q32 and Q33). To the more extreme end, some frontline workers opined that they came across cases in much worse housing conditions with older adults living alone faring poorly in hot weather since they could not afford to rent more proper housing (Q34).

#### Theme 4.2–Perspectives from Chinese medicine or general dislike of air conditioning

Interestingly, some older adult participants perceived that the “cold” and “damp” from the air conditioners is not good for their health from the Chinese medicine perspective, which could make them feel more tired and musculoskeletal pain (Q35 and Q36). If they were to choose, sometimes they would prefer natural wind rather than air conditioners. A community frontline worker said that his clients rather enjoy the breeze in the park rather than air conditioning in the community center (Q37).

#### Theme 4.3–Outdoor space not conducive to cooling

The participants opined that there are not adequate shading devices in their neighborhood, especially in places which they frequently go, such as the bus stops and podium (Q38). Even though there are air-conditioned malls in the neighborhood, the older adults could hardly find a place to sit and relax inside the malls (Q39 and Q40). It appeared that malls generally do not seem to welcome older adults merely sit in the malls and seek shelter from heat (Q22).

#### Theme 4.4–Lack of discussion in the public discourse

The increasingly hot weather is giving, to some extent, more hassles to the older adults in their daily lives. However, the impact of heat is seldom discussed in any public discourse regarding what proper actions to take in the face of more frequent and intense extreme heat. The participants generally did not perceive the government has done adequately to address the problem of extreme heat. Although the government opens the community heat shelters at night when VHWW is hoisted, most of the participants expressed that they were not aware of this at all. Some frontline NGO workers also felt that the community heat shelters were not attractive for the older adults, and that discussions of the heat-health issue were almost non-existent in the public domain (Q41 to Q43).

### 3.2.5. Theme 5: New services that could be implemented

Service providers generally agreed that as compared to services targeting at the cold weather, there were sparse services targeting at the hot weather. Even though there are still regular services provided by the NEC/DECC such as home visits and community health talks, the activities were not designed to heed to the health needs of the older adults in hot weather. The frontline service workers have brainstormed some forms of activities for future considerations. One participant mentioned a water exercise group in their community center to encourage older adults to maintain physical activity during summer, but that was suspended due to the pandemic (Q44). One service provider shared their plan to open the community centers on Sunday and public holidays. In this way, the older adults could have intergeneration activities and at the same time having a cool shelter (Q45). Another frontline worker also suggested that one could send picture reminders to their clients via texting apps such as WhatsApp to remind them to take appropriate precautions during hot weather

TABLE 2 Illustrative quotes for each theme.

Quote number	Quote	Participant characteristics*
<b>Theme 1: Perceived impact of hot weather</b>		
<b>Theme 1.1: Changing pattern of hot weather</b>		
Q1	<i>"Compare to the old-time, the weather condition now is not as cool, nor is the temperature at night. It's not comfortable... when I work in the daytime, it is tough, and I can't stop sweating."</i>	W 70
Q2	<i>"It's hot, very hot (all)... especially the recent hot weather... the hot weather came earlier than before... it used to come in June or July (now it's not yet mid-May)"</i>	W 65 and W 74
<b>Theme 1.2: Physical health</b>		
Q3	<i>(Interviewer: will you suffer from insomnia?) "Yes, I will. Since my apartment faces the West, the sun heats up my room very seriously during the daytime. We need to push back our bedtime until late at night, so we can save the spending on electricity, just turn on the fan to cool off the room. If it's too hot, we still turn on the air conditioner."</i>	W 50
Q4	<i>"When I am hot, my face feels like boiling, I cannot breathe normally and my heart beats very quickly."</i>	W 65
Q5	<i>"Especially walking with the mask on, I have difficulty breathing and get dizzy so easily."</i>	W 64
Q6	<i>"We collaborated with Personal Emergency Link Service; they informed us whenever there were seniors who pressed the emergency alarm... Sometime later we sensed that there seemed to be a trend, although we never really analyzed from data. We think [more seniors] reached out to seek help in heatwaves."</i>	M [DECC worker, exp 10 years]
<b>Theme 1.3: Mental health</b>		
Q7	<i>"Sometimes the hot sunlight annoys me, especially the air is still, I become impatience and easily irritated under this kind of weather."</i>	W 69
Q8	<i>"For example, when the weather is hot, our mood can be affected easily. When you get irritated, your blood pressure would go up... people can get irritated easily when feeling hot in the hot weather."</i>	W 63
<b>Theme 1.4: Reduced social activities</b>		
Q9	<i>"I will not leave home often during the summer, won't do it unless necessary."</i>	W 70
Q10	<i>"It must be (affecting me to see my friends or family). I won't leave home unless it's necessary, don't you think so? It's too hot."</i>	W 65
Q11	<i>"(Normally,) I will walk for an hour. If the weather today is as hot as yesterday, I will only walk for half an hour."</i>	M 72
<b>Theme 1.5: Not concerned about hot weather</b>		
Q12	<i>"I don't always turn on the electric fan, just use a handheld fan to cool down. I feel all right, not too hot. I seldom turn on the electric fan... I don't think it is that hot."</i>	W 80
Q13	<i>'Some elderly think they will catch a cold easily under the cold weather. However, when the weather is hot, it is unlikely to cause death or harm to their body... not as relevant compared to the cold weather, based on their experiences.'</i>	M [DC, exp 1 year]
Q14	<i>"I visited a client yesterday. I sweated profusely but my client looked calm. When he saw me wiped the sweat off, he asked, "Do I need to turn on the fan for you?"."</i>	M [DECC worker, exp 12 years]
<b>Theme 2: Adaptation appraisal</b>		
<b>Theme 2.1: Indoor strategies</b>		
Q15	<i>"When it is hot, I will turn on the air conditioning or electric fan... or take a shower... Usually, I will turn on the air conditioning at night and use the electric fan in the afternoon."</i>	W 63
Q16	<i>"The best way to do it is to open the windows and doors, not turn on the air conditioner... we always open the windows... when the windows are opened, the breeze can come into the apartment by the convection currents."</i>	W 70
Q17	<i>"I will take a shower twice, one in the morning, and another one at night. If it's too hot, I will take a third shower."</i>	W 68
Q18	<i>"We drink plenty of water during the summer."</i>	W 74
<b>Theme 2.2: Outdoor strategies</b>		
Q19	<i>"If I am going to do exercise in the morning, I will go early to avoid the hot sunlight, so not as hot."</i>	W 65
Q20	<i>"If the weather is hot, I will go out once in the afternoon and go to the supermarket to enjoy the air conditioning. Then, I will walk to other places and rest in between when the weather is too hot."</i>	M 61
Q21	<i>"Inside my backpack, there are a bottle of water, a parasol, a fan, a towel and miscellany. I always use the parasol when I walk and wipe away my sweat with the towel."</i>	W 67
Q22	<i>"They will hang around Wan Tau Tong Shopping Center and Uptown Plaza. There are plenty of seats and usually [the older adults] won't get driven out. But some older adults will spend the entire day there, from the morning to the evening... some older adults will come to our center and community halls."</i>	W [NGO worker B, exp years not available]

(Continued)



TABLE 2 (Continued)

Quote number	Quote	Participant characteristics*
<b>Theme 3: Enabling physical and social environment</b>		
Theme 3.1: Accessible public space with cooling features		
Q23	<i>"There is a banyan tree shade (at the park). The banyan tree has been there for a long time and is well-taken care of with pruning. It is cool, we do exercise over there as there are tree shade and a gazebo next to it. When it is raining, we will stand under the gazebo to shelter from the rain."</i>	W 67
Q24	<i>"The facilities are pretty good over there (Mui Shue Hang). It is a shaded area in the afternoon, no direct sunlight."</i>	M 67
Theme 3.2: Housing design		
Q25	<i>"My apartment is inside a hash-shaped building. It's comfortable, won't get too hot during summer and not too cold during winter. The apartment is faced to the southeast and is right across from the community hall. I have never turned on the air conditioner."</i>	W 84
Q26	<i>"Since I live in the corner flat inside a Y-shaped building (trident), I have extra three windows, so when I open the doors and the windows... because my flat is at the end of the corridor, the breeze can reach my flat through convection currents, so it is not very hot."</i>	W 63
Q27	<i>"Y-shape building, it is hard for the breeze to reach the center of the building."</i>	M [DC, exp 1 year]
Q28	<i>"When I stay home during the daytime, I usually don't turn on the electric fan. It is because my apartment is faced to the southwest, when I sit next to the window, I can feel the breeze coming through the window. It's quite comfortable."</i>	W 67
Q29	<i>"There is nothing I can do. Our apartment is faced to the west, the sun starts to shine on the apartment at noon until 5–6 pm. It is quite suffering... can't avoid the heat from the sun living in an apartment facing west."</i>	W 65
Theme 3.3: Channels to access hot weather information		
Q30	<i>"Something was shown on the television that said if a person stays under the sun for too long, it may cause dizziness and fall. It reminds people to be alerted of the hot weather today."</i>	W 70
Q31	<i>"From the television. There is a weather forecast on television that shows the temperature during the day and night. The weather forecast by the Hong Kong Observatory is quite accurate... it's pretty accurate, over 90% accuracy... won't say it is 100% accurate."</i>	W 68
<b>Theme 4: Perceived barriers to adaptation to hot weather</b>		
Theme 4.1: Economic concern		
Q32	<i>"We try to push back the time to turn on the air conditioner. For example, we will turn on the air conditioner when we are ready for bed. We won't turn it on beforehand because the cost of electricity is expensive."</i>	W 69
Q33	<i>"It is wasteful to turn on the air conditioner just for one person."</i>	W 65
Q34	<i>"I have come across clients who lived in squatters which was built from zinc and iron sheets. You could not imagine how they fare. It was hot outside – some 30 degrees, but even hotter inside – around 40 degrees. There were older adults who live in these kinds of places alone."</i>	M [DECC worker, exp 10 years]
Theme 4.2: Perspectives from Chinese medicine or general dislike of air conditioning		
Q35	<i>"When we go to see a doctor, especially in the perspective of Chinese medicine, they say it is not healthy to stay in an air-conditioned environment for too long. It may increase the risk of getting arthritis. So, it is better to avoid staying in that environment for too long. Even if you turn on the air conditioner to sleep, you will feel more tired the next morning."</i>	W 69
Q36	<i>"Elderly people believe in nature, or nature in the perspective of Chinese medicine. They believe the cool air from the air conditioner is not good for their health."</i>	M [DC, exp 1 year]
Q37	<i>"Older adults usually like to sit at the parks and socialize. I've once invited them to come to the community center because it was hot outside. But they seemed not interested in getting rest under air conditioning. They rather chose the park."</i>	M [NEC worker, exp 1.5 years]
Theme 4.3: Outdoor space not conducive to cooling		
Q38	<i>"So, I always stay home (when the weather is hot)... because it is too hot outside. There are many places without cover."</i>	W 69
Q39	<i>"The shopping malls here are too small to walk around... But the malls don't provide seats as well... you can only walk or stand."</i>	W 62
Q40	<i>"Before the renovation of the Tai Wo Market, there were seats provided for people to rest. Now, the seats are removed after the renovation and due to infection control. There are not many places left for them to hang out, only at the restaurant, but can't stay long."</i>	W [NGO worker A, exp years not available]
Theme 4.4: Lack of discussion in the public discourse		
Q41	<i>"I really don't know (there are heat shelters nearby), even though I have been living here for a long time."</i>	W 65
Q42	<i>"Under the extremely hot weather, I believe no one goes to the heat shelter. Elderly people don't prefer to go there to rest because there is nothing inside. How do you ask people to stay there?"</i>	W [NGO worker C, exp years not available]

(Continued)

TABLE 2 (Continued)

Quote number	Quote	Participant characteristics*
Q43	<i>"I think the news has reported heat-related issues, but not much about how hot weather could negatively affect our bodies. So, elderly people are not aware of this issue."</i>	W [NGO worker C, exp years not available]
<b>Theme 5: New services that could be implemented</b>		
Q44	<i>"Since last year, we have been planning some pool activities for our clients in the community swimming pools – it was fun for cooling."</i>	W [DECC worker, exp 12 years]
Q45	<i>"Our community center this year also plan for opening also during weekends and public holidays... so that they could come hang around and enjoy air conditioning, or they could enjoy intergenerational activities with their grandchildren"</i>	M [NEC worker, exp 3.5 years]
Q46	<i>"As we have experienced the pandemic of COVID-19, we would notify the members through WhatsApp, which is widely used nowadays, about 60% of the members are covered and they are used to receive our message. This could serve as an alarm system for heatwaves in the future."</i>	W [DECC worker, exp 12 years]

\*Men (M)/Women (W); numbers are age in years unless otherwise specified; district councilor (DC); worker from district elderly community centers (DECC)/neighborhood elderly centers (NEC)/non-government organization (NGO); experience (exp) in years.

(Q46). Taken together, solutions that are creative and without additional manpower and financial resources are urgently warranted.

## 4. Discussion

### 4.1. Summary of findings

This study provides insights into the perception and awareness of extreme hot weather among the older adults in a north-eastern neighborhood in Hong Kong and how these older adults adapt to the hot weather and the possible barriers that they face. It was agreed upon among the participants that the weather in recent years has become increasingly hot and this led to some health and social problems for them, although some participants perceived that hot weather did not have any impact in their daily lives and they were not vulnerable. Despite the seriousness, the heat-health issues so far have not received proportionate attention in the public domain. Public education in this regard has been sparse. From the service providers' point of view, there is also a lack of relevant community services or support for older adults in hot weather. However, the older adults we interviewed were generally flexible and adapting to the increasingly hot weather with their own means, albeit their conception about air-conditioners from the Chinese medicine point of view might have limited their use. Indoor environment and community facilities are important resources for older adults to adapt to hot weather.

### 4.2. Comparison with previous studies

Our findings that some older adults perceived that hot weather did not constitute a health concern and that they are not vulnerable groups are consistent with previous findings in Western settings (35, 44). There could be two reasons for this finding. First, understandably, some participants noted that they endured intense manual labor jobs in the pre-air-conditioned era, further strengthening the belief that they were well in control of their health and adaptation was not necessarily. Second, older adults might be less likely to adopt adaptive behaviors given their physiological decline following the natural process of aging such that they become less sensitive to ambient temperature and thirst (14). We also highlighted

that extreme hot weather affects older adults' mental health when some participants reported that they felt more anxious when the weather is hot and such weather conditions limited their social and physical activities, which was similar to what was reported in a previous study in Adelaide of Australia (45).

Overall, the older adults who we interviewed mostly agreed that the changing climate increasingly become a problem to them, and they were reasonably flexible to adapt. A previous local cross-sectional study reported that perception of risk of extreme hot weather is not related to the utilization and ownership of cooling devices in the Hong Kong population (38). Our study corroborated by showing that almost all the older participants we interviewed owned air-conditioners, but they are more reluctant to use them. Although the use of air-conditioners has been considered as one of the strong protective factors against heat-related illnesses (46), its use could be limited especially in older adults given the concern for the cost of electricity, a finding which is consistent with a previous qualitative study conducted in a sample of older adults in Australia (47). This is perhaps partly reflective of the relatively lower socioeconomic status of our participants, who mainly lived in public housing estates, compared to the rest of the Hong Kong population.

We found that our participants often reported that they reduce the frequency of going out when the outdoor temperature, as informed by the media, is hot. This is opposite to what was reported in a small study with 29 older adult households of Detroit of the United States (48). Using hourly logs to record the participants' behaviors, White-Newsome and colleagues (48) reported that the older adults were more like to go outside of their places of residence when outdoor temperature increased. This is perhaps because the building density of Detroit is less than that of Hong Kong, resulting in a less intense urban heat island and greater thermal comfort even amidst the heat. Reduced ventilation in typical residential neighborhoods in Hong Kong also discourages outdoor activities.

### 4.3. Policy implications

Heat action plans are now common in many developed countries (21, 49). However, the perspectives of public health were not

integrated in the current climate action plan even given mounting local and international evidence of the heat-health relationship. Currently, the HKO issues VHWW signal to alert the public and, accordingly, the Home Affairs Department operates temporary night-time heat shelters when such warning is hoisted. The night-time heat shelters only seemed to have lukewarm reception in the public because they are usually situated not according to the geographical distribution of urban heat hazard spots (50) and there are no meaningful activities to engage their users, discounting the usefulness and attractiveness of these centers. It is welcome to see that, as of recently, the HKO added messages along with the VHWW signal to remind the public to take particular care of older adults and other vulnerable groups in the case of heat. However, other than that, as noted by our community service providers in this study, the discussion of the heat-health issue has only very recently started to gain traction in the public discourse. The Hong Kong government recently published the Climate Action Plan 2050, which proposed that as a part of the plan to mitigate urban heat, the government will work to improve building design and increase urban vegetation. However, little was discussed on how to prepare the local community to become more aware and prepared for the future climate scenario. Resources are often available in the community, but there is a lack of ingenuity and collective will to integrate and coordinate these resources into helping especially the vulnerable groups to adapt to extreme hot weather. For instance, several of our older adults participants and community service providers opined that publicly air-conditioned spaces in Hong Kong such as shopping malls can provide a cool environment for the older adults without the worry of costs of electricity. Unlike in other settings, these public spaces in Hong Kong are often within walkable distances within a community hence the older adults can reach easily (47). Nonetheless, it was mostly agreed upon by our participants that these spaces often lack places for older adults to sit and relax.

Contextualizing the heat-health issue in the older population entails an understanding of the underlying social, cultural, and institutional factors. It is therefore context-specific for the older adults in Hong Kong to believe that the use of air-conditioners has implications to their health from the angle of Chinese medicine, as discussed by some of our participants. Such aversion could have stemmed from the idea that “nefarious Wind” could cause “disharmony” in the body and causes symptoms generally called “external wind cold” such as headaches, generalized aches and runny nose (51). While part of it could be related to influenza-like illnesses, this conception could affect older adults’ attitude to use air-conditioners. It is therefore suggested that when formulating heat-health messages to the older adults in Hong Kong or more broadly the Chinese community, a wide variety of alternative strategies could be suggested in addition to the use of air-conditioners such that older adults could be provided with ample choices of strategies to adapt.

In addition to public air-conditioned spaces, as our participants noted, another indoor space that was deemed to be an important shelter from heat is their homes. Compact living spaces in high-rise buildings is one of the unique characteristics of urban configuration of Hong Kong, which often linked to poor thermal comfort resulting from intense solar radiation, poor ventilation, and the slow release of heat from building materials, particularly during intense heat in summertime (52). As a matter of fact, air conditioning at home still remains a major solution for older adults to relieve from heat. It is welcome to see local charities started community initiatives to

subsidize electricity bills for older adults who are financially incapable (53). The government could also consider the possibility of formal subsidy for electricity for needy older adults during hot seasons or minor home modifications to improve indoor thermal comfort. However, in the long run, our city has to adopt of adaptive design following the future climate scenario. Strategies such as using higher albedo materials covering urban built surfaces (e.g., building ceilings or pavements), facilitation of air turbulence within a community or incorporation of blue-green spaces were all proven to bring better thermal comfort for urban dwellers (54). The use of air-conditioning could therefore be minimized.

Our interviews revealed that the community service providers were in general not well equipped with heat-health knowledge. This is in line with the lack of public discourse and could potentially explain a lack of coordinated and targeted efforts to mitigate the heat situation faced by the older adults. Empowering the frontline workers of DECC and NEC in Hong Kong as well as the district councilors will constitute a salient strategy as they have expansive reach to older adults in the community. Reaching out to particularly vulnerable targets, such as those living in inadequate housing, living alone or those with dementia, will be essential. Creative strategies such as texting picture reminders to their clients will also be potentially helpful.

#### 4.4. Strengths and limitations

The current study has recruited both older adults and frontline workers in the community, who have enriched our insights from the angle of service providers in addition to the subjective experience of the older adults. Our interviews were conducted in summertime such that the participants did not have to rely on memory to recall the experience of hot weather. However, the current study has limitations. First, our older adult participants were mostly sampled from the two designated public housing estates in Tai Po district. Our sample and hence their opinions might not be representative for older adults in other housing types and from other districts. Future studies could consider recruiting samples from other districts in Hong Kong to confirm the findings in this study. However, in a broader sense, this sample of participants were knowledgeable about the climatic conditions on a neighborhood scale. The meanings and processes of everyday lives in the midst of extreme hot weather expressed by the participants would therefore be relevant to other highly dense urbanized settings. Second, the convenience sampling nature of our study implied that our sample was only constituted of subjects who were more aware of the issue of heat than the general population. Future quantitative studies, such as a territory-wide questionnaire, could confirm the extent to which the older population are aware of the heat-health issue. Third, our sample was only limited to those who were able to independently walk to the community center, which rendered us unable to assess the views of those most vulnerable to heat.

#### 5. Conclusions

Our findings showed that older adults in Hong Kong are concerned that extreme hot weather constituted a surging problem for them physically, mentally and socially. While some of the older

adults we interviewed were reasonably flexible and adaptive, some others believe that there is no need to adapt, which could be problematic in the long run as the future climate scenario continues to unfold. Discussions and education effort regarding the heat-health issue in the public domain remain scarce. Multilateral efforts are urgently needed to co-create a heat action plan to improve community awareness and resilience.

## 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 Survey and Behavioral Research Ethics Committee of the Chinese University of Hong Kong. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

EL, KL, and JW conceptualized the study. EL, PC, and KL coordinated the recruitment of subjects and supervised the data transcription process by research assistants. EL, PC, KC, and MK conducted the data analysis, synthesized the findings, reviewed the literature, and wrote the manuscript. All authors participated in critically reviewing and intellectually input to the drafts of the manuscript. All authors contributed to the article and approved the submitted version.

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2023.1056800/full#supplementary-material>



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# Implementation and evaluation of a model-based risk management process and service enhancement for home-based community care services amidst COVID-19 pandemic in Hong Kong: A mixed-method approach

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**Background:** The COVID-19 pandemic has greatly challenged all public social services, particularly home-based community care services (HBCCS). Aberdeen Kai-fong Association (AKA) is a non-government organization (NGO) in Hong Kong that systematically manages the challenges to HBCCS. This paper presents a practical example of the implementation and evaluation of the risk management process for HBCCS.

**Methods:** Mixed-method design was used to evaluate the implementation of the risk management process in encountering the challenges from existing and potential problems to maintain and enhance HBCCS in four major areas amidst the pandemic. A cross-sectional questionnaire survey and three qualitative focus group interviews were conducted by AKA from 30 December 2021 to 12 March 2022 to collect staff feedback on the institutional risk management process in four areas.

**Results:** 109 HBCCS staff members (69% aged 40 years or above; 80% female) completed the questionnaire survey. For resource arrangement and staff training, over 90% of the participants agreed (including strongly agreed) that they had sufficient and reliable personal protective equipment and clear infection control guideline and effective training. Over 80% agreed they had safe working space and effective manpower allocation. However, only 75% agreed they had received emotional support from the organization. Over 90% agreed that the basic services were maintained for service continuation and enhancement, the service users and their families trusted the organization, and the provided services were adjusted according to users' needs. 88% agreed that the organization had obtained support from the neighborhood. For communication among stakeholders, over 80% agreed they had open discussions with the senior management team, and the senior management team was willing to listen. Twenty-six staff members joined the three focus group interviews. The qualitative findings corroborated the quantitative results. Staff appreciated the organization's work to enhance staff safety and continue advancing services during this difficult period. Regular in-service training, updated information and guidelines to staff, and proactive phone calls to service users, especially the elderly, were suggested to enhance the quality of services.

**Conclusions:** The paper could help NGOs and others encountering management challenges in community social services in diverse settings amidst the pandemic and beyond.

#### KEYWORDS

risk, management, COVID-19, service enhancement, non-government organization, social service, home-based, community services

## Introduction

The COVID-19 pandemic has brought unprecedented and great challenges to all public social services. A good risk management process is vital for organisations' and sectors' service maintenance, enhancement, and assurance. Home-based community care has played a crucial role throughout the pandemic, meeting the most urgent social needs of vulnerable groups, such as the elderly and disabled. Effective and efficient risk management strategies can help organizations identify problems, analyse the needs and risks early, prioritize services, and act appropriately and promptly.

Global life expectancy has increased with modern medicine and technological advancements (1, 2). The aging population has led to an unprecedented rise in demand for healthcare and social services. To meet the caring needs of older people with multiple health problems and complex conditions, the Hong Kong SAR Government provides a range of home-based community care services (HBCCS), such as personal care, nursing care, rehabilitation services, meal and household cleaning services, carer support and emergency assistance through non-governmental organizations (NGOs) (3). These services aim to facilitate service users to continue living in the community for as long as possible, maintain their optimal level of function, improve their quality of life and ease the burden of services (3).

The Aberdeen Kai-fong Welfare Association Social Service (AKA) is one of the 61 non-government organizations (NGOs) running HBCCS. AKA provides a wide range of services, including home care, nursing and rehabilitation services for elders, people with disabilities and families in need in the Southern District of Hong Kong (4). Their goal is to facilitate this group of people and their carers to keep living in their community with dignity while receiving appropriate care. Furthermore, it incorporates a partnership with the neighborhood and local organizations to supplement the services and benefit the service users.

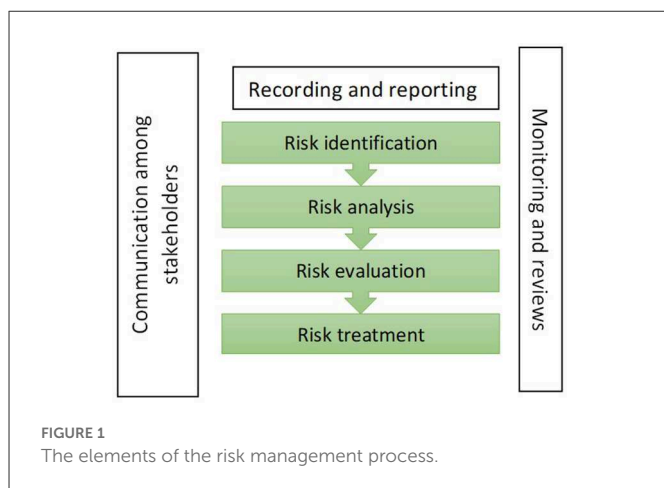
Hong Kong has experienced five waves of COVID-19 since December 2019 (5). By adopting the zero-COVID policy, the pandemic had successfully controlled with decisive border control, strict quarantine, and social isolation measures in the first four waves throughout the 2 years of 2020–2021 (6–9). Hong Kong reported fewer than 13,000 confirmed cases and 211 cases of death (10). However, the highly transmissible Omicron variant started the fifth wave in January 2022, and the number of confirmed cases escalated drastically (10). Over 42,000 confirmed cases were reported daily, with over 7,000 cases of COVID-19-related deaths during the peak of the fifth wave in March 2022 (11).

During the pandemic, the first and fifth waves are the most difficult periods for local citizens and social service providers because of resource constraints, social distancing measures and

the reduction of public services to limited essential services and immediate suspension of face-to-face services. These brought enormous demands and burdens on health and social services and traumatic economic impacts (12, 13). The deteriorating social situations, such as expensive personal protective equipment (PPE), insufficient COVID-19 test kits, panic-buying of daily necessities, long queues for compulsory COVID-19 testing etc., have brought a tremendous threat to the daily living of residents (14, 15). As a result, the demands for HBCCS services dramatically increased, and organizations needed to adapt to the frequent infection control and related policy changes and adjust their services to meet the needs of their service users. Another major issue was the shortage of manpower in HBCCS providers. To control the spread of the virus, close contacts of COVID-19 patients were quarantined in quarantine centers or required to home quarantine for seven to 14 days, which varied during different phases of the pandemic (10). Therefore, many organizations did not have sufficient manpower to maintain their essential services when staff members were infected or quarantined.

The International Organization for Standardization (ISO) is a worldwide federation of national standards bodies which promotes using the risk management process to identify, analyse, and evaluate existing and potential problems and risks, and to effectively manage challenges and provide proactive measures in maintaining the services (16). Figure 1 shows the elements of the risk management process (16). Risk is defined as the effect of uncertainty on objectives (16). The risk management process is “a process that involves the systematic application of policies, procedures and practices to activities of communicating and consulting, establishing the context and assessing, treating, monitoring, reviewing, recording and reporting risk” (16, 17). The process includes risk identification, analysis, and evaluation to assess all sources of risk and risk treatment to handle and control the risks (16, 17). The processes are supported by effective communication and consultation, detailed recording and reporting and continuously monitoring and reviews (16, 17). Communication among stakeholders and professional consultations help stakeholders understand the identified risks and make decisions with relevant evidence. Through systematic risk management practices, a risk management culture can be developed within the organization in monitoring and managing risk, and the governance and performance of the organization can be improved (16, 18, 19).

We searched “PubMed” and “Social Service Abstract Search” for those articles published from 2020 to 2022 on 6 Jan 2023. Four groups of keywords were selected for searching relevant studies. The first set was a specific phenomenon “COVID-19.” The second set was the targeted population “Home-based care,” the third set was intervention “risk management” and the fourth set was the



outcome “staff’s experience/satisfaction.” It yielded 91 citations from the databases; none were duplicated records. Of the 91 studies, 18 were removed because they were literature reviews, conference proceedings, commentary, instructional materials, or guidelines, 60 were removed after the title and abstract screening, and one was removed after reviewing the content. Twelve studies reported the risk management support to home-based community care staff during the COVID-19 pandemic, including six studies with qualitative feedback (20–25), four studies with quantitative feedback (26–29) and two studies with mixed method (30, 31). Of these, three studies reported limited access to personal protective equipment (PPE) for home care staff and their service users in the early phase of COVID-19 and unclear guidelines on infection control (26, 27, 29). Halcomb et al. (27) addressed the insecure working atmosphere of primary healthcare settings in Australia at the start of the pandemic. Lethin et al. (26) reported how community organization support affected the mental health of home care staff in four European countries. Many healthcare activities were stopped because of social isolation measures (20, 23, 25, 28). Five studies (22–25, 29) reported telemedicine as one of the strategies for maintaining the home-based primary care service and its challenges, such as technical difficulties in approaching patients amidst the pandemic. Researchers also stated how community health workers adjusted the services to meet their needs, such as arranging case management outreach, coordinating elderly services and providing assistance to secure the basic needs of their home-based community care services (20, 21, 28, 30, 31). Mulligan et al. (31) evaluated the client satisfaction with mental health interventions, such as stress management, sleep hygiene etc. de Vries et al. (30) reported the mental distress of vulnerable groups and health professionals, and physical distancing affected the quality of life, mobility, and safety amidst the pandemic.

This paper aims to offer a practical example of multi-sector collaboration led by AKA and the mixed-method evaluation of the risk management process. Our research question was, “Did AKA HBCCS eligible staff agree that the risk management and service enhancement measures were effective?”. Besides, this paper demonstrates a step-by-step risk management process to manage COVID-19-related challenges and provides actionable suggestions for staff-centered training and service enhancement. The results might also help improve the effectiveness of the risk management process.

## Implementation of the risk management process

AKA used a modified ISO theoretical framework to implement a risk management process, including risk identification, analysis, and evaluation (32) to systematically encounter the challenges and potential problems at three (personal, interpersonal and institutional) levels in four major areas amidst the COVID-19 pandemic. The four major areas were: “Staff training and support” at the personal level, “Communication among stakeholders” at the interpersonal level, and “Space and resource” and “service continuation and enhancement” at the institutional level.

Table 1 shows the risk management process in four major areas of HBCCS in AKA during the pandemic. The four areas include (i) space and resources to prevent the spread of COVID-19; (ii) staff in-service training and support to promote professional knowledge and psychological support to enhance the institutional working atmosphere and staff morale; (iii) service continuation and enhancement, to continuously provide services to meet physical and psychosocial needs of their service users; and (iv) communication among stakeholders, to meet all relevant stakeholders regularly to listen to their voices, seek expert advice, connect with regional neighborhood organizations, institutions and local leaders and ask for collaboration, if necessary.

## Space and resource arrangement

To prevent the spread of COVID-19, the Government has imposed a series of preventive measures, including social distancing, suspension of non-essential services and closure of many public facilities, a vaccine pass scheme and compulsory testing at different periods during the pandemic. Despite the suspension of the non-essential services, the core services of HBCCS, like basic personal and nursing care, meal delivery and escorting services, must be maintained. Since the community hall of AKA had to be closed, AKA needed more space to provide infection control training to staff and volunteers. In this regard, AKA liaised with neighbor institutions, like the nearby schools to lend their classrooms (when school teaching was suspended) for infection control training. Moreover, to minimize the risk of virus exposure, AKA assessed the work arrangements among staff. The clerical support staff were arranged to work from home, and staff of home-based services were divided into sub-groups and located in different offices to reduce clustering.

Another major issue was a manpower shortage. Because of the rapid escalation of the confirmed cases, one-third of the HBCCS staff members could not work because of getting infected and mandatory quarantine. As the day-care center service was forced to be suspended, AKA allocated staff to those departments with insufficient manpower. Through interdepartmental collaboration, the organization had overcome much of the threat of manpower shortage.

## Staff in-service training and support

To continue the HBCCS, AKA recognized that the frontline staff might have a higher risk of exposure to COVID-19, especially

**TABLE 1** The risk management process in four areas of home-based community care services in AKA amidst the COVID-19 pandemic.

Area	Risk identification, analysis and evaluation	Risk treatment
1. Space and resource	<ul style="list-style-type: none"> <li>• Inadequate space to provide infection control training for staff and volunteers</li> </ul>	<ul style="list-style-type: none"> <li>• Liaised with nearby schools to use their classrooms for infection control training</li> </ul>
	<ul style="list-style-type: none"> <li>• Insufficient working space for staff which increased the risk of clustering</li> </ul>	<ul style="list-style-type: none"> <li>• Arranged clerical support staff to work from home</li> <li>• Home-based frontline staff were divided into sub-groups and relocated to different offices.</li> </ul>
	<ul style="list-style-type: none"> <li>• Shortage of manpower</li> </ul>	<ul style="list-style-type: none"> <li>• Allocated some staff members from other departments to those with insufficient workforce.</li> </ul>
2. Staff in-service training and support	<ul style="list-style-type: none"> <li>• Frontline staff were required to have home visits; they had a higher risk of exposure to COVID-19</li> </ul>	<ul style="list-style-type: none"> <li>• Regular infection control training and individual consultation</li> <li>• Provided showering facilities for staff after home visits</li> <li>• Sought expert advice from the infection control team of clinical partners</li> <li>• Delivered updated infection control guidelines to staff</li> </ul>
	<ul style="list-style-type: none"> <li>• Increased stress from frontline staff</li> </ul>	<ul style="list-style-type: none"> <li>• Purchased and delivered healthy foods and personal care products for free, e.g., air purifiers, to frontline supporting workers</li> </ul>
3. Service continuation and enhancement	<ul style="list-style-type: none"> <li>• Some service users and disadvantaged families did not have a quick and adequate supply of PPE</li> </ul>	<ul style="list-style-type: none"> <li>• Arranged volunteers to pack and deliver the personal protective equipment and delivered it to their service users for free, resident organizations and churches to support the community</li> </ul>
	<ul style="list-style-type: none"> <li>• Some service users lacked access to daily necessities because of the panic buying and hoarding of the public</li> </ul>	<ul style="list-style-type: none"> <li>• Served as a purchasing agent and delivered the daily necessities by staff and trained volunteers</li> <li>• Delivered the care packs to vulnerable people in the community by connecting with local leaders</li> </ul>
	<ul style="list-style-type: none"> <li>• Some service users could not maintain household hygiene</li> </ul>	<ul style="list-style-type: none"> <li>• Collaborated with AKA's corporate partners to provide free disinfection cleansing service to their service users</li> </ul>
	<ul style="list-style-type: none"> <li>• Some service users were unable to queue for long hours for the COVID screening</li> </ul>	<ul style="list-style-type: none"> <li>• Arranged special escort service for vulnerable groups</li> <li>• Provided delivery service to send specimens for COVID screening</li> </ul>
	<ul style="list-style-type: none"> <li>• Social distancing policy affected the mental health of the elderly</li> </ul>	<ul style="list-style-type: none"> <li>• Arranged volunteers to make regular phone calls to service users and vulnerable groups</li> <li>• Taught older adult service users to use online social media</li> </ul>
4. Communication among stakeholders	<ul style="list-style-type: none"> <li>• Uncertain of the effectiveness of the risk management measures</li> </ul>	<ul style="list-style-type: none"> <li>• Consulted professional parties and mid-level managerial staff</li> <li>• Arranged regular department meetings to meet with different levels of staff to collect their feedback</li> <li>• Connected with district neighbor associations and institutions, including nearby schools, and local leaders, for further collaboration</li> </ul>

for those who did home visits. To enhance the awareness and knowledge of COVID-19 and self-efficacy of self-protection, the organization conducted infection control training regularly and provided individual consultations to staff and volunteers as needed. The training and support helped equip staff and volunteers to deal with uncertain situations during service delivery. Moreover, AKA provided showering facilities after home visits to protect their staff. AKA sought expert advice from the infection control team of their clinical partners, monitored the local situations closely and delivered the latest infection control guidelines to protect the health of the staff. Despite providing PPE and infection control training to staff to minimize the risk of infection, some staff still had varying degrees of worriedness and fear of being infected. To strengthen staff morale and show care and concern to frontline supporting staff, AKA purchased and delivered healthy foods and personal care products, for example, air purifiers, to them as compliments, which positively reinforced the organization and staff commitment to persevere in serving the public.

## Service continuation and enhancement

Due to the massive local and global shortage of PPE, such as surgical masks and COVID rapid test kits (33, 34), AKA purchased PPE swiftly and delivered them to their service users for free. Besides, AKA noted that some low-income and disadvantaged families might also lack surgical masks and hygiene products. AKA arranged volunteers to pack the PPE and deliver them to the local community, including disadvantaged families, schools, churches, etc., to support the community in fighting the pandemic.

Apart from PPE, in the early stage of the pandemic, the Hong Kong public were panic buying and hoarding daily essentials and hygiene products, such as toilet paper, rice and bleach (15, 35). Such panic was more serious in the aged and disabled. Thus, AKA provided a special service to help with shopping and daily necessities. Furthermore, considering the lack of support for the vulnerable people, AKA also delivered the care packs, including bleach, detergent, liquid soap etc., to them *via* the local leaders. The



local leaders were familiar with the deprived groups, particularly those living in the squatter areas in the districts, and they were most helpful.

Given the restrictions of social distancing, AKA recognized that some service users might be unable to maintain household hygiene. AKA collaborated with its corporate partners to provide free disinfection cleansing services to their service users, particularly the disadvantaged elders and families in the community.

Because of the compulsory test regulation, the Government requires any person present at designated places during the specified period to undergo a COVID-19 nucleic acid test. Some of the elderly were living alone or were disabled, so they could not queue for long hours for the mandatory COVID-19 screening. AKA arranged a special escort service for these service users to comply with the law. AKA also arranged delivery services, such as specimen collection packs and specimens after collection, to service users who needed to collect and send deep-throat salivary specimens for compulsory tests.

Due to the social distancing policy, many older people's mental and physical health were adversely affected. Therefore, AKA arranged two teams of volunteers to show their care and concern for their service users, vulnerable people, and their families. First, AKA arranged a team of trained volunteers to make regular phone calls to the service users and vulnerable groups to show their concerns and help identify any issues or problems that they needed help. They also made referrals to other organizations and followed up when necessary. Second, AKA arranged a team of youth volunteers to teach the older adult service users to use online social media to help them stay connected with relatives and friends and community service organizations, including AKA.

## Communication among stakeholders

Effective communication and consultation are crucial to improving the staff's understanding of risks and management processes. Regular department meetings were held, with formal and informal contacts with different levels of AKA staff to collect their feedback and opinions and establish organization rapport. AKA also established connections with district neighbor associations, institutions, and local leaders, facilitating collaboration and mutual help.

## Methods

### Study design

We used a mixed-method approach to evaluate the effectiveness of the risk management process and service enhancement measures in four major areas by conducting (i) a cross-sectional self-administered questionnaire survey and (ii) three focus group interviews.

### Recruitment procedures

A self-administered questionnaire was distributed to staff from 30 December 2021 to 28 February 2022 to collect feedback on the risk management measures. Participation was voluntary.

**TABLE 2** The semi-structured interview guide for focus group interviews.

1.	How the COVID-19 pandemic affects your work? Especially when the protective resources were severely insufficient, what was your feeling during that moment?
2.	Any special needs from the service users? How do you respond to their needs?
3.	What are the challenges at work? How do you solve these challenges?
4.	In your experience, have you ever cared for service users who suffered from COVID-19? If yes, can you please share your experience?
5.	How do you comment on the risk management measures of the organization during the pandemic?
6.	How was the service affected during the pandemic?
7.	Did you ever feel stressed during the pandemic? Why?
8.	Please tell me what support you need at work.

Invitations were sent to all HBCCS staff for the focus group participants, and they could join the focus group interviews voluntarily. The focus group interviews explored social workers' individual lived experiences in a group context, which might provide a greater understanding of the phenomenon under study. The Zoom interview link was sent *via* email or WhatsApp to those who agreed to join the online focus group interviews. Three 1.5-hour online focus group interviews were conducted on 23 Feb 2022 (2 groups) and 10 Mar 2022 (1 group). The interviews were moderated by the first author (CY), a university academic in nursing with a Master's degree in Nursing and over 20 years of clinical nursing and teaching experience. CY was responsible for asking questions using a semi-structured interview guide (Table 2). The last author (AL), another university academic in nursing and behavioral scientist with two doctoral degrees in Nursing and Public Health and over 20 years of clinical nursing and teaching experience, was responsible for monitoring participants' responses and ensuring active participation. A research assistant with a master's degree in applied psychology was responsible for taking notes during the interviews to record important points. The focus group interviews were tape-recorded and transcribed verbatim. Questions were structured chronologically to aid recall and were phrased to provide scope for additional areas to emerge. The questions focused on staff's experiences with COVID-19, particularly the challenges at work and support needs amidst the pandemic in Hong Kong in the past 2 years.

### Participants

All HBCCS staff from the AKA Social Service were invited to join the study. The inclusion criteria were: (i) aged 18 years or older, (ii) able to read Chinese and speak Cantonese. The exclusion criteria were: (i) non-HBCCS staff of AKA and (ii) those who cannot read Chinese and speak Cantonese. The ethical approval of this study was approved by the Institutional Review Board (IRB) of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (HKW IRB reference number: UW21-781). Written informed consent was obtained.



## Measures

### The survey

The research team designed an outcome-based questionnaire in Chinese, including two experienced social workers (AW and MC) and two academics with extensive experience in conducting service and training evaluations. We invited two AKA HBCCS frontline staff to answer and comment on the draft and then modified the questions according to their feedback to ensure the adequacy and understandability of the questionnaire.

Participants were asked to indicate the extent of agreement with statements in the four areas of risk management by using a six-point Likert scale, ranging from “1 = strongly disagree” to “6 = strongly agree.” A higher score indicates greater satisfaction. The four areas of risk management measures were:

(i) **Space and resource arrangement:** Three statements were on the supply of PPE, the arrangement of a safe working venue, and the manpower allocation (for example, “The organization provided reliable and effective personal protective equipment.”)

(ii) **Staff in-service training and support:** Three statements were on the infection control training, guidelines and institutional support to staff (for example, “The organization provided emotional support and encouragement to staff.”).

(iii) **Service continuation and enhancement:** Five statements were on the sustainability and enhancement of services, including service maintenance, trust from service users and their families, adjustment to user-orientated service, encounters of service users’ needs and support from the neighborhood (for example, “The organization adjusted the home care services based on the needs of the service users.”).

(iv) **Communication among stakeholders:** Two statements were on the communication within the organization throughout the risk management process (for example, “The senior management team is willing to hear the feedback from staff.”).

The survey also included five items on demographic information: sex, age, education level, years of service in social services and their role in the organization.

### The focus group interviews

Two researchers (CY and AL) trained in qualitative methods conducted focus group interviews on 7–10 participants using a semi-structured interview guide and Zoom video conference software. The interview questions focused on (i) how the pandemic affected their work, (ii) the risks that they experienced at work, (iii) comments on the risk management measures of the organization, and (iv) what their support needs are.

## Statistical analysis

### Data analysis

All statistical analyses were performed with SPSS for Windows (version 28). Participants with missing data were excluded. Data were presented in frequencies and percentages, and continuous data were presented as mean and standard deviation. Chi-squares test was used to assess any difference in staff characteristics between those who joined and those who did not join the focus group interviews.

For the focus group interviews, all contents were audio-taped and transcribed verbatim in Cantonese to capture every nuance of expressions unique to the dialect. At least (10%) of the transcripts were checked against the recordings. Two project team members who had attended all the interviews processed coding. Transcripts were analyzed by thematic content analysis, following the guidelines recommended by Morse and Field (36). Each transcript was analyzed sentence by sentence and coded for the participants’ meanings.

### Techniques to enhance trustworthiness

Different strategies were used to enhance the trustworthiness of the findings, including credibility (the truthfulness of data), dependability (the stability of data), confirmability (the congruence of data) and transferability (the applicability of data). To enhance study credibility, member checking was conducted by asking participants (one respondent from each focus group interview) to review the transcripts from interviews they participated in and give feedback on emerging interpretations to ensure a good representation of their realities. Two researchers analyzed each interview. Peer debriefing was then held to review the consistency of identified information with other co-investigators. To enhance study dependability, the description of the coding and the descriptions of themes were checked and reconfirmed by a research staff member who was not involved in data collection. To promote study confirmability, an audit trail was conducted by making field notes when conducting interviews to allow tracing of the course of work. Moreover, we reported the study design details, investigators’ characteristics, participants’ characteristics, sampling strategies, data collection and analysis procedures to promote study transferability.

Mixed-method triangulation design was used to interrelate and interpret the qualitative and quantitative data to validate the results (37).

## Results

All 119 AKA HBCCS eligible staff were invited to join the study. Three refused to join. One hundred and sixteen staff signed the consent form and completed the questionnaire. Eight did not provide complete data and were excluded. Those who agreed to participate in the survey were invited to join the focus group interviews. Finally, 26 joined the focus group interviews.

### Participants

Table 3 shows that 80% were female, 69% were aged 40 years or above, and 69% had secondary or below education. 76% were supporting staff (care workers or health assistants), and 25% were professional staff (social workers, nurses, physiotherapists, and occupational therapists). 55% had worked in community care settings for 5 years or more. Of the 26 (77% female and 73% aged 40 years or above) who joined the focus group interview, 69% were supporting staff, and 58% had working experience in HBCCS for 5 years or more. We found no significant differences in demographic characteristics between those who joined and did not join the focus group interviews.

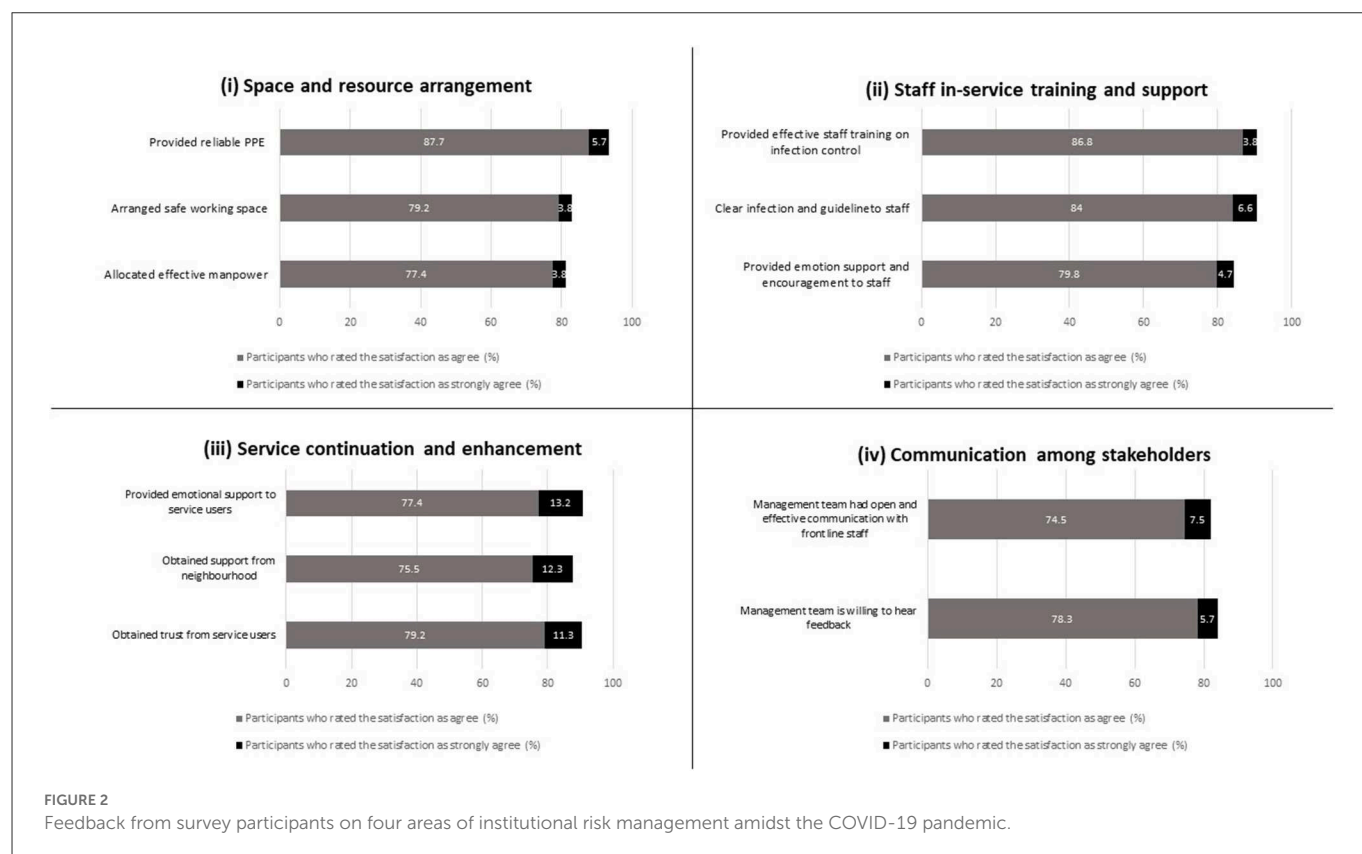
TABLE 3 Characteristics of survey participants.

	All ( <i>n</i> = 109)	Joined focus group ( <i>n</i> = 26)	Did not join a focus group ( <i>n</i> = 83)	<i>P</i> -value
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	
Sex				0.67
Female	87 (79.8)	20 (76.9)	67 (80.7)	
Male	22 (20.2)	6 (23.1)	16 (19.3)	
Age group				0.29
18–40 years	34 (31.2)	7 (26.9)	27 (32.5)	
40 years or above	75 (68.8)	19 (73.1)	56 (67.5)	
Educational level				0.66
Secondary school or below	75 (68.8)	15 (57.6)	60 (72.3)	
University level or above	34 (31.2)	11 (42.3)	23 (27.7)	
Roles in the organization				0.41
Supporting staff <sup>a</sup>	80 (75.5)	18 (69.2)	62 (74.6)	
Professional staff <sup>b</sup>	26 (24.5)	8 (30.8)	18 (21.6)	
Years of service in community care				0.07
Below 5 years	49 (45.0)	11 (42.3)	38 (45.7)	
Five years or above	60 (55.0)	15 (57.7)	45 (54.3)	

<sup>a</sup>Supporting staff included care workers and health assistants.

<sup>b</sup>Professional staff included social workers, nurses, physiotherapists, and occupational therapists.

Chi-square test by *P*-value for the difference between 2 groups.



**TABLE 4** Mean scores on the extent of agreement on risk management measures amidst the COVID-19 pandemic ( $n = 109$ ).

		All participants ( $n = 109$ ) Mean $\pm$ SD
<b>Space and resource arrangement</b>		
1.	The organization provided reliable and effective PPE.	4.99 $\pm$ 0.35
2.	The organization arranged a safe working space for staff to work.	4.83 $\pm$ 0.55
3.	The organization allocated the workforce effectively to maintain the service.	4.83 $\pm$ 0.48
<b>Staff in-service training and support</b>		
1.	The organization provided effective infection control training to staff.	4.94 $\pm$ 0.36
2.	The organization had clear infection control guidelines for staff.	4.97 $\pm$ 0.39
3.	The organization provided emotional support and encouragement to staff.	4.79 $\pm$ 0.53
<b>Service continuation and enhancement</b>		
1.	The organization maintained basic services.	5.07 $\pm$ 0.54
2.	The organization adjusted their service based on the needs of the service users.	5.00 $\pm$ 0.53
3.	The organization provided service to fulfill the emotional needs of the service users.	5.03 $\pm$ 0.51
4.	The organization obtained support from the neighborhood.	4.98 $\pm$ 0.62
5.	The organization obtained trust from the service users and their families.	5.03 $\pm$ 0.49
<b>Communication among stakeholders</b>		
1.	The management team had openly and effectively communicated with frontline staff.	4.88 $\pm$ 0.52
2.	The management team is willing to hear feedback from staff.	4.88 $\pm$ 0.50

Higher scores indicate higher satisfaction: 6-point Likert scale: 1 = strongly disagree; 2 = disagree; 3 = slightly disagree; 4 = slightly agree; 5 = agree; 6 = strongly agree.

## The findings

Figure 2 shows the feedback on four areas of the risk management process and measures amidst the COVID-19 pandemic, which included (i) space and resource arrangement, (ii) staff in-service training and support, (iii) service continuation and enhancement, and (iv) communication among stakeholders. Table 4 shows each area's mean score and standard deviation (mean  $\pm$  SD).

### Space and resource arrangement

Ninety four percentage of participants strongly agreed or agreed that they had sufficient and reliable PPE from the organization (mean 4.99  $\pm$  0.35). 84 and 81% strongly agreed or agreed that a safe working space was arranged for work (mean 4.83  $\pm$  0.55) and manpower was allocated effectively to maintain the service (mean 4.83  $\pm$  0.48), respectively.

In the focus group interviews, some participants expressed that the organization supplied PPE and COVID rapid test kits for them at work throughout the pandemic. Moreover, some participants wanted the organization to provide masks with higher levels of protection at work, especially during the fifth wave of the pandemic.

*“Actually, for supplies, the organisation provides us, like gloves, hand rubs, most of the supplies they give us are OK!” (Participant 12, a female care worker).*

*“The organisation provides the rapid test kits for colleagues, and I think that this is a good thing” (Participant 21, a female social worker).*

*“I think that right now what we need the most is high-quality masks (KF94) for us to use... Because the fifth pandemic wave is so severe and infectious, colleagues of other departments were also infected” (Participant 2, a female care worker).*

On the other hand, owing to the global shortage of PPE during Wave 1, a nurse manager expressed understanding that the organization had put much effort into sourcing PPE for staff despite facing many difficulties in procurement of PPE and the high price of PPE.

*“It was hard to purchase goods (of PPE) two years ago... Going to foreign websites to order (PPE) in the middle of the night... one protective suit cost more than a hundred (Hong Kong; US\$1=HK\$7.8) dollars, and even though it was expensive, we still had to buy it to support and protect our frontline staff” (Participant 20, a female nurse manager).*

Some participants also expressed the problems of manpower shortage during the peak of Wave 5. Still, the problem was solved by inter-departmental coordination and cooperation to minimize the work pressure and maximize the services in helping the elderly during such a critical moment.

*“We lost one-third of our manpower (during the peak surge of Omicron, Wave 5), but another team supported us” (Participant 23, a male social worker).*

*“We allocated manpower from other departments (forced to suspend the service) to some departments with insufficient manpower... Although different departments provided different types of services since the pandemic was so severe, we helped and complemented each other internally in those departments that were severely affected... we integrated service management to maximise the facilitation... since we're helping the elderly now, who need our services a lot” (Participant 19, a female social worker).*

### Staff in-service training and support

Ninety one percentage of the participants strongly agreed or agreed that the infection control training (mean 4.95  $\pm$  0.36) and guidelines offered by the organization were effective and clear (mean 4.97  $\pm$  0.39), and 75% of the participants strongly agreed or agreed that they received emotional support and encouragement from the organization (mean 4.79  $\pm$  0.53).

Some focus group participants agreed that the infection control training could strengthen their awareness of infection control and help protect themselves and others. However, a participant expressed

her frustration with the great outbreak of Omicron, as she needed to update the infection control guidelines frequently and adequately and explain them to the staff. Still, the government's infection control and quarantine guidelines were unclear.

*"The in-house (infection control) training was useful. At least our awareness of keeping clean and awareness about the pandemic is strengthened every day... our department head also did online training for us (on top of the official training)" (Participant 1, a female care worker).*

*"It (the infection control training) let us learn how to protect ourselves and the importance of protecting others" (Participant 6, a female care worker).*

*"Because of the great outbreak of Omicron variant, no one knows who will be infected... and I couldn't reply to staff when I was asked to provide some information. I had to ask my friends (doctors in charge of the infection control team) who had up-to-date information, or I attended regular meetings in the hospital to get the newest information and explain it to my colleagues.... I'm not worried whether I will get the virus or not, but rather the risk of the team getting infected!" (Participant 20, a female nurse manager).*

Moreover, some participants appreciated the organization for delivering healthy drinks, food, and care products to show concern.

*"This (delivering healthy food and drinks to frontline staff) is pretty good for morale, I think it can boost morale. At least someone cares about us, the frontline staff" (Participant 3, a female care worker).*

*"Like today, the organisation gave us an air purifier, and we felt warm inside! I think it's a kind of encouragement" (Participant 2, a female care worker).*

## Service continuation and enhancement

Ninety one percentage of participants strongly agreed or agreed that the basic services were maintained (mean  $5.07 \pm 0.54$ ), and the service users and their families trusted the organization (mean  $5.03 \pm 0.49$ ). 88% and 90% strongly agreed or agreed that the organization obtained support from the neighborhood (mean  $4.98 \pm 0.62$ ) and adjusted the service based on the needs of the service users (mean  $5.0 \pm 0.53$ ), respectively. Furthermore, 90% strongly agreed or agreed that they fulfilled the emotional needs of their service users (mean  $5.05 \pm 0.51$ ).

Some focus group participants expressed concerns about the influences of the frequently changed government policies on the elderly. These policies affected the daily lives of and placed much stress on the elderly. The staff tried their best to help the elderly cope with the challenges.

*"They (the elderly) were forced to go for COVID compulsory screening, but they couldn't get tested after lining up for 6-7 hours, so it's difficult for some of the elderly!" (Participant 22, a female social worker).*

*"Two years ago, sometimes the elderly called the centre to ask, 'What should I do? I can't buy any masks!'. Recently (during Wave 5), they could not buy any food because the shelves at the supermarkets were empty, so we arranged services to help*

*the elderly to buy daily necessities" (Participant 22, a female social worker).*

*"... for our group of social workers, we all needed to check and trace the latest information and policies of the government, and see which buildings have to undergo compulsory testing... we had to call and see when the elderly were preparing to queue, and we had to think of how to arrange their meals... and we must help them adapt to this environment" (Participant 21, a female social worker).*

Some not only made many efforts to meet the physical needs of the elderly but also provided proactive phone call supports to comfort them and detect any potential problems.

*"I have noticed that during this pandemic, the elderly's emotions fluctuated a lot... like yesterday, we received a lot of phone calls from the elderly as they were scared by the alarm of unprecedented emergency alert via the mobile phones from the Government... I observed that no matter whether it is a piece of news or the ever-changing policies of the government, it would bring many worries to the service users. Hence, the role of a social worker is to comfort the elderly and the carers' emotions. We spent more time than usual on these" (P22, a female social worker).*

Owing to government policies on pandemic control, the home-based rehabilitation service was forced to suspend. To prevent the worsening of the health condition of service users, the rehabilitation service was transformed from face-to-face to online exercise classes to continue the service with the help of the family members of the elderly.

*"Under the pandemic, many service users have stopped the rehabilitation services... we found out that their situation (cognitive and movement abilities) was worse than before. After the long waves of this pandemic, we tried to find ways to help them each time. Although the services were suspended, we would find some service users with online devices that could let them have a Zoom meeting at home, and we would exercise with them over Zoom. Maybe some families don't have these devices; we prepared several short videos and sent the link to them through WhatsApp or email to the elderly's families; they can do exercises together at home" (Participant 25, a female physiotherapist).*

Other than how to enhance and extend the HBCCS, some participants expressed their dedication to serving the community.

*"We need to face the virus calmly; the community needs us; we definitely shouldn't be afraid!" (Participant 3, a male driver).*

*"... at work, I am not very worried (about getting infected). I'll do my best and whatever I can" (Participant 8, a female care Worker).*

*"... we have to be positive since we're helping the elderly now, who need our services a lot. Even though it may not be perfect, we'll do what we can!" (Participant 19, a female social worker).*

## Communication among stakeholders

Eighty two and eighty three percentage of participants strongly agreed or agreed that they had open discussion and communication



with the senior management team (mean  $4.88 \pm 0.52$ ), and the senior management team was willing to listen (mean  $4.88 \pm 0.5$ ), respectively.

Some focus group participants highlighted the importance of communication among staff to build rapport and trust and the importance of being a role model and having a good team spirit.

*"I remember using much time to explain (infection control measures and guidelines) to the frontline staff... I did a lot to reassure my colleagues; I didn't only care about their work, I also cared about their health, and did what I could to be well-prepared for the challenges, which helped build trust" (Participant 20, a female nurse manager).*

*"I'll have to be a role model and do my best so that they can follow us as an example. We're a team; this is teamwork" (Participant 23, a male social worker).*

## Discussion

This is the first paper to report the implementation of "risk management process," the systematic mixed-method evaluation of space and resources arrangement, staff in-service training and support, service continuation and enhancement, and communication among stakeholders. We have also made some actionable suggestions for in-service training and service enhancement from the staff's perspective.

Regarding space and resource arrangement, the shortage of PPE during this pandemic was a grave global issue. Our participants responsible for purchasing PPE also faced difficulties sourcing them because of the global shortage and the expensive prices. This is consistent with others' findings that the increased demand for facemasks by the public caused price acceleration and supply constraints to frontline healthcare professionals (38, 39). At the same time, some participants expected the organization to provide masks with the highest standard for them. This might be due to the inconsistent guidelines across regions and the frequently changed guidelines. Therefore, governments and public health agencies should give rational recommendations on the appropriate level of face mask use (39) and frequent updates and clarification (40).

To encounter the limited manpower and resources, AKA made good use of its neighborhood and social networks to collaborate with neighborhood institutions and district organizations, such as nearby schools, district leaders, medical partners, and volunteers to continue or adjust the existing services and provide emergency services amidst the pandemic. Good neighborhood and social networks help create useful connections, linkages and potentials within and among the community, organizations and society, facilitate resource mobilization (41, 42), and widen the support and encourage solidarity (42, 43). Researchers suggest that NGOs could maintain their activities by having peer support to overcome social risks and unexpected situations, such as disasters and health crises (44, 45). The mutual help of the local community networks can foster the quality of life and better living of the elderly (46), empower NGOs to build capacities to keep serving the community (43) and ensure the vulnerable and disadvantaged receive needed support and assistance (42).

Regarding staff in-service training and support, high satisfaction with the in-service infection control training was reported. The

purpose of the in-service training was not only to focus on infection prevention but also to enhance the self-efficacy of staff to educate their service users and caregivers (47). Training is crucial for staff career development and job satisfaction (48). Besides, regular updates of infection control guidelines are also important during the pandemic (49). The uncertainty and unpredictability might affect one's intolerance of uncertainty (50) and cause fear and anxiety (51). Therefore, prompt and effective communication is one of the essential strategies for all government departments, institutions, and professional bodies in responding to the ongoing pandemic of COVID-19 (52). Emotional support and encouragement to staff, such as healthy drinks and care products, were given to staff by the organization. These actions can make staff feel valued, build loyalty and commitment, and minimize the risks of burnout (53, 54).

Regarding service continuation and enhancement, most participants agreed that the essential HBCCS service had been maintained, and the service was adjusted, extended, and enhanced to meet the needs of the service users. Proactive phone calls could provide psychological support and comfort to the elderly. Such service enhancement process involved teamwork, inter-departmental collaboration and rapport among staff which facilitated swift response during the critical time of COVID-19. This is consistent with other findings in the literature: interprofessional participation, trust and collaboration within teams can empower positive changes in services (55, 56). Furthermore, some focus group participants reported their dedication to serving the vulnerable, demonstrating significant commitment and goodwill to the community in response to the COVID-19 crisis (55).

In communication among stakeholders, most participants reported that the organization maintained effective communication. Communication is one of the core elements in developing a workplace culture of respect and trust (57). In addition, staff who found that their voices were recognized were more likely to have higher job satisfaction and feel empowered and recognized (58).

The study's strength was the use of both qualitative and quantitative data to enrich the understanding of the staff feedback on the management process amidst the pandemic. We suggest using a step-by-step risk management process (16) to manage those challenges from COVID-19 or others. Besides, our mixed method triangulation design can enhance the validity, reduce bias, and provide insights into the real situation of HBCCS during the COVID-19 pandemic (59, 60). Our questionnaire could be adopted or adapted for evaluating risk management processes in other community services or institutions.

However, our study had several limitations. First, we only showed the implementation of the risk management process in one NGO, which might limit the generalizability of the findings. Organizations might have different values, beliefs, human behaviors, cultures and dynamics; thus, the feasibility, applicability and effectiveness of using this model of risk management process might vary (61). Second, because validated questionnaires were unavailable, we developed our outcome-based questionnaire to assess staff feedback. We measured perceptions only, which might not reflect the actual situations. Individuals' perceptions can be influenced by their personality and self-perception (26, 62). Third, the subjects of this study were the organization's staff, and some might not express their opinions freely. Social desirability bias might have exaggerated the positive findings.



Therefore, an evaluation conducted by a third party may provide more reliable results.

## Conclusions

This paper offers a practical example of implementing and evaluating an NGO's step-by-step risk management process, providing continuous enhancement of home-based and community services during the pandemic.

Our paper demonstrates a step-by-step risk management process to systematically manage COVID-19-related challenges, evaluate staff feedback to understand staff and service needs better, and provide actionable suggestions for staff-centered training and service enhancement. This example might be helpful to others encountering management challenges in community social service challenges in diverse settings and services amidst the pandemic and beyond.

## 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 study was approved by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (HKU/HA HKW IRB: UW 21-781). The patients/participants provided their written informed consent to participate in this study.

## Author contributions

CY contributed to the conception and design of the study, supervising data collection, data analysis, and manuscript drafting.

AL contributed to the study's design, statistical analysis, and manuscript drafting. AW contributed to the conception and design of the study and recruitment strategy. MK contributed to the data collection strategies, commenting, and evaluating the manuscript. T-HL contributed to the conception and design of the study, drafting, and editing the manuscript. All authors read and approved the final manuscript.

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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.

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# Socio-ecological determinants of older people's mental health and well-being during COVID-19: A qualitative analysis within the Irish context

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**Background:** Evidence indicates that older people with biological and social vulnerabilities are at high risk of short- and long-term consequences related to the COVID-19 pandemic. However, studies have also highlighted that the crisis may present opportunities for personal growth if older individuals are met with appropriate resources and support.

**Objective:** The aim of this study was to explore the perceptions of older people regarding how individual, social, and environmental factors have supported or hindered their well-being and health during COVID-19.

**Methods:** We analyzed data collected between April–May and October–November 2021 from the Well-being, Interventions and Support during Epidemics (WISE) study, a qualitative investigation of community-dwellers based in Ireland and aged 65 years or over. Participants ( $n = 57$ ) completed written submissions, narrative interviews and/or go-along interviews detailing their experiences during the pandemic. Framework analysis was carried out in NVivo 12 to identify determinants, linkages, and explanations within Bronfenbrenner's socio-ecological model.

**Results:** The mean age of participants was 74.9 years, 53% were female, 45% lived alone, and 86% lived in areas with high urban influence. Our findings highlight the heterogeneous effect of COVID-19 across diverse older individuals who held distinct concerns, capabilities, and roles in society before and during the pandemic. Multi-scalar contextual characteristics such as individual's living arrangements, neighborhood social and built environments, as well as social expectations about aging and help seeking, had an influential role in participants' well-being and available supports. We identified mixed views regarding public health restrictions, but a consensus emerged questioning the suitability of one-size-fits-all approaches based on chronological age.

**Conclusions:** Our results suggest that some negative pandemic consequences could have been avoided by increasing collaboration with older people and with the provision of clearer communications. The interdependencies identified between individual characteristics and socio-ecological factors that influenced participants' availability of supports and development of adaptive strategies represent areas of opportunity for the development of age-friendly interventions during and beyond public health crises.

## KEYWORDS

aging population, COVID-19 pandemic, socio-ecological determinants, mental health, well-being, qualitative research

## 1. Introduction

The highest proportion of hospitalizations in intensive care units and mortality rates during the COVID-19 pandemic have been observed amongst older populations (1–3). The health risk is unequally distributed and the poorest prognoses have been observed among older individuals who experience both biological and social vulnerabilities (4). The influence of these risk factors is not limited to the prevention and course of a COVID-19 infection, but significantly contributes to broader economic and social consequences that may affect older people's quality of life and well-being in the short- and long-term. A deterioration in older people's mental health and well-being during the pandemic may also be compounded by previous social isolation and loneliness, increased sedentary behaviors and limited access to healthcare services for non-COVID needs (5–7). Additionally, age-specific public health measures, such as exclusive hours to carry on essential activities and sheltering-in-place (also known as cocooning), have created among older individuals ambivalent emotions of feeling protected and feeling ostracized (8). However, emerging research also indicates that some older individuals have experienced positive changes and enhanced meaning of life during the pandemic (9, 10).

An in-depth understanding of the barriers and enablers to well-being experienced by older people during the pandemic is needed to identify characteristics associated with resilient and vulnerable individuals, and to develop appropriate support interventions. Given the heterogeneity of potential factors associated with older people's mental health and well-being in the pandemic context, a socio-ecological perspective is best suited for consideration of diverse social, material and affective determinants embedded at multiple levels of influence (11–13). A growing body of studies utilizing quantitative approaches has provided valuable insights into some of the predictors associated with mental health and well-being outcomes related to COVID-19. However, most of these studies have explored only one level of influence or type of determinant. For instance, evidence has emerged from studies focused on psychological and socio-demographic characteristics (14, 15), health behaviors (16), social resources (17, 18), and access to nature and/or outdoor environments (19, 20). However, limited attention has been given to possible interactions between multiple levels and/or possible intersections within determinants. Moreover, the variables utilized within existing analyses can rely on researchers' preconceived assumptions and experiences of other public challenges that may differ from COVID-19.

Findings from qualitative studies provide a more nuanced portrayal of older people's experiences in diverse contexts, and additional insights into the complexity inherent in health-related outcomes during the pandemic. For instance, findings on how older adults based in Switzerland made sense of the pandemic during the first lockdown suggest several levels of influence may produce ambivalent affects in the same individual (8). Similarly, a study based in Northern Texas identified some individual, social and

environmental factors that supported early resilience in marginalized older adults (21). However, little attention has been given to how these factors interact with each other according to those who experience them. Additionally, to date most of the existing qualitative evidence pertains to the first months of the pandemic, so it remains unclear how determinants at multiple levels shape adaptation strategies in the longer-term.

To fill this gap, the aim of our study is to explore the experiences of those aging-in-place after 1 year of the pandemic onset in Ireland, and to identify enabling and hindering health and well-being determinants across the multiple levels of influence proposed by Bronfenbrenner's socio-ecological model. Levels of analysis include individual factors, the immediate environment of everyday life (micro-system), interactions between diverse everyday spheres (meso-system), broader environments where the individual may not be directly involved (exo-system), shared socio-cultural norms, values and ideologies (macro-system), and changes occurring through time (chrono-system) (11). This theoretical framework allows us to contextualize older people's experiences, and to deepen our understanding of the interactions between actors, networks and agencies that contribute to health and well-being during times of a public health crisis. Our exploratory qualitative approach provides the opportunity to focus on the processes underlying the associations between diverse determinants from the participant's perspectives. Findings from our study contribute to the evidence of what needs to be done, and for whom, in order to support the health and well-being of individuals aging-in-place during times of social upheaval and massive infectious outbreaks.

## 2. Methodology

### 2.1. Study design

The data analyzed are part of the WISE study, for which a detailed protocol has been published (22). Briefly, utilizing a convenient sampling approach, people aged 65 years and over who were living in community settings across Ireland, were invited to share their experiences during the COVID-19 pandemic through a narrative interview, a written submission, and/or a go-along interview. Participants completed a brief background questionnaire of socio-demographic characteristics (23). Written submissions were open-ended, and researchers provided a few prompts that participants could choose to use to reflect on their experiences (23). Narrative interviews were conducted over the phone or by videoconferencing software, and followed a topic guide touching upon their experiences, perceived stressors, supports available and concerns for the future (23). Go-along interviews utilized prompts to gain a deeper understanding of participants' lived experiences at a location chosen by them to showcase places of meaning during the pandemic (23).



From the conceptualization of the study, we explored our positionality as researchers and the potential impact of our own experiences, assumptions, and biases in the data collection, analysis, and interpretation of data. These discussions were recorded in our research log and allowed us to consider our insider/outsider perspectives and to adapt our methods accordingly. All participants provided written informed consent before participation.

## 2.2. Study context

The data analyzed was collected between April and early-May 2021 (narrative interviews and written submissions), and between October to November 2021 (go-along interviews). At the first point of data collection, Ireland was experiencing Wave 3 of the pandemic and had confirmed a total number of 223,142 cases with a mortality rate of 96.6 per 100,000 population (24). During early stages of the pandemic in Ireland, public health advice emphasized hygienic measures, such as respiratory etiquette and appropriate hand-washing, and wider initiatives included a prohibition of gatherings and a mandate to stay within a 2 km radius from home (24). For people over 70 years or those extremely medically vulnerable, a specific public health measure termed ‘cocooning’ advised people to strictly remain at home and minimize all face-to-face interactions with others (25). With a decrease in the number of new COVID-19 cases, a phased easing of restrictions allowed movements within a 5 km and then 20 km radius from home, reopening of some services and amenities, and outdoor gatherings for a limited number of individuals (26). From mid-August 2020, an increase in the number of cases led to Wave 2 and prompted the reintroduction of public health restrictions and development of the 5-level plan to live with COVID-19 (24). Leading up to the Christmas holidays, many of the restrictions had been lifted and Ireland saw its worst surge in cases, which led to Wave 3 and the re-introduction of nationwide restrictions. Moreover, by the end of December 2020 the COVID-19 vaccination roll-out for vulnerable and older individuals began (25). From mid-May 2021 onwards there was a wide lifting of restrictions on travel, personal services, retail, outdoor socializing and religious services, which was as a result of satisfactory developments in the number of cases and escalation of vaccination efforts (27).

## 2.3. Public and patient involvement (PPI)

A research advisory panel conformed of five individuals aging-in-place in Irish communities contributed to the study design and development at multiple stages of the research cycle. A detailed account of their contributions according to the Guidance for Reporting Involvement of Patients and the Public- GRIPP2 (28) is available (23).

## 2.4. Analysis

The current analysis comprises accounts from 57 participants who completed a narrative interview ( $n = 44$ ) and/or written submissions ( $n = 17$ ) and/or a go-along interview ( $n = 5$ ). We selected framework analysis as our analytical method due to its suitability to manage a relatively large amount of qualitative data, and the opportunity to

explore both *a priori* and emerging issues (29–31). NVivo 12 software was used to organize the data, assist the coding, and track our analytic decisions. We followed the five framework analysis stages outlined by Ritchie and Spencer (32): (1) The first author transcribed audio-recordings and handwritten submissions, imported and organized files in NVivo, and became familiarized with all transcripts and field notes; (2) The full material from the WISE study was categorized in relation to each of the overall research questions (22). A preliminary codebook from analysis of the first 15 interview transcripts was developed to identify determinants at each socio-ecological level and to generate initial codes. Text was included in more than one code if relevant. A second researcher reviewed the coding structure for consistency and completeness; (3) The codebook was iteratively refined through group discussions and codes consolidated into broader categories which were used to systematically analyze the remaining transcripts; (4) A framework matrix was developed by creating a summary of each participant’s experience and perspectives of relevant determinants at multiple levels; and (5) We compared within and between cases and explored patterns in the data. Determinants’ categories were finalized based on identified relationships between codes and the experiences described by participants. Steps taken to enhance methodological rigor are further detailed in Table 1 according to the Four-Dimensions Criteria (FDC) (33).

## 3. Findings

The mean age of participants was 74.9 (range 65–96), 53% were female, 45% lived alone, and 86% lived in areas with high urban influence (35). Our analysis identified multiple barriers and enablers that were associated with participants’ health and well-being through diverse levels of the socio-ecological model. Figure 1 provides an overview of the determinants identified at each level, while narrative and tabular representations below provide additional details and quote examples. Participants’ names have been changed for pseudonyms and are followed by their gender (F = female; M = male; NB = non-binary) and age at time of data collection.

### 3.1. Individual level (L1)

The determinants identified at this level (shown in Table 2 with representative quotes) highlight that COVID-19 did not have an equal effect across the older population, but instead it differently affected diverse older individuals who had distinct concerns, capabilities, and roles in society before and during the pandemic. Therefore, individual characteristics such as health status, previous experiences of hardship and personal disposition, played a significant role in enabling or hindering coping mechanisms and adaptive strategies during different stages of the pandemic.

Significantly, individual determinants, such as gender, also interacted with social-expectations and influenced the types of community supports available. For instance, Seamus (see Table 2) referred to the impact of losing face-to-face activities particularly for men who may bond and support each other within physical encounters. While Enda (NB, 66 y), shared that as a gender nonconforming older adult they had to navigate available social networks and cultural expectations during the pandemic:



TABLE 1 Strategies adopted to establish methodological rigor according to the FDC (33).

Rigor criteria	Study's strategies
Credibility	<ul style="list-style-type: none"> <li>Data collection instruments were co-developed in collaboration with 5 experts by experience.</li> <li>Data collection instruments were pilot tested (2 narrative interviews; 1 go-along; 1 written submission).</li> <li>Lead researcher and co-researchers completed training in qualitative study design, analysis, and interpretation.</li> <li>The overall study was supervised by established researchers with expertise in qualitative research.</li> <li>All participants' data and fieldnotes were stored in a safe location.</li> <li>Data was uploaded and organized with NVivo software.</li> </ul>
Dependability	<ul style="list-style-type: none"> <li>Developed and published a research protocol (22).</li> <li>Kept a detailed research log as a track record of the data collection process and key analytical decisions.</li> <li>Framework matrix constitutes an audit trail of the codes identified, selection of determinants, participants' summaries, and participants' quotes.</li> </ul>
Confirmability	<ul style="list-style-type: none"> <li>Completed field notes of preliminary thoughts and interpretations immediately after data collection.</li> <li>Triangulation between written, narrative, and visual data sources, as well as theoretical background on socio-ecological models in general and aging populations.</li> </ul>
Transferability	<ul style="list-style-type: none"> <li>Sample size was guided by principles of information power (34).</li> <li>A multi-method data collection approach was used to facilitate participation opportunities for people with diverse socio-demographic backgrounds, needs &amp; preferences.</li> </ul>

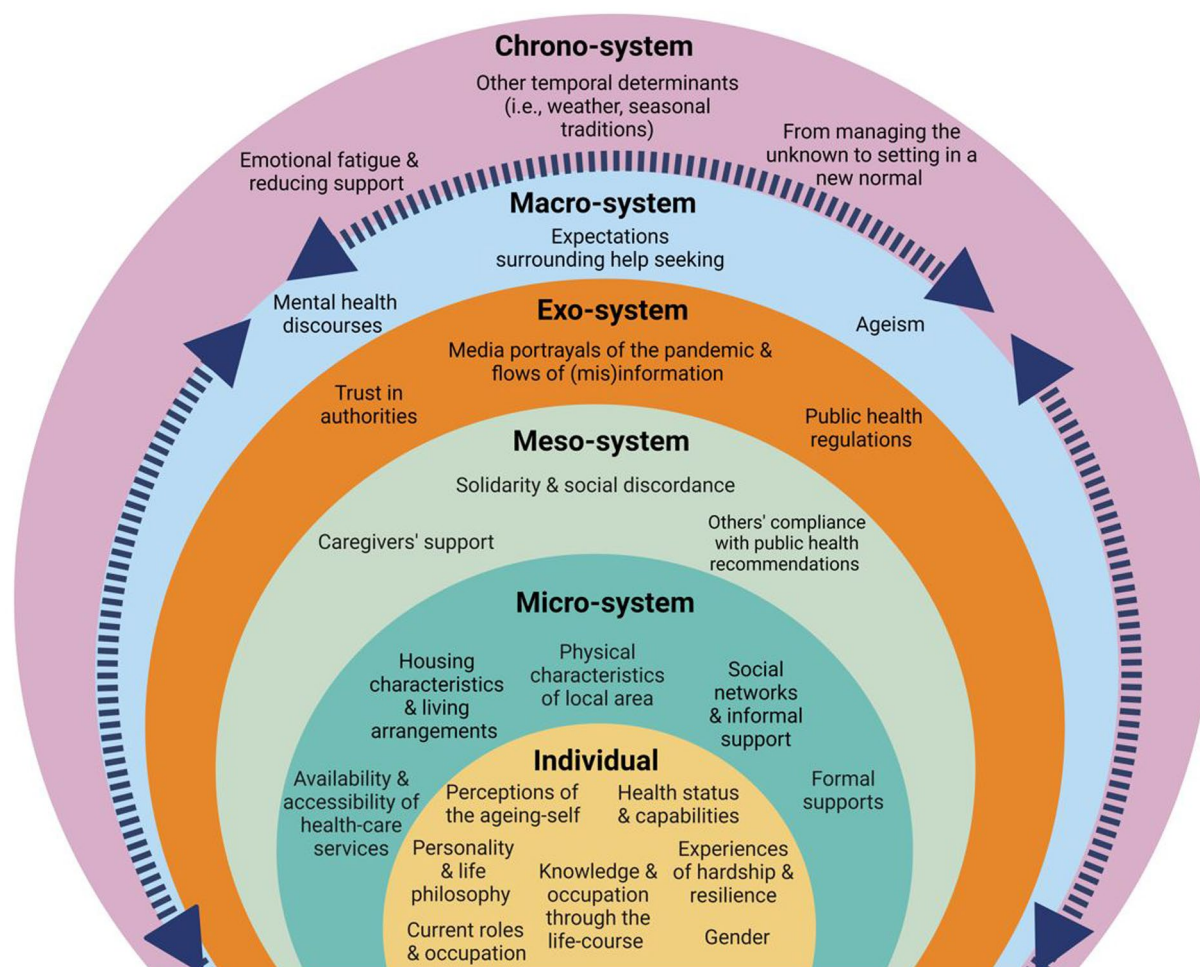
FIGURE 1  
Socio-ecological determinants identified at each level.

TABLE 2 Details of socio-ecological determinants at the individual level (L1).

Determinant	Definition	Illustrative quotes
1.1- Previous experiences of hardship and resilience	Life-course experiences that have allowed the participant to establish successful coping mechanisms and develop resilience.	“A lot of my life changed about 30 years ago, and I had to take a long journey, which was very, very difficult. So, when this hit, I thought, ‘Oh, I can, I can cope with this, I’ve coped with lots of other things’, and I have coped with it.” Elisa (F, 73 y)
1.2- Personality, character disposition and life philosophy	Personal disposition and interests that influence daily life (i.e., extrovert/introvert, optimistic/negative life outlook, hobbies).	“You cannot change how you deal with life on a day of crisis, you are going to fall back into your normal way of being. So, it’s good to develop a normal way of being that allows you to survive things, and to survive challenges and difficulties and deal with them. Make a plan on a good day so that on a bad day you can fall back on it.” Aoife (F, 66 y)
1.3- Knowledge, roles, and occupation through the life-course	Knowledge acquired during the life-course that provides useful information and skills to cope with the pandemic (i.e., health literacy, digital competency).	“I used to be radiographer and I worked in a hospital. So, I understand the whole transmission of infection stuff and from the very beginning I was very particular about wearing a mask.” Kathleen (F, 68 y)
1.4- Current roles and/or occupation	Current roles and/or occupation- including roles that may support current purpose of life and self-esteem, and/or roles that may be related to enhanced burden during the pandemic (i.e., caregiving for partner or grandchildren, volunteering positions, etc).	“I’m so busy with work things that there’s very little to miss. I’m happy once I’m doing something that’s got a purpose [...] I was able to keep volunteering because it was all done by email and phone.” Orla (F, 71 y)
1.5- Perceptions of the aging-self	Personal beliefs about aging and perceptions of oneself as an older person, including comparisons between personal and other’s experiences.	“I totally agreed with the spirit of the law, but not the letter of it. It really made me feel that I was 70, and I’m a fit 70-year-old (...) I just felt a bit uncomfortable being lumped with the 90-year-olds and 80-year-olds... I thought the best thing is not to get resentful, just make it work for me.” Siobhan (F, 76 y)
1.6- Gender	Perceptions of the influence of gender in response to stressors and availability of supports during the pandemic.	“Men do not talk face to face. They very much talk shoulder to shoulder when they are doing things, sort of breaks down barriers. With the Men Sheds closed I’d say a lot of men like me found it very tough.” Seamus (M, 76 y)
1.7- Health status and individual capabilities	Perceived impact of medical conditions on personal function and capabilities during the pandemic, including disease symptoms and functional limitations.	“I’m probably a little bit paranoid about catching it. Because I reckon if I caught it, I probably would not survive. I mean because I also have high blood pressure, which I’m taking medication for, you know. So, I definitely think it could be fatal for me, especially, if I got it. So, I have been a bit paranoid about not going anywhere really.” Ruairi (M, 72 y)
1.8- Income and personal finances	Perceptions on the impact of the pandemic on personal economy and capability to support oneself financially.	“We are retired. So, we have enough, you know, our pensions are adequate to live on. We’re not short, we do not have any difficulties like that, which a lot of people have (...) That’s a huge difference that you do not have that kind of concern.” Greg (M, 72 y)

“I don’t have a hetero normative support structure available to me during the pandemic or as I grow older because I didn’t marry, and I don’t have children [...] I look for allies where I can find them, and I have what I call my rainbow family.”

Additionally, participants such as Eithne (F, 73 y) highlighted how their perceptions of themselves as aging and/or vulnerable had shifted due to the emphasis on chronological age during the pandemic:

“I keep trying to do everything, keep doing things as I had been doing, but that the pandemic put an end to that really, because it just made the older years seem very real. So, now I can only do what I’m allowed to do health wise and with the general rules that are imposed on you from outside.”

As in the case of Eithne, other participants also reported that the pandemic had forced them to view themselves as old and vulnerable,

even if this was not their self-perception beforehand. This resulted from the combination of assumptions about the older population among the general population, as well as the public messaging regarding the restrictions and the behaviors of others that were shaped by the pandemic circumstances across the following socio-ecological levels.

### 3.2. Micro-system level (L2)

The influential factors identified at the micro-level (shown in Table 3 with example quotes) include physical characteristics and social interactions within participants’ proximate environments that enabled or hindered the fulfilment of basic needs and opportunities to take part in valued activities. Features of residential places that allowed interactions with others at a safe physical distance, facilitated exercise and/or provided contact with the

TABLE 3 Detailed socio-ecological determinants at the micro-system (L2).

Determinant	Definition	Illustrative quotes
2.1- Housing characteristics and living arrangements	Characteristics of participants' dwelling environments and living arrangements that enable or hinder their health and wellbeing during the pandemic.	"The hardest part for me was keeping my family out, and the grandchildren (...) But in all fairness, like, you know, we are Travellers and family is very important... and it's just the living conditions with Travellers as well. I mean, I live in group housing, but there are some of the Travellers living in halting sites and there're very bad conditions, they may not have running hot water, and the right facilities." Nan (F, 75 y)
2.2- Physical characteristics of local area- including natural and built environments	Neighborhood characteristics that enable or hinder health and wellbeing during the pandemic (i.e., population density, walkability, accessibility to desirable places such as shops or places with nature).	"This lockdown is tough because the 5k is very tough. If you could travel within your county at least you'll be able to go to different woods or different forest or different lake, you know, and it's amazing how just going to a different forest or a different lake cheers you up because you are seeing new trees, new grass, new whatever" Tara (F, 66 y)
2.3- Availability and accessibility of health-care services/support	Opportunities and barriers to access adequate health-care services for COVID-19 and non-COVID-19 needs in a timely manner.	"I need care that is not available to me at the moment because the HSE* is crushing under the weight of COVID-19 and all. You know, my cancer treatment has been suspended, cancelled. It's clearly not working for me, and I'm having to settle for less and less and less, you know, lowering the bar of expectation. I have no expectation of survival, and the irony is, I do not think it's gonna be COVID that's gonna kill me." Kevin (NB, 66 y)
2.4- Social networks and informal support from family members, friends, and neighbors	Characteristics of social networks and their role to support and facilitate access to resources to satisfy basic and higher order needs.	"During the COVID-19 Pandemic our children have been very supportive right throughout with visits, phone calls, texts and a constant supply of home-cooked meals. I do not know what we do without our children. They have been the biggest help and reassured me that my wife and I must have done something right." Paul (M, 86 y)
2.5- Formal non-medical supports from community organizations and the government	Characteristics of formal supports from local authorities, volunteering, and community organizations (i.e., support lines, access to home repairs, access/delivery of food, medication, and other necessary goods, etc.)	"There was a bit of relief that we were being looked after. There were a lot of things being put in place. Like if you had problems, you know, if you cannot get your shopping, you phone up this phone at the local guards or something like that. So, a feeling that yes, we were being protected, and there was the possibility of being looked after, rather than simply shut away. That was a big positive." Grainne (F, 74 y)

\*The Health Service Executive (HSE) is the publicly funded healthcare system in Ireland, responsible for the provision of health and personal social services.

outdoors, such as porches and gardens, were mentioned as beneficial for mental and physical health. Views from home to pleasant landscapes including nature, wildlife or other people were also supportive of positive emotions and "good mood." However, one of the most relevant determinants was the fit between the home characteristics and individual needs and capabilities, which was illustrated by Odhran (NB, 66 y):

"The housing that I'm in is inadequate. I mean, I'm in a flat all by myself, I have a beautiful view of the Irish Sea which I'm grateful for, but I need home health care. I don't think it's going to arrive in time quite frankly, and I'm alone here you know, which is quite dangerous. I can't really climb the stairs any longer. I'm a prisoner here."

Public health measures also led to participants spending more time in local areas that saw an increase in "more people cycling, more people walking, more people just being aware of what's in their own neighborhood" (Niamh, F, 71 y). However, access to enabling

neighborhood characteristics varied across participants and conflict sometimes arose between users who had different views of public health measures. For instance, Thomas (M, 72 y) described how his health conditions made proximate environments unsuitable for him to engage in physical activity:

"Where I live, just on the other side of the bridge into [anonymized location] it's very hilly. I have no problem walking down the hill but with heart failure, I have a problem walking back up. So, I had to take the car to go to somewhere that was flat in order to walk. So that's what I did, I did exceed the five kilometers I'm afraid."

Participants also referred to newfound advantages and disadvantages of urban and rural living. For instance, participants based in rural settings mentioned it had been easier to maintain physical distance since their homes were in low-density areas. However, they also mentioned that local services, shops, and amenities were often located beyond the catchment areas allowed by public

health measures which curtailed their sense of independence, as in Steven's (M, 72 y) case:

"The town we usually go to is maybe 25 kilometers away. I just can't go and do stuff that I would have done, you know, very, very simple things [...] I have felt down occasionally, I'm probably a bit more emotional about things, and it's probably something to do with being kind of locked up."

Remote living environments also increased social isolation in participants who did not drive and who relied heavily on remote contact through the phone, post, and digital technologies. In this sense, close relationships, either in terms of geographical proximity (i.e., neighbors) or kinship provided significant emotional support. For instance, Gerald (M, 72 y) reported:

"Just being able to chat with people that you really love and respect and care for, it's very positive and it allows you to look beyond the immediate situation and to realize how incredibly lucky we are here."

Additionally, formal, and informal social networks helped to fulfil basic and higher order needs, which was detailed by Sean (M, 72 y):

"The things that helped me get through are, number one, the support of friends and neighbors to do shopping, to provide meals and also to offer transport for appointments [...] Then, I remember An Post [*Irish postal service*] provided free postcards. I got a number of those sent from friends who couldn't make it here, you know, when we were cocooning. Then contact from the group called social prescribing, I valued their phone calls and the packet of goodies that they sent on two different occasions. Then online support, people were offering to do shopping, like. Also, I have a cat and the local animal welfare group were offering to come and take the cat if I needed to take the cat to the vet. Even the guard [*police*] was available to collect medication from the pharmacy if I couldn't go."

### 3.3. Meso-system level (L3)

Definitions of the determinants identified at this level and quote examples are provided in Table 4. The overlap between social interactions and the characteristics of public spaces, such as shops or parks, highlights the influence of perceived social solidarity, discordance, and the compliance of others with recommendations. Participants reported they often felt little control in spaces shared with other people, particularly when strangers disregarded the restrictions and/or showcased behaviors associated with increased risk of infection, which led to feelings of stress, anger, anxiety, and fear. In a wider sense, these interactions threatened participants' sense of community as they felt others did not share the social responsibility of shortening the course of the pandemic or did not care if they carried the disease to other people. Moreover, some participants reported their feelings of dread in public spaces coupled with security resources being deployed elsewhere which led to decreases in foot traffic in certain areas with rising neighborhood

insecurity and "groups of dangerous people roaming around" (Deirdre, F, 81 y).

Several participants also noted their own health and wellbeing was facilitated by the opportunity of family, friends and/or caregivers to be supported either by formal or informal interventions, such as the pandemic unemployment payment, availability of PPE for home-visitations, and vaccination roll-out.

### 3.4. Exo-system level (L4)

Definitions of exo-system determinants and quote examples are provided in Table 5. Participants' narratives indicate a wide spectrum of outlooks concerning the government response to the pandemic with some consensus around the notions that the government "took it seriously" (Ruairi, M, 72 y), and that quick action was needed with limited information. However, several participants questioned the one-size fits all approach based on chronological age and suggested that some unintended consequences could have been avoided by consulting older people's voices and the provision of clearer communications.

Responses also indicate a wide range of uses of mass media communications, such as keeping informed about the pandemic spread and number of cases, as well as learning about best practices to minimize risk of infection or possible treatments, which contributed to "allowing people and empowering people to build up their common sense" (Barry, M, 78 y). However, participants such as Ruth (F, 66 y) reported that the heavy flow of information could "make it feel as if it's never going to end" and lead to increased anxiety:

TABLE 4 Details of socio-ecological determinants at the meso-system (L3).

Determinant	Definition	Illustrative quotes
3.1- Solidarity, social discordance, and compliance of others with public health recommendations	Sense of others' compliance with public health regulations and safety in public spaces.	"A lot of people have been taking shortcuts or having parties and things like that. Unless you all pull in the same direction, you will not achieve the result that you really want to achieve, as soon as you would like to achieve it." Richard (M, 96 y)
3.2- Support for those providing support	Perceived availability and accessibility of supports for individuals or groups supporting the older person (i.e., family, community groups).	"My daughter, who is a nurse, she is still waiting to get her vaccine, so I'm not happy with that. That's important because she's the only one that goes out, and that I have any direct contact with." Eamon (M, 85 y)



“It got to a stage that it was too much. I just needed to hear it once a day and then turn away from it. I just think there is a limit to seeing scenes in hospitals and listening to people who weren’t coping... Although I wouldn’t have missed it because I wanted to be in the loop, so I had to manage it.”

Strategies to manage media consumption included carefully selecting trusted sources and limiting the exposure times. Participants also highlighted the importance of clear language in public health communication and referred that transparency in the rationale for implementation of measures made them more inclined to comply and contributed to building trust.

### 3.5. Macro-system level (L5)

Definitions of macro-level determinants and quoted examples are provided in Table 6. Participants perceived that as a group, older people had been discriminated against because the general population considered COVID-19 a “disease of the old” and that public health restrictions resulted from the need “to protect people of certain ages that are so vulnerable to it, we must all adjust and live like this to protect you” (Geraldine, F, 68 y). According to participants, the portrayals of older people in public communications as a homogeneous and vulnerable group fed into previous socio-cultural stereotypes of older people as highly demanding of resources and low contributors to society. These negative perspectives deeply influenced how other people behaved around them and led to further age-discrimination and intergenerational divide:

“In the very beginning almost every bulletin, every news, every announcement was about people catching COVID, and it was almost like they dismissed anybody of a certain age. In other

words, they’re going to die anyway. And in the very initial stages, I couldn’t believe it, when we were actually put into a separate category, while they were speaking about the able-bodied person and prime person in their 30-40-50s. Then it was like, we were the cause of the pandemic spreading, in the sense that we were using up the hospital because the virus could kill us but wouldn’t kill a young person. You know, created this divide.” Ciara (F, 66 y)

Anecdotes and media coverage of older people receiving sub-standard treatment because of their age, as well as the high number of cases and deaths in nursing homes, led to concerns that ageism could influence participants’ access to healthcare and the quality of services received in the case of a COVID-19 infection. For instance, Agnes (F, 70 y) recounted:

“Ten of the old people here in the small hospital got it then and died (...) I think that maybe if they weren’t old, they might have been more conscientious about testing them, but because there were 80 or something, they said ‘oh, it should be alright’ but wasn’t.”

Direct and indirect age-discrimination experiences contributed to fears about becoming ill and frustration about societal responses; while discourses equating older age with declining capacities and low independence resulted in patronizing recommendations, which angered participants like Cathy (F, 73 y) who shared: “The over 70s were almost taken as if they were children again, I was very annoyed with that. I’m a thinking person, I certainly did not want to be told what to do.” Additionally, depictions of older people as dependent influenced participants’ help-seeking behaviors, as they feared losing their autonomy and dignity, as well as becoming a burden to others. For example, Bridget (F, 76 y), who was living alone and had formed

TABLE 5 Detailed socio-ecological determinants at the exo-system (L4).

Determinant	Definition	Illustrative quotes
4.1- Public health regulations for the general and older populations	Positive and negative implications of the implementation of public health regulations to contain the spread of the virus, and specific measures for older people.	“The ironic thing is that the older people are not the vectors, so it is only logical to ask why we are all being locked up... Perhaps one size does not fit all? The blanket approach that has meant that people who are already isolated by location, can hardly be compared with those who live in densely populated regions - cities for example. Has any cognisance at all been taken of the mental effects of such increased isolation in the present crisis? Is it possible that the long term health effects of this forced isolation will have far more negative effects on the health of individuals than the virus itself... given that not everyone will get the virus and of those who do, many will survive. There is no doubt but that people who are vulnerable must be protected but is the present way the only good way?” Mary (F, 72 y)
4.2- Media portrayals of the pandemic and flows of (mis) information	Influences of mass media communications in participants’ affective states, as well as its role in shaping their knowledge about the virus and behaviors through the pandemic.	“The message has not always been 100% clear, but it has not anywhere. I suppose the main thing is to try and have clarity, make the message clear, and simple, so that everybody can understand it.” Darragh (M, 72 y)
4.3- Trust in experts, government, and institutions	Role of the perceived reliability, truth, or ability of experts, governments, and institutions to handle the pandemic effects.	“We have to rely on people like NPHE <sup>a</sup> to make the right decisions for us as a community, and I accept what they are doing. You know, governments may have made some poor decisions, but COVID has been a learning exercise and I hope as we proceed on the COVID journey, we’ll learn from our mistakes and the community and government will learn from the mistakes.” Mark (M, 71 y)

<sup>a</sup>NPHE: National Public Health Emergency Team in Ireland.



TABLE 6 Details of socio-ecological determinants at the macro-system (L5).

Determinant	Definition	Illustrative quotes
5.1- Socio-cultural perspectives about aging and ageism	Perspectives about how the general society feels, thinks, and acts towards aging and older people.	“There is a perception out there that once one gets to 70 (the magic number), one is ill informed and/or too stupid to understand what is happening and is incapable of looking after oneself. It seems that older people are once again portrayed as objects or commodities who because of their age are a bit of a nuisance so the solution is to lock them up for the duration - cocoon, handy word but very disrespectful.” Louise (F, 72 y)
5.2- Socio-cultural expectations surrounding help seeking behaviors	Perspectives of how social norms influence help seeking behaviors and how these may be influenced by culture.	“Some people are proud, and they’ll refuse help. Like, you know, that crowd I was telling you about, they ring them up and say, ‘This number you can ring it any time, if you want to chat to someone, ring any time up to nine o’clock at night’. But they would not, because ‘Oh, I do not want to be disturbing people because there’s people more worse off than I am,’ and they would be too proud to ask for help, and too proud to admit that there were lonely [...] They will be saying, ‘Oh, I’m fine. I’m fine. I’m grand,’ you know, and they put on a big smile, but they are not. I know they are not because I’ve been lonely myself at times.” Agnes (F, 70 y)
5.3- Discourse and social norms regarding mental health	Perspectives of the socio-cultural norms surrounding discourses about mental health and/or influencing the opportunity to discuss mental health issues.	“I’ll go forward, you know, doing the best I can, but I will not drink that kool-aid of toxic positivity that I get from other people. Ugh! You know, there’s nothing worse than the people with a great big smile, and oh, everything’s grand and, ‘oh, let us be positive and all of that,’ you know? I can tell you what to do with your positivity.” Enda (NB, 66 y)
5.4- Global forces in an intrinsically connected world	Wider socio-cultural circumstances that transcend borders and influence the course of the pandemic (i.e., rise of political extremes)	“This global pandemic that has exposed issues of racism, sexism, transphobia, xenophobia, you know, not just by Trump and his haters or the Brexiters <sup>a</sup> , there are plenty of them right here in Ireland [...] That’s the far-right wing, finding an opportunity and exploiting it [...] They’re organising, and strategizing, and rowing, you know, it’s sinister stuff.” Lorcan (M, 68 y)

<sup>a</sup>Brexiters: People in favor of the United Kingdom withdrawing from the European Union.

a bubble with a couple in her neighborhood, reported that she had to carefully consider how often she could contact them to avoid impinging on their personal lives, even though she felt lonely and desired more social interactions. Similar responses also indicated a fear of asking for help because “others may need it more,” which highlights the benefits of community organizations and friends reaching out, as Thomas (M, 72 y) shared: “It felt very, very positive that people offered help without being asked. That made a big difference. It’s a lot better for someone to offer something than for you to have to ask them to do it. Feels better.”

Participants also had contrasting views about perceived cultural characteristics contributing to or hindering resilience. For instance, Niamh (F, 65 y) considered that “We have a habit of, particularly in Ireland, we love misery. Sometimes the people are whining a bit too much about little, small things,” while Odhran (NB, 66 y) reported “I dig deep for that Irish resilience, and the Irish sense of humor that I inherited from my Irish grandmother, who I never met, but I know I have it, and that’s sustaining.” Similarly, participants also held contrasting views about socially acceptable coping mechanisms and the opportunities to discuss their mental health. In this regard, Enda’s quote in Table 6 touches upon the implications of superficial solutions that may brush over more severe mental health challenges. Similarly, Noreen (F, 73 y) shared: “They go on and on about how you have to be stronger, even in at a time like this, and I do not want to be stronger. I’m fed up with it all. I mean, I want to put my feet up and eat cream cakes all day long (laughs),” which highlights the potential for some negative implications of social expectations regarding resilience.

### 3.6. Chrono-system level (L6)

The determinants identified at the chrono-system level relate to temporal and ephemeral determinants during the pandemic. Definitions and example quotes are provided in Table 7. Across participants’ narratives, the pandemic is described as an evolving event that is characterized by an abrupt beginning, followed by emerging knowledge about the virus, and several waves of increases in infections with a readjustment of public health measures. Accordingly, early stages of the pandemic are described as an uncertain period that is associated with contrasting positive and negative feelings with fear and anxiety on the one hand, and a sense of novelty and social solidarity on the other. As the pandemic unravelled through weeks and months, individual and communities put in place adaptive strategies and settled into new routines. In this regard Sarah (73 y, F) shared: “We were in on the drill and knew what the drill was: what we had to do, what we could do, what we were allowed to do, and we were all sticking through.” However, new waves of increasing number of infections paved the way for new stressors to emerge while communities support fizzled down. For instance, James (70 y, M) shared: “There’s a cumulative effect. I think the longer that it’s on, the more you feel you are really missing the kind of things that you could tolerate missing for a short while.” As such, public health advancements in treatment and prevention, particularly the COVID-19 vaccine, were viewed as a welcomed development that provided “some light at the end of the tunnel.”

TABLE 7 Detailed socio-ecological determinants at the chrono-system (L6).

Determinant	Definition	Illustrative quote
6.1- From managing the unknown to setting in a new normal	Related to perceptions of the pandemic as an unfolding event where it is possible to identify different stages that are associated with diverse emotional states.	“My confidence is much better now. I suppose we have grown accustomed to living with it. Initially, when the first lockdown came, there were no cars on the roads, people were scared to be travelling on a bus or travelling on a train. It used to be. I’d be very conscious of it. Even going to the dentist or going into the doctor surgery where you would be in close contact or going to the hairdresser. But now I’ve had the vaccine, I wear the mask, I’ve grown accustomed to this, we are living with it. That’s where we are at.” Paddy (M, 89 y)
6.2- Emotional fatigue and reducing support	Related to winding down of support and solidarity throughout the pandemic.	“I think at the beginning there was a rush of community groups reaching out. I think it probably has floundered a bit. Maybe there’s a fatigue in some of the organizations... I have not had any packages recently, that could be because of financial limitations. I’m not sure. But I would like to think that it’s not finished.” Greg (M, 72 y)
6.3- Other temporal determinants	Related to ephemeral characteristics of social and physical environments (i.e., weather, seasonal traditions).	“When January came and Christmas was over, people talked about the January blues. Weather-wise it was terrible, and it was awful looking out. There were so many evenings I thought ‘I do not remember getting dark as early as this before in the month of January’. But that’s maybe because I wasn’t sitting around hoping the day would last longer. I do not know, but I was very, very down in January.” Roisin (F, 70 y)

The fluctuation of affect and accumulation of stressors was also exacerbated by ephemeral conditions such as weather and seasonal traditions. Whereas darker, colder, and rainier months were associated with an increase in negative emotions; while warmer temperatures and more sunshine were associated with positive affect through more opportunities to take part in outdoor coping activities such as meeting with others at a safe-physical distance, walking or gardening.

## 4. Discussion

To our knowledge, this is the first study utilizing all the levels of Bronfenbrenner’s socio-ecological model to identify and categorize the many factors that have influenced the health and well-being of people aging-in-place during COVID-19. This exhaustive approach denotes the uniqueness of each individual experience but also highlights multi-scalar opportunities for interventions to support older people during public health crises by identifying junctions where short- and long-term vulnerability may emerge. According to results of this study, vulnerability is rarely linked to a single determinant and often emerges from multi-faceted interactions between individual and contextual circumstances that can be nested in the proximate, socio-cultural and/or policy environment. In the pandemic context, disruptions at several levels of everyday life had the potential to accelerate previous trajectories of vulnerability and even to become points of no-return but may have also presented new opportunities for personal growth if individuals were met with appropriate resources and support.

As such, our findings reinforce that the wide arrange of pandemic experiences is reflective of the vast diversity of needs and capabilities among the older population (36). Moreover, in line with previous scholarship, findings suggest that a good person-environment fit, understood as a high degree of compatibility between individual’s needs and their opportunities to access suitable material, social and affective resources (37), may facilitate the timely development of adaptive strategies and successful coping mechanisms during a public health crisis. In contrast, poor person-fit environment and the unequal distribution of health enabling resources has the potential to stimulate

or exacerbate poor health trajectories (4). This finding emphasizes the need to establish support services and physical environments that are crafted according to the very diverse needs and preferences of older individuals. Moreover, our results reinforce the notion that older people are not merely recipients of support but are active agents in their own health and well-being and may have a key role in supporting others (36, 38). Accordingly, catering for a heterogeneous older population should be integrated into support services at the community level and healthcare by closely collaborating with older people themselves (39).

These results also provide insights into the implications of one-size-fits-all approaches that lack recognition of the heterogeneity of older people. Echoing other COVID-19 studies (8), participants reported ambivalent outcomes related to the cocooning measure. While participants recognized it had provided protection from infection and that it had been necessary since the government was acting with a limited amount of evidence available and under time pressure, it overlooked unique circumstances among older people, which fueled ageist behaviors and social pressure to fit into a vulnerable identity. Previous evidence indicates that ageism may have strong influences on older people’s health and well-being by being internalized, which often leads to resentment towards others and affects individuals’ sense of agency and independence (40). Although blanket approaches may remain necessary in certain circumstances, counter measures to avoid unintended consequences include their implementation only for short periods of time, inbuilt pathways for ongoing adaptation and collaboration with the populations affected so it is feasible for policymakers to capture unintended effects in a timely manner and co-develop mitigation strategies. Additionally, results confirm that mass media communications have an important role in providing a clear message of the rationale of public health measures and in showcasing the heterogeneity of older people’s experiences, which can contribute to build intergenerational bonds (40, 41).

We acknowledge that the limitations of the present study include remote data collection, which may hinder communication between researchers and participants due to limited physical queues and technical difficulties, such as poor internet connection causing delays in online interviews. To compensate for these, the research team gave participants the opportunity to choose which method of data

collection they preferred, and utilized active listening, prompts and verbal queues to build rapport. An additional strength is our multi-method approach to collect data from participants, which diminishes the risk of only capturing the experiences of older people who are comfortable with digital technologies. However, due to the limitations to meet face-to-face during the recruitment, we had to rely on remote strategies, such as contact with community organizations and older people representatives, as well as advertisements in public spaces (i.e., shops, pharmacies, places of worship, post offices) that may not have equal reach across Ireland. We suggest findings from this study should be expanded and triangulated with further studies focusing on different contexts or populations, as well as studies with complementary research methodologies, such as those utilizing longitudinal and/or nationally representative data.

## 5. Conclusion

Findings from this study present a snapshot of the experiences of people aging-in-place during a limited period of the pandemic. As indicated in the chrono-system, participants' perspectives and needs are prone to change, which highlights individuals' adaptive potential, as well as the potential fragility and resilience of our social and physical environments, and that of our community support and healthcare services. Resonating with the participant's quote that illustrates individual resilience, the implication for public health practitioners and policy makers is to seek "to develop a normal way of being that allows us to survive challenges and difficulties." Ultimately, our evidence indicates that developing pro-active and resilient interventions in non-emergency times may have the most potential for adaption during times of crisis, and that interventions seeking to support the aging population should place collaboration with older people at their core.

## Data availability statement

The datasets presented in this article are not readily available because of the sensitive nature of the data for this study. Requests to access the datasets should be directed to [vivekaguzman@rcsi.ie](mailto:vivekaguzman@rcsi.ie).

## Ethics statement

The studies involving human participants were reviewed and approved by Royal College of Surgeons in Ireland Research Ethics

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VG, PC, NC, GH, AS, and PW: conceptualization and study design. VG: investigation, project administration, and writing—original draft preparation. VG, FD, RE, and MMP: methodology. VG, PC, NC, PW, and MP: analysis and interpretation. VG, FD, RE, PC, NC, PW, and MMP: writing—review and editing. FD, RE, and MMP: supervision. All authors contributed to the article and approved the submitted version.

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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.

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# Associations of psychological wellbeing with COVID-19 hospitalization and mortality in adults aged 50 years or older from 25 European countries and Israel

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**Background:** Lower psychological wellbeing is associated with poor outcomes in a variety of diseases and healthy populations. However, no study has investigated whether psychological wellbeing is associated with the outcomes of COVID-19. This study aimed to determine whether individuals with lower psychological wellbeing are more at risk for poor outcomes of COVID-19.

**Methods:** Data were from the Survey of Health, Aging, and Retirement in Europe (SHARE) in 2017 and SHARE's two COVID-19 surveys in June–September 2020 and June–August 2021. Psychological wellbeing was measured using the CASP-12 scale in 2017. The associations of the CASP-12 score with COVID-19 hospitalization and mortality were assessed using logistic models adjusted for age, sex, body mass index, smoking, physical activity, household income, education level, and chronic conditions. Sensitivity analyses were performed by imputing missing data or excluding cases whose diagnosis of COVID-19 was solely based on symptoms. A confirmatory analysis was conducted using data from the English Longitudinal Study of Aging (ELSA). Data analysis took place in October 2022.

**Results:** In total, 3,886 individuals of 50 years of age or older with COVID-19 were included from 25 European countries and Israel, with 580 hospitalized (14.9%) and 100 deaths (2.6%). Compared with individuals in tertile 3 (highest) of the CASP-12 score, the adjusted odds ratios (ORs) of COVID-19 hospitalization were 1.81 (95% CI, 1.41–2.31) for those in tertile 1 (lowest) and 1.37 (95% CI, 1.07–1.75) for those in tertile 2. As for COVID-19 mortality, the adjusted ORs were 2.05 (95% CI, 1.12–3.77) for tertile 1 and 1.78 (95% CI, 0.98–3.23) for tertile 2, compared with tertile 3. The results were relatively robust to missing data or the exclusion of cases solely based on symptoms. This inverse association of the CASP-12 score with COVID-19 hospitalization risk was also observed in ELSA.

**Conclusion:** This study shows that lower psychological wellbeing is independently associated with increased risks of COVID-19 hospitalization and mortality in European adults aged 50 years or older. Further study is needed to validate these associations in recent and future waves of the COVID-19 pandemic and other populations.

## KEYWORDS

COVID-19, psychological wellbeing, CASP-12, SHARE, older people



## 1. Introduction

The coronavirus disease 2019 (COVID-19) is a great threat to public health worldwide. As of 16 September 2022, there have been more than 600 million confirmed cases, including 6.5 million deaths (1). Moreover, the pandemic does not show any signs of ending at present. Most severe cases occurred in individuals aged 50 years and older. Compared with younger patients, their hospitalization and mortality rates are 3–5 and 25–340 times higher, respectively (2).

In addition to older age, well-established risk factors for severe COVID-19 include male gender, lower socioeconomic status, poor physical fitness, and underlying diseases such as cardiovascular disease, respiratory disease, cancer, kidney disease, diabetes, and obesity (3–6). As per the WHO's definition of health as “a state of complete physical, mental, and social wellbeing” (7), the above risk factors are related to the physical and social dimensions. However, less attention has been paid to whether factors related to the psychological dimension affect COVID-19 outcomes.

According to human need theory, psychological wellbeing can be measured as the degree that human needs are satisfied (8, 9). Based on this theory, the CASP (control, autonomy, self-realization, and pleasure) scale offers an approach to accessing psychological wellbeing in older people with a meaningful and valid research instrument (8). CASP-12 is the revised 12-item version of the CASP scale. The scale has been translated into 16 languages and used in more than 20 national and international studies (10–15). The objective of this study was to investigate the associations of CASP-12-measured psychological wellbeing with COVID-19 hospitalization and mortality in adults aged 50 years or older in 25 European countries and Israel.

## 2. Materials and methods

### 2.1. Study population

Data were from the Survey of Health, Aging, and Retirement in Europe (SHARE). SHARE is the largest pan-European social science panel study, which every 2 years collected information on health, socioeconomic status, and social and family networks from individuals aged 50 years and older (12). From 2004 until today, SHARE has had eight regular waves, including 140,000 participants from 28 European countries and Israel. In addition to the regular SHARE questionnaire, participants responded to specific questions about COVID-19 infections and changes in life during the pandemic between June and September 2020 (SHARE Corona Survey 1) and between June and August 2021 (SHARE Corona Survey 2) (16, 17). SHARE was reviewed and approved by the Ethics Council of the Max Planck Society (waves 4–8, and SHARE Corona Surveys 1 and 2).

In this study, we only included participants in SHARE Wave 7 (conducted in 2017) because this wave had the most recent CASP-12 measurement before the COVID-19 outbreak (18). From the sample of 69,750 participants aged 50 years or older who had valid data for CASP-12 in Wave 7, 4,323 were considered COVID-19 infected according to the subsequent SHARE Corona Surveys 1 and 2. COVID-19 infection was defined if participants

had experienced COVID-19 symptoms, had been tested positive for the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), had been hospitalized due to COVID-19, or had died of COVID-19 or complications. Only subjects with information available for all covariates were included (missing data were 10.1% for all included covariates), leaving 3,886 individuals for our analyses (Figure 1).

### 2.2. COVID-19 hospitalization and mortality

In SHARE Corona Surveys 1 and 2, participants were asked, “Have you or anyone close to you been hospitalized due to an infection from the Coronavirus?” If participants answered “yes,” they were asked, “Who was hospitalized?” Participants who indicated that they were hospitalized were included in the COVID-19 hospitalization analysis.

SHARE requested interviewers to confirm the decease of a participant by a proxy respondent. In the case of decease, an end-of-life interview was conducted to collect information such as the cause of death. The proxy respondent can be a family/household member, a neighbor, or any other person in the closer social network of the deceased participant. Participants who died of COVID-19 or related complications were included in the analysis of COVID-19 mortality. These deceased participants also constituted the sample of COVID-19 hospitalization because they usually died in hospitals or other health facilities.

### 2.3. Psychological wellbeing

Psychological wellbeing was measured using the CASP-12 scale (8, 19). The CASP-12 is a 12-item scale composed of four domains, such as control, autonomy, self-realization, and pleasure. Each domain has three items, which are presented as questions or statements to survey participants. Each item is assessed on a 4-point Likert scale (“often,” “sometimes,” “rarely,” and “never”) (Supplementary Table S1). The resulting score is the sum of these 12 items and ranges from a minimum of 12 to a maximum of 48 (19). A high score indicates a high level of psychological wellbeing. The literature does not indicate a threshold that categorizes psychological wellbeing as “low” or “high.”

### 2.4. Covariates

Potential confounding factors were included in the analyses as follows: age (when interviewed in SHARE wave 7 in 2017), sex, body mass index, smoking status, physical activity, household income, education, and underlying health conditions. Body mass index was calculated as weight/height<sup>2</sup> and was classified into categories of underweight (<18.5), normal weight (18.5 to <25), overweight (25 to <30), and obese (≥30), according to the WHO's criteria. Height and weight were self-reported in SHARE. Participants were asked how many days per week they engaged in

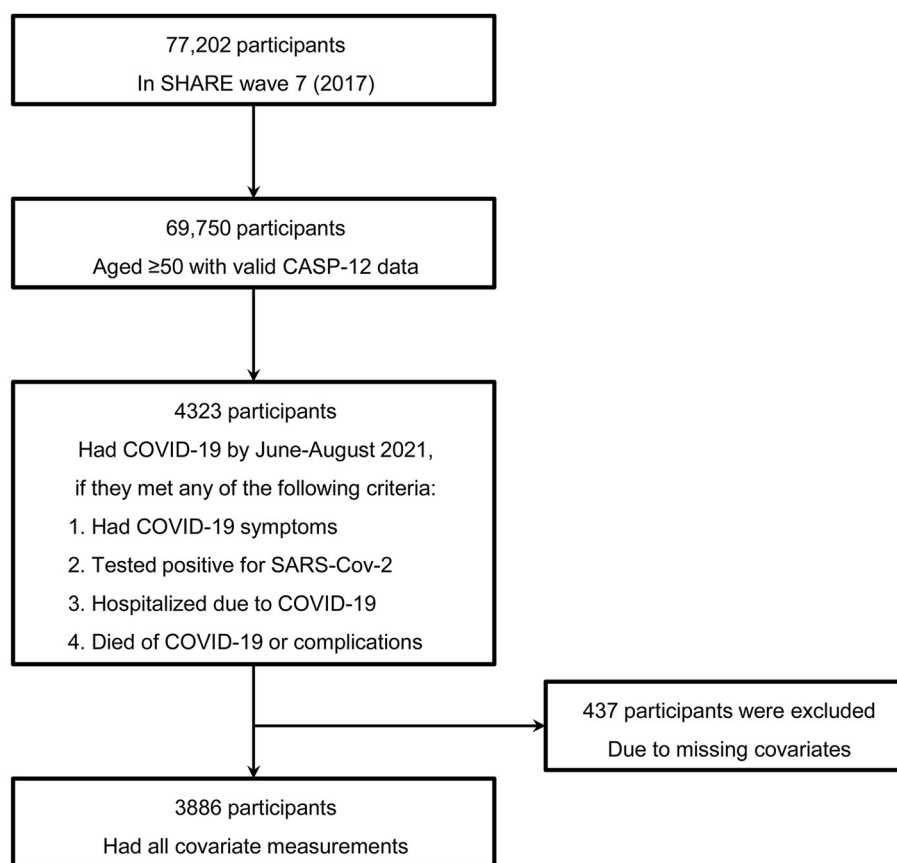


FIGURE 1

Determination of the study sample. COVID-19, coronavirus disease 2019; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2; SHARE, Survey of Health, Aging, and Retirement in Europe.

moderate (e.g., gardening, cleaning the car, or doing a walk) and vigorous-intensity physical activities (e.g., sports, heavy housework, or a job that involves physical labor). If participants answered “Hardly ever, or never,” they were considered physically inactive. Participants were asked, “Have you ever smoked cigarettes, cigars, cigarillos, or a pipe daily for a period of at least one year?” If participants answered “Yes,” they were classified as ever smoked daily. Education level was coded according to the International Standard Classification of Education-97 (ISCED-97) criteria and classified as low level (no education or ISCED-97 codes 1 and 2), middle level (ISCED-97 codes 3 and 4), and high level (ISCED-97 codes 5 and 6). Household income was categorized into country-specific quartiles. The following health conditions were asked whether participants ever diagnosed or had at the time of the interview: respiratory diseases (such as chronic bronchitis or emphysema), cardiovascular diseases (heart attack including myocardial infarction or coronary thrombosis or any other heart problem including congestive heart failure and stroke or cerebral vascular disease), diabetes or high blood sugar, cancer or malignant tumor (including leukemia or lymphoma but excluding minor skin cancer), chronic kidney disease, and rheumatoid arthritis.

## 2.5. Statistical analyses

A total of four logistic regression models were fitted to test the associations of the CASP-12 score with COVID-19 hospitalization and mortality. Model 0 was unadjusted. Model 1 adjusted for age (50–60, 60–70, >70 years) and sex. Additionally, Model 2 adjusted for body mass index, smoking, physical activity, household income, and education level. Finally, Model 3 further adjusted for underlying health conditions including respiratory disease, cardiovascular disease, diabetes, cancer, chronic kidney disease, and rheumatoid arthritis. Interaction terms were fitted to Model 3 to assess whether age (50–60, 60–70, >70 years) and sex modified associations with COVID-19 hospitalization and mortality.

First, odds ratios (ORs) for age-specific and sex-specific tertiles of the CASP-12 score were calculated, with participants in the highest tertile for the CASP-12 score used as the reference group. Linear associations between continuous independent variables and COVID-19 outcomes were checked using the Box-Tidwell test. As no evidence of deviation from linearity was found, the CASP-12 score was also treated as a continuous variable in the above models, and ORs were calculated per score decrement in the score.

A total of two sensitivity analyses were conducted. In the first sensitivity analysis, participants whose diagnosis of COVID-19 infection was solely based on symptoms were excluded. Thus, the included participants were those who tested positive for SARS-CoV-2, or hospitalized due to COVID-19, or died of COVID-19 or related complications. In the second sensitivity analysis, missing values of covariates were imputed ([Supplementary Method S1](#)).

A confirmatory analysis was conducted to validate the association between CASP-12 and COVID-19 hospitalization using data from the English Longitudinal Study of Aging (ELSA) ([13](#)). ELSA is a panel survey of people aged 50 years and older living in England. It has been carried out every 2 years since 2002 to collect data on health, economic, and social circumstances and now has nine regular waves. Wave 9, conducted in 2018–2019, is the most recent regular wave before the outbreak of COVID-19. During 2020, two additional waves (COVID-19 Wave 1, June–July 2020; COVID-19 Wave 2, November–December 2020) were conducted to collect information on the impact of the COVID-19 crisis on health, social care, financial circumstances, and social activity. Of the 6,965 participants aged 50 years and older with valid data for CASP-12 in ELSA Wave 9, 285 had COVID-19 infection and were included in the confirmatory analysis ([Supplementary Figure S](#)). The association between CASP-12 and COVID-19 mortality was not assessed because end-of-life data are currently not released. Ethical approval for ELSA Wave 9 was granted by the South Central Berkshire Research Ethics Committee through an application to the National Research Ethics Service. ELSA COVID-19 waves 1 and 2 were reviewed and approved by the University College London Research Ethics Committee. Detailed methods of confirmatory analysis are presented in [Supplementary Method S2](#). ORs were accompanied by corresponding 95% confidence intervals (95% CIs). All analyses were performed with StataSE 15 (Stata Corporation, College Station, TX, United States).

## 3. Results

### 3.1. Characteristics of the study population

Of the 3,886 participants with COVID-19 infection included in the study, 1,607 (41.4%) participants were men and 2,277 (58.6%) were women. The mean (range) age was 65.5 (50.1–96.3) years. The 3,886 participants were from 25 European countries and Israel. By June–August 2021, 580 (14.9%) participants were hospitalized and 100 (2.6%) died due to COVID-19.

The distribution of the CASP-12 score of the 3,886 participants is shown in [Figure 2](#). The score ranged from 14 to 48, with a median of 38 (interquartile range [IQR]: 33–42). Individuals who were hospitalized or died due to COVID-19 had lower CASP-12 scores before the COVID-19 outbreak compared with those not (median score: 36 (IQR, 31–40) vs. 38 (IQR, 34–42) for hospitalization; 35 (IQR, 30–39) vs. 38 (IQR, 33–42) for mortality;  $P < 0.0001$  for each, Mann–Whitney  $U$ -test).

[Table 1](#) summarizes the main characteristics of the participants by age- and sex-specific tertiles of the CASP-12 score. In brief, people in the lowest tertile (tertile 1) for the CASP-12 score had lower levels of education, household income, and physical activity and had a higher prevalence of obesity and comorbidities, including

cardiovascular disease, respiratory disease, diabetes, cancer, chronic kidney disease, and rheumatoid arthritis, compared with the highest CASP-12 score group (tertile 3) ( $P < 0.01$  for each, chi-square test).

### 3.2. Associations of established risk factors with COVID-19 hospitalization and mortality

Older age, male gender, physical inactivity, lower levels of education, diabetes, and being overweight or obese were associated with an increased risk of COVID-19 hospitalization. Older age, male gender, physical inactivity, and diabetes were associated with an increased risk of COVID-19 mortality. The other associations were not statistically significant ([Supplementary Table S2](#)).

### 3.3. Associations of CASP-12 with COVID-19 hospitalization and mortality

As shown in [Table 2](#), individuals in tertile 1 (the lowest) and tertile 2 (the medium) of the CASP-12 score had higher risks of COVID-19 hospitalization and mortality compared with those in tertile 3 (the highest) in Model 0. After adjustment for age and sex, the risks were similar in Model 1; after further adjustment, the magnitude of the risks was slightly attenuated in Model 2 and Model 3. In the fully adjusted model (Model 3), compared with individuals in tertile 3, the ORs of COVID-19 hospitalization were 1.81 (95% CI, 1.41–2.31) for those in tertile 1 and 1.37 (95% CI, 1.07–1.75) for those in tertile 2. As for COVID-19 mortality, the fully adjusted ORs in Model 3 were 2.05 (95% CI, 1.12–3.77) for tertile 1 vs. tertile 3 and 1.78 (95% CI, 0.98–3.23) for tertile 2 vs. tertile 3.

When the CASP-12 score was treated as a continuous variable, similar results for COVID-19 hospitalization and mortality were found ([Supplementary Table S3](#)). The fully adjusted ORs per score decrement in CASP-12 were 1.03 (95% CI, 1.02–1.05) and 1.04 (95% CI, 1.01–1.08) for COVID-19 hospitalization and mortality, respectively. Age and sex had no significant interaction effects on the associations of CASP-12 score with COVID-19 hospitalization and mortality ( $P$  for interaction  $> 0.05$ ).

### 3.4. Sensitivity analyses

In the first sensitivity analysis, 1,187 participants whose diagnosis of COVID-19 infection was solely based on symptoms were excluded, leaving 2,699 participants with 580 hospitalized and 100 deaths. The magnitude of the risks for COVID-19 hospitalization and mortality regarding the CASP-12 score hardly changed, either being treated as a tertile cutoff ([Supplementary Table S4](#)) or as a continuous variable ([Supplementary Table S5](#)). In the second sensitivity analysis, after imputing for missing data of covariates, there were 4,323 participants with COVID-19 infection, including 646 hospitalized

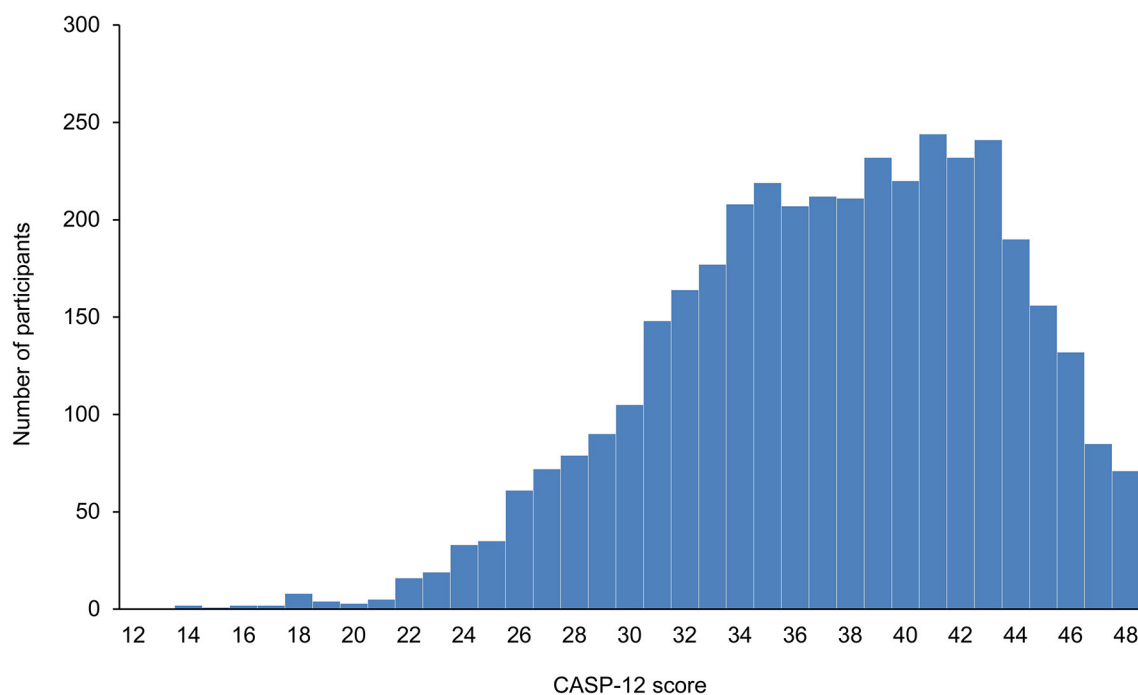


FIGURE 2  
Distribution of the CASP-12 score of the 3,886 participants.

and 111 deaths. The magnitude of the risks was only slightly attenuated ([Supplementary Table S6](#)).

### 3.5. Confirmatory analyses in the ELSA Cohort

Of the 285 participants with COVID-19 infection in the ELSA cohort, 108 (37.9%) were men and 177 (62.1%) were women. The median age was 65 (IQR, 56–72) years. By November–December 2020, 37 (13.0%) participants were hospitalized due to COVID-19. The score of CASP-12 ranged from 17 to 48, with a median of 38 (IQR, 33–42). Individuals who were hospitalized due to COVID-19 tended to have lower CASP-12 scores before the COVID-19 outbreak compared with those not (median score: 35 (IQR, 29–41) vs. 38 (IQR, 34–42),  $P = 0.067$ , Mann–Whitney  $U$ -test). The unadjusted OR per score decrement in CASP-12 was 1.06 (95% CI, 1.00–1.11) for COVID-19 hospitalization. The association (OR, 1.06; 95% CI, 1.01–1.13) did not change after adjustment for age and sex. As only 37 subjects were hospitalized, adjustment for more covariates was not performed.

## 4. Discussion

The main finding of this study is that a lower CASP-12 score was associated with hospitalization and mortality in COVID-19-infected individuals aged 50 years and older from 25 European countries and Israel. The associations observed were relatively robust after adjustment for established risk factors

for severe COVID-19, including older age, male gender, lower socioeconomic status, poor physical fitness, and underlying diseases such as cardiovascular disease, respiratory disease, cancer, kidney disease, diabetes, and obesity. The association of CASP-12 with COVID-19 hospitalization was confirmed in the English population.

To the best of our knowledge, this is the first study to investigate how psychological wellbeing affects clinical outcomes of COVID-19 infection. Previous studies mainly focused on the impact of the COVID-19 pandemic on psychological wellbeing, and most studies showed a negative effect on people's psychological wellbeing for those who were infected and for those who were not infected (20). Prospective studies of populations with other diseases showed that positive psychological wellbeing is associated with favorable physical health outcomes (21–26). These diseases include cancer, cardiovascular disease, renal failure, human immunodeficiency virus infection, and patients undergoing major surgery. Involved measures of psychological wellbeing include emotional wellbeing, positive mood, joy, happiness, vigor, energy, life satisfaction, hopefulness, optimism, and a sense of humor. Data from ELSA, a general aged population in England, showed that compared with the lowest quartile, the highest quartile of CASP-19 (a 19-item CASP scale) score was associated with a 30% (95% CI 16.7–41.7%) reduction in mortality risk after adjusting for age, sex, education and wealth, health status, measures of depression, and health behaviors such as smoking, physical activity, and alcohol consumption (27). As for COVID-19, the current study revealed a similar trend for disease outcomes concerning the CASP-12 scale. Taken together, increasing psychological

TABLE 1 Characteristics of the cohort by age- and sex-specific tertiles of CASP-12 score.

Characteristics	All ( <i>n</i> = 3,886)	Tertile of CASP-12 score		
		Tertile 1 (lowest) ( <i>n</i> = 1,347)	Tertile 2 ( <i>n</i> = 1,252)	Tertile 3 (highest) ( <i>n</i> = 1,287)
Gender, male	41.4% (1,609)	42.0% (566)	41.1% (515)	41.0% (528)
Age, mean (SD), years	65.5 (8.6)	65.8 (9.0)	65.6 (8.5)	65.3 (8.3)
<b>Body mass index categories</b>				
Underweight (< 18.5)	0.7% (27)	0.7% (9)	0.5% (6)	0.9% (12)
Normal weight (18.5 to <25)	29.4% (1,141)	24.5% (330)	29.6% (370)	34.3% (441)
Overweight (25 to <30)	40.9% (1,590)	41.6% (560)	41.5% (520)	39.6% (510)
Obese (≥30)	29.0% (1,128)	33.3% (448)	28.4% (356)	25.2% (324)
<b>Education level</b>				
Low	30.2% (1,174)	38.2% (514)	29.2% (365)	22.9% (295)
Middle	45.2% (1,756)	44.3% (597)	46.1% (577)	45.2% (582)
High	24.6% (956)	17.5% (236)	24.8% (310)	31.9% (410)
<b>Household income</b>				
Quartile 1 (lowest)	19.8% (768)	27.0% (363)	18.1% (226)	13.9% (179)
Quartile 2	24.0% (934)	27.7% (373)	22.4% (280)	21.8% (281)
Quartile 3	26.4% (1,025)	23.5% (317)	29.6% (370)	26.3% (338)
Quartile 4 (highest)	29.8% (1,159)	21.8% (294)	30.0% (376)	38.0% (489)
Physical inactivity	9.3% (360)	15.4% (207)	7.8% (97)	4.4% (56)
Ever smoked daily	42.2% (1,638)	42.6% (574)	41.4% (518)	42.4% (546)
Cardiovascular disease	13.6% (530)	19.6% (264)	13.2% (165)	7.9% (101)
Respiratory disease	5.2% (203)	6.5% (88)	5.7% (71)	3.4% (44)
Diabetes	12.3% (479)	15.7% (211)	11.0% (138)	10.1% (130)
Cancer	4.4% (170)	5.8% (78)	4.7% (59)	2.6% (33)
Chronic kidney disease	2.2% (86)	3.0% (41)	2.7% (34)	0.9% (11)
Rheumatoid arthritis	10.6% (412)	15.1% (204)	10.0% (125)	6.5% (83)

Values are percentages (numbers) unless stated otherwise.

TABLE 2 Associations of tertile CASP-12 score with COVID-19 hospitalization and mortality.

Model	COVID-19 hospitalization, OR (95% CI)		COVID-19 mortality, OR (95% CI)	
	Tertile 1 vs. Tertile 3	Tertile 2 vs. Tertile 3	Tertile 1 vs. Tertile 3	Tertile 2 vs. Tertile 3
0	1.92 (1.54–2.40)	1.41 (1.12–1.79)	2.49 (1.44–4.32)	2.09 (1.18–3.70)
1	1.98 (1.58–2.49)	1.44 (1.13–1.84)	2.55 (1.46–4.46)	2.12 (1.19–3.79)
2	1.77 (1.39–2.25)	1.38 (1.08–1.77)	2.00 (1.10–3.62)	1.92 (1.07–3.45)
3	1.81 (1.41–2.31)	1.37 (1.07–1.75)	2.05 (1.12–3.77)	1.78 (0.98–3.23)

Model adjustment.

Model 0: unadjusted.

Model 1: age and sex.

Model 2: Model 1 + body mass index, smoking, physical activity, household income, and education level.

Model 3: Model 2 + respiratory disease, cardiovascular disease, diabetes, cancer, chronic kidney disease, and rheumatoid arthritis.

CI, confidence interval; OR, odds ratio.

wellbeing is not only a goal in itself for a human being, but may also be a promising non-biological approach to improving outcomes in healthy and diseased populations, including those with COVID-19.

The current population-based study implies the potential value of CASP-12 in predicting the prognosis of COVID-19. Moreover, the CASP-12 scale was developed for older people (8). Thus, this tool may be more advantageous in COVID-19 than other



tools assessing psychological wellbeing, since severe disease and mortality mainly occur in older people. In addition, the 12-item questionnaire can be easily performed, and the respondent burden is low. The CASP-12 has demonstrated good validity and reliability and now has been widely adopted, particularly in large surveys of aging populations (10–15). Future studies should assess its prognostic value in clinical settings.

Behavioral pathways are thought to partly mediate the association between psychological wellbeing and clinical outcomes. For example, negative psychological wellbeing, which is characterized by low levels of positive emotions, high levels of negative emotions, and a lack of life satisfaction, is related to smoking, drinking, low physical activity levels, poor sleep quality, and eating fewer fruits and vegetables (27, 28). The latter are well-established predictors for mortality and morbidity. In the current study, individuals with lower CASP-12 scores had lower levels of physical activity. After adjusting for physical activity, the ORs of COVID-19 hospitalization and mortality regarding CASP-12 were slightly attenuated. Future studies are suggested to include other behavioral factors.

Some biological mechanisms may be involved in the association between psychological wellbeing and COVID-19 outcomes. Negative wellbeing is related to increased levels of cortisol (29, 30), which is a marker of the severity of many diseases, such as pneumonia (31). Evidence supports high cortisol levels as an independent predictor of COVID-19 severity and mortality (32). Negative wellbeing is also associated with stress-induced elevations of inflammation, such as C-reactive protein, interleukin-6, fibrinogen, and white blood cell (29, 30, 33), which are biomarkers of critical COVID-19 and associated with mortality (34–36).

The first strength of the study is the longitudinal design of SHARE and its representative sample of Europeans aged 50 years or older. Second, the OR values suggested the associations of the CASP-12 score with COVID-19 hospitalization and mortality are relatively strong. A dose-dependent effect was suggested from logistic regressions when the CASP-12 score was treated as a continuous variable. A higher OR value for tertile 1 vs. tertile 3 than that for tertile 2 vs. tertile 3 also showed the trend. Third, the associations are relatively robust to missing data or the exclusion of cases solely based on symptoms. The association of CASP-12 with COVID-19 hospitalization was externally confirmed in the ELSA cohort.

The study has some limitations. First, information on COVID-19 infection, hospitalization, mortality, and covariates was collected with questionnaires. They are not as accurate as data from medical records, mortality registers, and direct measurements. Psychological wellbeing was measured in 2017 which was a significant period before the COVID-19 outbreak. Second, although a wide range of demographic, lifestyle, socioeconomic, and clinical factors were adjusted, other unmeasured factors that could potentially confound the observed associations cannot be ruled out. Third, in the validation cohort ELSA, the sample size was small and not allowed to adjust for more covariates, and due to the lack of mortality data, the association of the CASP-12 score with COVID-19 mortality was not validated. Fourth, information was lacking on COVID-19 vaccination and strains of SARS-Cov-2, which are associated with the disease severity.

People's psychological status, as well as their socioeconomic status, living conditions, behavior, and lifestyle, have been profoundly changed by the pandemic. The shortage of health resources at the early stages of the pandemic has been alleviated to some extent now (37, 38). Taken together, whether the findings of the current study will change in recent and future waves of the COVID-19 pandemic needs further evaluation.

In conclusion, this study shows that lower psychological wellbeing measured on the CASP-12 scale is independently associated with increased risks of COVID-19 hospitalization and mortality in European adults aged 50 years or older. Further study is needed to validate these associations in recent and future waves of the COVID-19 pandemic and in other populations. If this is the case, promoting psychological wellbeing may be a potential approach to improving the disease outcomes in patients with older age, the most vulnerable subgroup of COVID-19.

## 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 the Ethics Council of the Max Planck Society. The patients/participants provided their written informed consent to participate in this study.

## Author contributions

WW, XJ, FJ, and SD conceived and designed the study. WW and JW acquired the data and conducted the statistical analyses. JS and YL verified the data. WW, JW, JS, and YL drafted the manuscript. All authors interpreted the data, reviewed and contributed revisions to the final version of the manuscript, and approved the final version of the manuscript.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2023.1124915/full#supplementary-material>

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# Predictors of food insecurity among older adults before and during COVID-19 in the United States

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**Background:** The COVID-19 pandemic has strained the health and wellbeing of older adult populations through increased morbidity, mortality, and social exclusion. However, the impact of COVID-19 on the health of older adults through food security has received relatively little attention, despite the strong impact of diet quality on the health and longevity of older adults.

**Objective:** The objective of this study was to identify sociodemographic and socioeconomic predictors of self-reported food insecurity before and early in the COVID-19 pandemic among community-dwelling older adults in the United States.

**Methods:** Using longitudinal data from the Health and Retirement Study, a nationally representative sample of middle-aged and older adults in the United States, we examined the associations between sociodemographic and socioeconomic predictors of self-reported food insecurity between 2018 ( $N = 2,413$ ) and June 2020 ( $N = 2,216$ ) using population-weighted multivariate logistic regression models.

**Results:** The prevalence of food insecurity doubled among participants from 2018 (4.83%) to June 2020 (9.54%). In 2018, non-Hispanic Black and rural residents were more likely to report food insecurity, while individuals with higher education and greater wealth were less likely to report food insecurity in adjusted models. In June 2020, those who were relatively younger, not working due to a disability, and renting were more likely to report food insecurity. Those with an increased number of functional limitations, a recent onset of a work-limiting disability, and those who were no longer homeowners experienced an elevated longitudinal risk for food insecurity.

**Conclusion:** Future research should examine effective policies and interventions to address the disproportionate impacts of COVID-19 on populations at a heightened risk of experiencing food insecurity.

## KEYWORDS

food insecurity, food security, COVID-19, older adults, disability, Health and Retirement Study

## 1. Introduction

The COVID-19 pandemic has particularly strained the health and wellbeing of older adult populations through increased morbidity, mortality, and social exclusion. However, the impact of COVID-19 on the health of older adults through food access and food security has received relatively little attention, despite the strong impact of diet quality on the health and longevity of older adult populations (1–4). Food insecurity is defined as having limited or uncertain access to adequate nutritious food to maintain an active and healthy life (5). Studies of the early food insecurity impacts of COVID-19 have found as much as a one-third increase (32.3%) in household food insecurity overall since the onset of COVID-19, with 35.5% of food insecure households classified as a newly food insecure in the United States (6).

During the COVID-19 pandemic, food security has been affected by stay-at-home orders, closure/limited hours of food retailers, supply chain issues, the relatively sudden surge of high unemployment, inflation, and other economic impacts. In particular, the pandemic has highlighted challenges in food access and food security for older adults. Older adults could be disproportionately affected due to increased financial hardship, reduced use of public transportation, and less access to food delivery services among this population. Because of older adults' relatively high vulnerability to morbidity and mortality from COVID-19, older adults might be concerned about their safety while accessing grocery retailers (7). Social distancing policies may also hinder older adults' ability to benefit from community food resources, such as the Supplemental Nutrition Assistance Program (SNAP) and food banks. This is likely particularly true for older adults with disabilities who are disproportionately affected by COVID-19 (8, 9).

Food insecurity is a chronic, longstanding issue that has been exacerbated during COVID-19. Historically, food insecurity has disproportionately impacted people of color and low-income households, mainly because communities of color and low-income communities are less likely to have geographically and economically accessible healthy food than predominantly white communities and more affluent communities (10–12). Among middle-aged and older populations, women and those of relatively younger age were found to be more susceptible to food insecurity (13, 14). Previous studies have also linked food insecurity in older adults to multiple chronic conditions (13, 15, 16) and functional limitations (15, 17, 18). The presence of chronic illness comorbidities and functional limitations may adversely affect individuals' ability to shop for food, carry food home, and prepare meals, potentially contributing to food insecure conditions.

Persistent gender, socioeconomic, racial, and ethnic disparities in food insecurity during COVID-19 have been consistently observed across all age groups (6, 19–25). While some studies have examined the differential impacts of COVID-19 on food security and food access using longitudinal data to examine changes in food insecurity before and after the onset of the pandemic (26, 27), no studies have focused on risk and

protective factors specific to older adult populations (28). Little is known about the risk and protective factors associated with food insecurity among diverse middle-aged and older adult populations. Using a nationally representative sample of adults aged 50 and older in the United States, the present study examines sociodemographic and socioeconomic predictors of food insecurity before COVID-19 (2018) and during COVID-19 (since June 2020). We also investigate time-varying longitudinal risk factors for food insecurity during the pandemic. Sociodemographic characteristics examined include age, gender, race/ethnicity, partnership status, and urbanicity. Socioeconomic characteristics examined include educational attainment, total household wealth, individual income, current working status, and home ownership status.

## 2. Methods

### 2.1. Sample

The data utilized in this study were from a longitudinal cohort of older adults who completed the June COVID module (2020) and 2018 waves of the Health and Retirement of Study (HRS). HRS is a nationally representative longitudinal survey of adults over the age of 50 in the United States that began in 1992 and continued with data collection every 2 years since. A multi-stage probability sampling strategy was utilized by HRS with an adjustment for geographic stratification, clustering, and oversampling of African Americans and Hispanic/Latinx populations (29). In 2020, HRS added COVID-19-specific questions to the core interview which were fielded to a 50% random subsample of households. Questionnaires were administered to one-half of the subsample on 11 June 2020 and to the other half of the subsample on 24 September 2020. The current study used data from the June 2020 release, which includes 3,266 respondents, accounting for a random sample of approximately 25% of HRS participants. Pre-pandemic data for the same 3,266 respondents were drawn from 2018 HRS survey data.

Of the 3,266 respondents in 2018, 853 (26%) were excluded from the analysis on predictors of 2018 food security status for the following reasons: (1) younger than 50 years of age ( $n = 96$ ); (2) missing food security status ( $n = 62$ ); (3) missing observations for any independent variables ( $n = 493$ ); and (4) missing sampling weight ( $n = 304$ ). The analytical sample for 2018 is 2,413. Of those 3,266 respondents in June 2020, 1,050 (32%) were excluded from the analysis on predictors of 2020 food security status for the following reasons: (1) younger than 50 years of age ( $n = 96$ ); (2) missing food security status ( $n = 853$ ); (3) missing observations for any independent variables ( $n = 76$ ); and (4) missing sampling weight ( $n = 25$ ). The analytical sample for 2020 is 2,216.

The HRS was approved by the University of Michigan Health Sciences/Behavioral Sciences Institutional Review Board (HUM00061128). The core HRS questionnaires for 2018 and 2020 can be accessed at [https://hrsdata.isr.umich.edu/data-products/public-survey-data?\\_ga=2.76255637.1075731333.1676136739-821463064.1675792997](https://hrsdata.isr.umich.edu/data-products/public-survey-data?_ga=2.76255637.1075731333.1676136739-821463064.1675792997).



## 2.2. Measures

### 2.2.1. Food insecurity

Food insecurity was identified through two self-reported measures as developed in prior research (30, 31). Participants were asked whether, since the last interview, they always had enough money to buy the food they needed. Response options were coded as *yes*, *no*, *don't know*, or *refused*. Participants who answered “no” to the first question were then asked whether, in the past 12 months, they ever ate less than they felt they should because there was not enough money to buy food. Response options were coded as *yes*, *no*, *don't know*, or *refused*. These two questions were used to create a dichotomous variable to categorize food security status in 2018 and 2020 (30, 31). Participants reporting that they had enough money to buy the food they needed since the last interview were considered food secure. Participants reporting that they did not have enough money to buy the food they needed since the last interview and ate less in the past 12 months were considered as food insecure. This self-reported measure is consistent with prior research using the HRS (30, 31), in line with conceptual developments in food security measurement toward the use of subjective measures (32), and consistent with other widely used self-reported measures of food insecurity, including the measure adopted by the United States Department of Agriculture (USDA) (33).

### 2.2.2. Sociodemographic characteristics

Sociodemographic characteristics examined in this study included age group (50–64, 65–74, and 75+), gender (male and female), partnership status (uncoupled and coupled), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic/Latinx, and non-Hispanic Other), and urbanicity (urban, suburban, and ex-urban), which was classified by following the 2013 Beale Rural-Urban Continuum Codes. Age group and partnership status were measured in 2018 and 2020, while gender, race/ethnicity, and urbanicity were only assessed at baseline (2018).

### 2.2.3. Socioeconomic characteristics

We included socioeconomic characteristics that are associated with food access, diet quality, and food insecurity among older adults in recent studies (28, 34, 35). Examined socioeconomic characteristics include educational attainment (less than high school, high school or General Education Diploma (GED) completion, some college, and college or more), total wealth (negative net wealth, below median, and above median), individual income (no income, below median, and above median), current working status (currently working, not currently working, not working due to disability, retired, and others), and home ownership status (own, rent, and other). Total wealth (including secondary residence) was calculated by total assets minus total debts.<sup>1</sup> The individual income

included the respondent's total earnings from salaries, wages, bonuses received from employment and self-employment, and investments. Total wealth, current working status, and home ownership status were assessed in 2018 and 2020, while only baseline measures were available for educational attainment and individual income.

### 2.2.4. Health-related characteristics

We controlled for health-related characteristics that may confound the associations between food security status and the sociodemographic and socioeconomic predictors. Functional limitations were assessed by instrumental activities of daily living (IADLs). IADLs were measured by the level of assistance needed to use a telephone, take medication, and handle money (36). Participants were assessed whether they were able to complete each IADL item without assistance (0) or with assistance (1). The final scores were summed for IADLs (range: 0–3) to indicate functional limitations. The number of chronic illness comorbidities was assessed using participants' reports of diagnosis with eight potential conditions—including arthritis, cancer, diabetes, heart disease, hypertension, lung disease, psychiatric problems, and stroke (range: 0–8). Chronic illness comorbidities were assessed at baseline (2018) only, while the measure of IADLs was time-varying.

## 2.3. Analytic approach

We characterized food security status in the unweighted sample in 2018 and 2020. Parametric *t*-tests and chi-squared tests were conducted to assess associations between sample characteristics and food security status in 2018 and 2020. We then examined the independent relationships between sociodemographic and socioeconomic characteristics and food insecurity in 2018 and 2020 using two separate binomial logistic regression models.<sup>2</sup> Odds ratios and the corresponding 95% confidence intervals were reported to compare the relative odds of food insecurity across sociodemographic/socioeconomic subgroups. Functional limitations and chronic disease comorbidities were included as control variables, as these characteristics could confound the relationship between sociodemographic and socioeconomic characteristics and food insecurity among older adults (13, 15–18, 37). We further exploit the longitudinal nature of the data by coding the available time-varying measures according to changes

mutual funds, investment trusts, checking, savings, money market accounts, CD, government savings bonds, T-bills, bonds, and bond funds. Debts include the sum of all mortgages/land contracts (including secondary residence), other home loans (including secondary residence), and other debts.

<sup>2</sup> The objective of this study was to characterize factors that were—and were not—associated with food insecurity before and during COVID-19. Therefore, we opted to include all examined variables in the analyses, whether or not they were found to be significantly associated with food insecurity in descriptive and multivariate analyses. The −2 log-likelihood results were 698.82 for 2018 ( $p < 0.0001$ ) and 1,201.14 ( $p < 0.0001$ ) for 2018.

<sup>1</sup> Assets include the sum of the net values of primary residence, secondary residence, real estate, vehicles, business, all IRA and Keogh accounts, stocks,

observed from 2018 to 2020 (38). For example, in the case when a respondent reported a work disability in 2020 but not in 2018, we generate a variable indicating a “new disability onset” which is compared with those with no change in disability status. We then examined the relationship between the time-varying variables (IADLs, working status, partnership status, and homeownership status) and the onset of food insecurity in 2020 to identify those at risk for food insecurity during the pandemic. All regression analyses were weighted<sup>3</sup> to adjust for selection and non-response biases. Multicollinearity was not a concern, as variance inflation factors (VIFs) for all predictor variables were below 1.50, well below the established threshold of 4.0 (39). All analyses were conducted using Stata 17.0 SE (College Station, TX).

### 3. Results

The mean age of the sample was 66.9 years (SD: 10.3, range: 50–99) at baseline. As shown in Table 1, all examined sociodemographic, socioeconomic, and health-related characteristics are significantly associated with food insecurity ( $p < 0.05$ ) in 2018 and/or 2020, except for urbanicity and income. See Table 1 for complete sample characteristics and bivariate analyses (unweighted).

Table 2 reports the population-weighted multivariate logistic regression models. The prevalence of food insecurity nearly doubled from 2018 (4.83%) to 2020 (9.54%) in unweighted, unadjusted models.

According to these population-weighted multivariate models, in 2018 specifically (Table 2; Figure 1), significant sociodemographic correlates of food insecurity included race/ethnicity and urbanicity.

Non-Hispanic Blacks had 2.43 times (95% CI: 1.41, 4.19) higher odds of experiencing food insecurity than non-Hispanic Whites. In contrast to urban residents, rural/ex-urban residents had 1.81 times (95% CI: 1.04, 3.15) higher odds of experiencing food insecurity. Age, gender, and partnership status were not found to be associated with food security status in 2018. In 2018, significant socioeconomic correlates of food insecurity included educational attainment and wealth. Individuals with college-level education or more had 0.27 times (95% CI: 0.09, 0.79) lower odds of reporting food insecurity than individuals with less than a high school education. Relative to individuals with negative net wealth, individuals with wealth value below the median experienced 0.34 times (95% CI: 0.15, 0.75) lower odds of food insecurity. Similarly, individuals with wealth value above the median experienced 0.12 times (95% CI: 0.05, 0.33) lower odds of food insecurity. Individual income, current working status, and home ownership status were not associated with food insecurity status in 2018.

In June 2020 (Table 2; Figure 2), early in the pandemic, relatively younger age was a significant sociodemographic predictor of food insecurity. Those aged 50–64 (vs. 75+) had 5.23 times (95% CI: 2.44, 11.21) higher odds of food insecurity, and those aged 65–74 (vs. 75+) had 4.80 times (95% CI: 2.33, 9.91) higher odds of experiencing food insecurity. Other examined sociodemographic characteristics—including race/ethnicity, partnership status, and urbanicity—were not associated with the food security status in 2020. Early in the pandemic (June 2020), significant socioeconomic correlates of food insecurity included current working status and home ownership status. Respondents who were not able to work due to a disability experienced 3.10 times (95% CI: 1.72, 5.58) higher odds of food insecurity than those currently working. In comparison with respondents who owned their homes, those who were renting experienced 2.96 times (95% CI: 1.85, 4.74) higher odds of food insecurity. Those with greater IADL limitations experienced 2.00 times (95% CI: 1.46, 2.75) higher odds of food insecurity. Educational attainment, wealth, and individual income were not associated with food security status in 2020.

In Table 3, we apply logistic regression to examine longitudinal predictors of the onset of food insecurity in 2020 when controlling for baseline food insecurity (model 1) and when restricted to those who did not experience food insecurity in 2018 (model 2). The results from model 1, which are similar to those in model 2, indicate that those who developed a greater number of IADL limitations from 2018 to 2020 experienced 4.82 times (95% CI: 2.56, 9.07) higher odds of food insecurity in 2020. Those with a reduced number of IADLs in 2020 also experienced 1.96 times (95% CI: 0.96, 4.00) higher odds for food insecurity relative to those with no change in their IADLs, although it is notable that this risk is lower than for those whose number of functional limitations increased. Recent onset of a work disability was also associated with 2.35 times (95% CI: 1.32, 4.15) higher odds of experiencing food insecurity relative to no change in work disability status. Those who were homeowners in 2018 but were no longer homeowners in 2020 experienced 2.75 (95% CI: 1.66, 4.55) times higher odds of food insecurity relative to those whose homeownership status did not change.

### 4. Discussion

To the best of our knowledge, the current study is among the first to examine whether selected sociodemographic and socioeconomic characteristics were associated with food insecurity before the COVID-19 pandemic (2018) and in the early pandemic (June 2020) among a nationally representative sample of community-dwelling middle-aged and older adults in the United States. Using a retrospective cohort, we were able to capture individual food security status before the COVID-19 pandemic and compare the changes in sociodemographic and socioeconomic correlates of food security before and early in the pandemic. We further examined longitudinal risk factors for the onset of food insecurity during the pandemic, which represents

<sup>3</sup> Preliminary weights are provided that adjust for selection and non-response into the special release. Because 2020 ACS data are not yet available, the post-stratification is only approximate. Respondents born 1966 or later, or who did not give an interview before 2020, do not have weights. The preliminary weight variable is CVWGTR.

TABLE 1 Unweighted sample characteristics in 2018 and 2020 by food security status, Health and Retirement Study.

	Total sample 2018 <i>n</i> = 2,413	Food insecure 2018 <i>n</i> = 90	Food secure 2018 <i>n</i> = 2,323		Total sample 2020 <i>n</i> = 2,216	Food insecure 2020 <i>n</i> = 211	Food secure 2020 <i>n</i> = 2,005	
	M(SD)/% ( <i>n</i> )	M(SD)/% ( <i>n</i> )	M(SD)/% ( <i>n</i> )	<i>p</i> -value	M(SD)/% ( <i>n</i> )	M(SD)/% ( <i>n</i> )	M(SD)/% ( <i>n</i> )	<i>p</i> -value
<b>Age group</b>				<i>p</i> = 0.33				<i>p</i> < 0.0001
50–64	49.0 (1,183)	53.3 (48)	48.9 (1,135)		38.8 (859)	62.6 (132)	36.3 (727)	
65–74	25.6 (617)	18.9 (17)	25.8 (600)		28.9 (640)	26.1 (55)	29.2 (585)	
75+	25.4 (613)	27.8 (25)	25.3 (588)		32.4 (717)	11.4 (24)	34.6 (693)	
<b>Gender<sup>a</sup></b>				<i>p</i> = 0.03				<i>p</i> = 0.02
Male	37.5 (905)	26.7 (24)	37.9 (811)		36.9 (817)	29.4 (62)	37.7 (755)	
Female	62.5 (1,508)	73.3 (66)	62.1 (1,442)		63.1 (1,399)	70.6 (149)	62.3 (1,250)	
<b>Race/ethnicity<sup>a</sup></b>				<i>p</i> < 0.0001				<i>p</i> = 0.69
Non-Hispanic White	77.8 (1,876)	50.0 (45)	78.8 (1,831)		74.2 (1,644)	73.0 (154)	74.3 (1,490)	
Non-Hispanic Black	14.3 (346)	36.7 (33)	13.5 (313)		16.0 (355)	18.0 (38)	15.8 (317)	
Hispanic/Latinx	5.7 (137)	10.0 (9)	5.5 (128)		7.5 (166)	6.2 (13)	7.6 (153)	
Non-Hispanic Other	2.2 (54)	3.3 (3)	2.2 (51)		2.3 (51)	2.8 (6)	2.2 (45)	
<b>Partnership status</b>				<i>p</i> = 0.001				<i>p</i> = 0.004
Uncoupled	45.0 (1,086)	62.2 (56)	44.3 (1,030)		57.4 (1,272)	66.8 (141)	56.4 (1,131)	
Coupled	55.0 (1,327)	37.8 (34)	55.7 (1,293)		42.6 (944)	33.2 (70)	43.6 (874)	
<b>Urbanicity<sup>a</sup></b>				<i>p</i> = 0.12				<i>p</i> < 0.09
Urban	48.3 (1,166)	40.0 (36)	48.6 (1,130)		47.6 (1,054)	45.4 (96)	47.8 (958)	
Suburban	24.2 (585)	23.3 (21)	24.3 (564)		24.4 (541)	20.4 (43)	24.8 (498)	
Ex-urban/ rural	27.4 (662)	36.7 (33)	27.1 (629)		28.0 (621)	34.1 (72)	27.4 (549)	
<b>Education<sup>a</sup></b>				<i>p</i> < 0.0001				<i>p</i> = 0.79
Less than high school	18.6 (585)	38.7 (58)	17.7 (523)		18.6 (585)	16.6 (35)	18.8 (376)	
High school/ GED	37.1 (1,168)	40.7 (61)	37.1 (1,097)		37.1 (1,168)	39.3 (83)	36.8 (737)	
Some college	22.2 (709)	15.3 (23)	22.9 (676)		22.2 (709)	23.2 (49)	22.3 (446)	
College or more	21.79 (686)	5.33 (8)	22.35 (661)		21.79 (686)	20.9 (44)	22.2 (445)	
<b>Total wealth</b>				<i>p</i> < 0.0001				<i>p</i> = 0.82
Negative net wealth	3.7 (89)	16.7 (15)	3.2 (74)		4.1 (87)	3.9 (8)	4.2 (79)	
Below median	45.3 (1,092)	67.8 (61)	44.4 (1,031)		47.7 (1,002)	50.0 (101)	47.4 (901)	
Above median	51.1 (1,232)	15.6 (14)	52.4 (1,218)		48.2 (1,014)	46.3 (94)	48.4 (920)	
<b>Individual income<sup>a</sup></b>				<i>p</i> = 0.23				<i>p</i> = 0.31
No income	90.0 (2,171)	94.4 (85)	89.8 (2,086)		89.9 (1,992)	92.9 (196)	89.6 (1,796)	
Below median	5.3 (128)	4.4 (4)	5.3 (124)		5.2 (116)	3.8 (8)	5.4 (108)	
Above median	4.7 (114)	1.0 (1)	4.9 (113)		4.9 (108)	3.3 (7)	5.0 (101)	
<b>Current working status</b>				<i>p</i> < 0.0001				<i>p</i> < 0.0001
Currently working	8.1 (257)	4.4 (4)	8.2 (191)		26.4 (585)	23.2 (49)	26.7 (536)	
Not currently working	6.1 (147)	3.3 (3)	6.2 (144)		9.5 (210)	10.0 (21)	9.4 (189)	
Not working due to disability	4.4 (106)	17.8 (16)	3.9 (90)		12.9 (285)	38.9 (82)	10.1 (203)	
Retired	81.4 (1,965)	74.4 (67)	81.7 (2,343)		49.2 (1,091)	23.7 (50)	51.9 (1,041)	
Others	0 (0)	0 (0)	0 (0)		2.0 (45)	4.3 (9)	1.8 (36)	

(Continued)

TABLE 1 (Continued)

	Total sample 2018 <i>n</i> = 2,413	Food insecure 2018 <i>n</i> = 90	Food secure 2018 <i>n</i> = 2,323		Total sample 2020 <i>n</i> = 2,216	Food insecure 2020 <i>n</i> = 211	Food secure 2020 <i>n</i> = 2,005	
	M(SD)/% ( <i>n</i> )	M(SD)/% ( <i>n</i> )	M(SD)/% ( <i>n</i> )	<i>p</i> -value	M(SD)/% ( <i>n</i> )	M(SD)/% ( <i>n</i> )	M(SD)/% ( <i>n</i> )	<i>p</i> -value
Home ownership status				<i>p</i> = 0.001				<i>p</i> < 0.0001
Owning a home	83.5 (2,015)	71.1 (64)	84.0 (1,951)		67.3 (1,491)	43.6 (92)	69.8 (1,399)	
Renting	12.2 (295)	24.2 (22)	11.8 (273)		27.8 (617)	48.8 (103)	25.6 (514)	
Others	4.3 (103)	4.4 (4)	4.3 (99)		4.9 (108)	7.6 (16)	4.5 (92)	
IADL limitations (0–3)	0.2 (0.60)	0.4 (0.79)	0.2 (0.59)	<i>p</i> = 0.45	0.4 (0.48)	0.3 (0.67)	0.1 (0.46)	<i>p</i> < 0.0001
Chronic illness count <sup>a</sup>	2.4 (0.85)	2.7 (0.65)	2.4 (0.86)	<i>p</i> = 0.001	2.4 (0.86)	2.5 (0.84)	2.4 (0.86)	<i>p</i> = 0.13

<sup>a</sup>Only 2018 data are available.

an advancement upon prior work which tends to be cross-sectional.

Consistent with emerging evidence of the escalation in the rates of food insecurity since the onset of the COVID-19 pandemic (6, 19, 40, 41), we found that the weighted prevalence of food insecurity increased from 4.83% (2018) to 9.54% early in the pandemic (June 2020). While several sociodemographic and socioeconomic characteristics were significantly associated with food security in 2018 and 2020, these associated risk and protective factors appear to have changed early in the COVID-19 pandemic.

With regard to sociodemographic factors, in 2018, non-Hispanic Black participants were more likely to report food insecurity, consistent with other studies finding that race and ethnicity predicted food insecurity among older adult populations (42–44). However, race and ethnicity did not appear to significantly predict food insecurity early in the COVID-19 pandemic. Similarly, those living in rural areas were more likely to report being food insecure in 2018, but not in 2020, in contrast to findings from some other studies that food insecurity worsened among rural populations early in the pandemic (45, 46). The relative shift in factors associated with food insecurity from non-Hispanic Black and rural populations in 2018 to populations of relatively younger age (under 75 years) in 2020 could be attributed to the resilience of rural, non-Hispanic Black, and older adult populations in accessing food during strained and difficult circumstances. It could also speak to the rise in family support, mutual aid societies, and other community-focused strategies to promote food access during the pandemic to rural, older, and Black populations (47). Local community programs such as Meals on Wheels rose to the challenge to address a dramatic surge of demand in food delivery for older adults in urban, suburban, and rural communities, delivering meals to a million more individuals (47% more than pre-pandemic) by July 2020 (48). For Black populations in particular, systemic racism was brought to the forefront in U.S. society during such events as George Floyd's murder in May 2020, which is in the latter portion of the observation period for the present study. For rural populations in particular, increased online access to food and more gardening observed early

in the COVID-19 pandemic could have contributed to the attenuated disparities observed in food security experienced by rural populations (45, 49, 50). Further research is needed to assess whether the observed attenuation of disparities in food security for non-Hispanic Black, rural, and relatively older adults continued further into the COVID-19 pandemic and beyond.

With regard to socioeconomic factors, the protective effects of higher levels of education and greater wealth for food insecurity in 2018 are unsurprising. Less intuitive were our findings that education level, wealth, and income were not significant predictors of food insecurity in 2020, contrary to the findings from other studies on the socioeconomic predictors of food insecurity during COVID-19 (21, 22, 26, 35, 51, 52). This finding suggests that the pandemic appears to have affected food security across different socioeconomic strata of middle-aged and older adults, being an equalizer of sorts in that regard. It is also possible that lower-income individuals were aided by pandemic relief such as stimulus funds, mortgage relief, or eviction moratoria. Food security might also reflect other factors related to scarcity (supply chain issues, changes in relative vs. absolute resources) beyond cost alone.

Our findings support that compared to working individuals, older adults who were not working due to a disability, as well as those experiencing greater IADL limitations, experienced significantly higher odds of experiencing food insecurity early in the pandemic. These findings are consistent with prior studies suggesting that people with disabilities are at elevated risk of food insecurity (25, 35, 53–56) and it appears that these risks have become heightened during COVID-19 (57). In a study of Medicare beneficiaries with disabilities, Friedman (56) found that people with one or more disabilities were more likely to be food insecure than non-Medicare beneficiaries during the COVID-19, potentially attributable to fear of going out for food, limited mobility to get food, and barriers accessing food delivery services. Older adults who were not working due to a disability may encounter multiple barriers related to disability and income instability in accessing, procuring, and preparing food items. People with disabilities also incur a substantial number of costs for needed disability-related goods and services, such

**TABLE 2** Population-weighted multivariate logistic regression predicting sociodemographic and socioeconomic correlates of food insecurity in 2018 and 2020, Health and Retirement Study.

	2018 <i>n</i> = 2,413		2020 <i>n</i> = 2,216	
	OR (95% CI)	<i>p</i> -value	OR (95% CI)	<i>p</i> -value
<b>Age group (ref: 75+)</b>				
50–64	0.81 (0.45, 1.49)	0.504	5.23 (2.44, 11.21)	<0.0001
65–74	0.61 (0.30, 1.24)	0.173	4.80 (2.33, 9.91)	<0.0001
Female <sup>a</sup> (ref: Male)	1.32 (0.77, 2.26)	0.305	1.57 (1.00, 2.48)	0.051
<b>Race/ethnicity<sup>a</sup> (ref: non-Hispanic White)</b>				
Non-Hispanic Black	2.43 (1.41, 4.19)	0.001	1.09 (0.59, 2.01)	0.777
Hispanic/Latinx	1.49 (0.64, 3.50)	0.357	0.98 (0.41, 2.35)	0.963
Non-Hispanic Other	2.36 (0.59, 9.40)	0.222	1.80 (0.43, 7.54)	0.419
Coupled (ref: uncoupled)	0.82 (0.50, 1.35)	0.444	0.69 (0.43, 1.13)	0.14
<b>Urbanicity<sup>a</sup> (ref: urban)</b>				
Suburban	1.19 (0.66, 2.14)	0.562	0.70 (0.40, 1.25)	0.231
Ex-urban	1.81 (1.04, 3.15)	0.036	1.00 (0.61, 1.63)	0.992
<b>Education<sup>a</sup> (ref: less than high school)</b>				
High school/GED	0.73 (0.39, 1.34)	0.309	1.19 (0.66, 2.16)	0.568
Some college	0.49 (0.22, 1.07)	0.074	0.88 (0.45, 1.71)	0.699
College or more	0.27 (0.09, 0.79)	0.017	1.10 (0.57, 2.13)	0.777
<b>Total wealth (ref: negative net wealth)</b>				
Below median	0.34 (0.15, 0.75)	0.007	0.97 (0.54, 1.72)	0.906
Above median	0.12 (0.05, 0.33)	<0.0001	1.11 (0.66, 1.85)	0.699
<b>Individual income<sup>a</sup> (ref: no income)</b>				
Below median	1.38 (0.44, 4.26)	0.579	0.98 (0.38, 2.58)	0.971
Above median	0.21 (0.02, 2.25)	0.197	0.51 (0.20, 1.30)	0.159
<b>Current working status (ref: currently working)</b>				
Not currently working	0.53 (0.09, 2.99)	0.474	1.33 (0.61, 2.90)	0.472
Not working due to a disability	2.64 (0.60, 11.70)	0.2	3.10 (1.72, 5.58)	<0.0001
Retired	1.16 (0.31, 4.34)	0.822	0.86 (0.42, 1.76)	0.679
Others	–	–	2.26 (0.61, 8.26)	0.221

(Continued)

**TABLE 2** (Continued)

	2018 <i>n</i> = 2,413		2020 <i>n</i> = 2,216	
	OR (95% CI)	<i>p</i> -value	OR (95% CI)	<i>p</i> -value
<b>Home ownership status (ref: homeowner)</b>				
Renting	0.73 (0.38, 1.43)	0.362	2.96 (1.85, 4.74)	<0.0001
Others	0.60 (0.22, 1.65)	0.322	1.49 (0.54, 4.10)	0.436
IADL limitations (0–3)	1.07 (0.78, 1.47)	0.661	2.00 (1.46, 2.75)	<0.0001
Chronic disease count <sup>a</sup>	1.41 (0.97, 2.05)	0.071	0.88 (0.69, 1.15)	0.354

<sup>a</sup>Only 2018 data are available. “–” estimates were omitted due to the insufficient sample size.—2 Log-likelihood results: 2018 = 698.82 ( $p < 0.0001$ ); 2020 = 1,201.14 ( $p < 0.0001$ ).

as for assistive technologies, home care, and medical expenses (58). During times of economic hardship and increasing prices, many people with disabilities may be forced to substitute food security for the purchasing of these needed goods and services. A notable finding from the longitudinal analysis, moreover, is that adults with worsening numbers of IADL limitations and a recent onset of work disability experienced a high risk of food insecurity during the pandemic. This suggests that a greater attention is warranted to preventing food insecurity for older adults experiencing worsening or recently developing functional limitations.

Early in the pandemic, homeownership was also associated with lower odds of experiencing food insecurity in our study. We found that renters, relative to homeowners, were nearly three times more likely to experience food insecurity. The vulnerabilities of renters to food insecurity relative to homeowners have been documented in prior studies before and during the COVID-19 pandemic (21, 51, 59, 60). Individuals and families that struggle with housing instability tend to experience food insecurity (61). Owning a home or having stable, affordable housing might help individuals set aside a larger part of their budget for food and other needed items. Even in the case of income loss, homeownership might provide buffering effects to mitigate the negative consequences of income loss on food security (59). In our sample, the percentage of participants who were homeowners decreased from 79.7% (2018) to 65.9% (2020), while the percentage of participants who were renters nearly doubled from 15.3% (2018) to 30.0% (2020). Those who were homeowners in 2018 but not in 2020 were nearly three times more likely to experience food insecurity. Many circumstances can contribute to pathways from homeownership to renting in older adulthood, including the death of a spouse (62), drops in household income (62), increased costs associated with homeownership (63), and financial shocks (experienced or anticipated) such as housing price changes (64). Therefore, it is likely that some of those who transitioned from homeowners in 2018 to renters in 2020 also experienced other personal and financial stressors that increase their vulnerability in experiencing food insecurity. Furthermore, while selling a home can result in increased wealth liquidity,



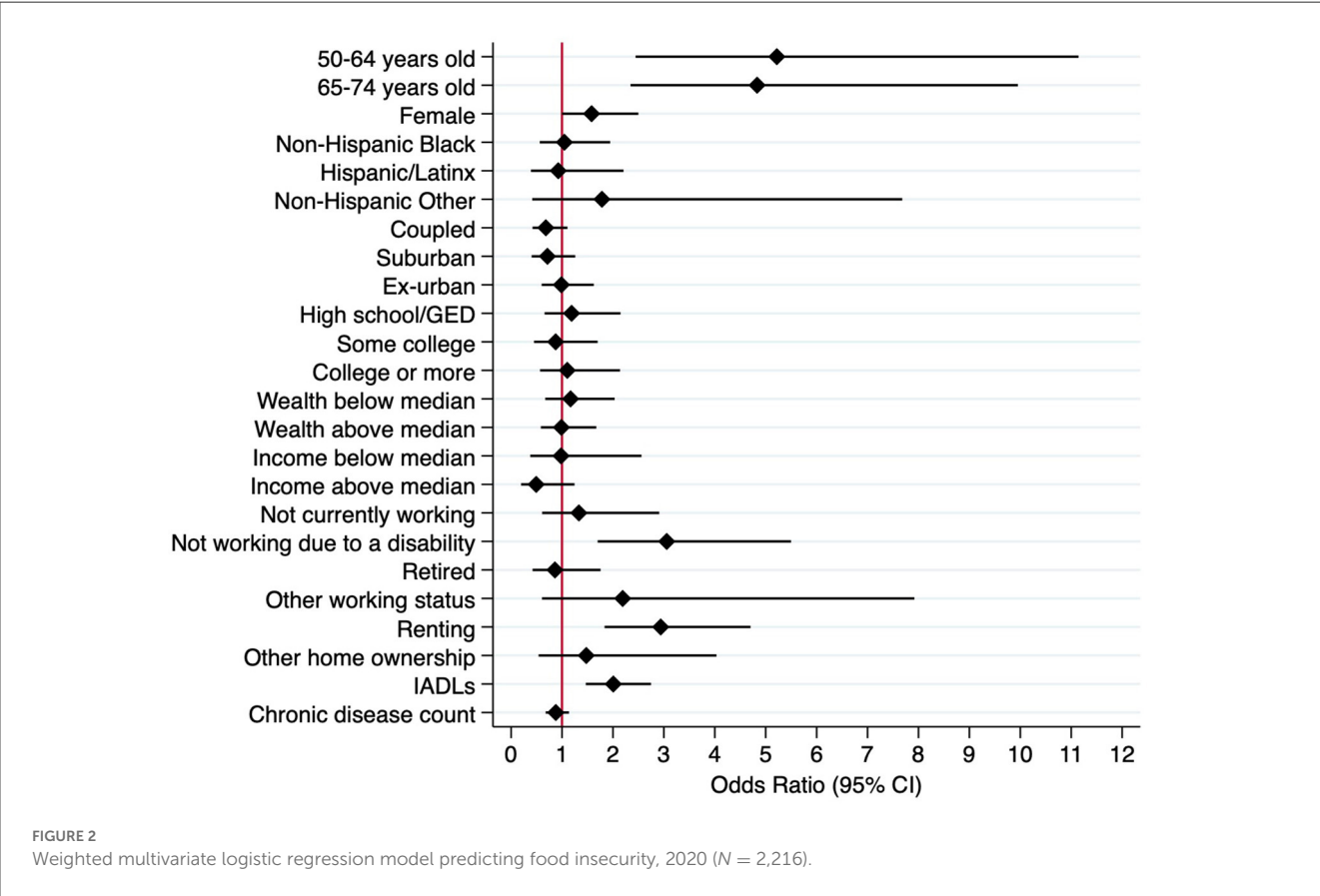
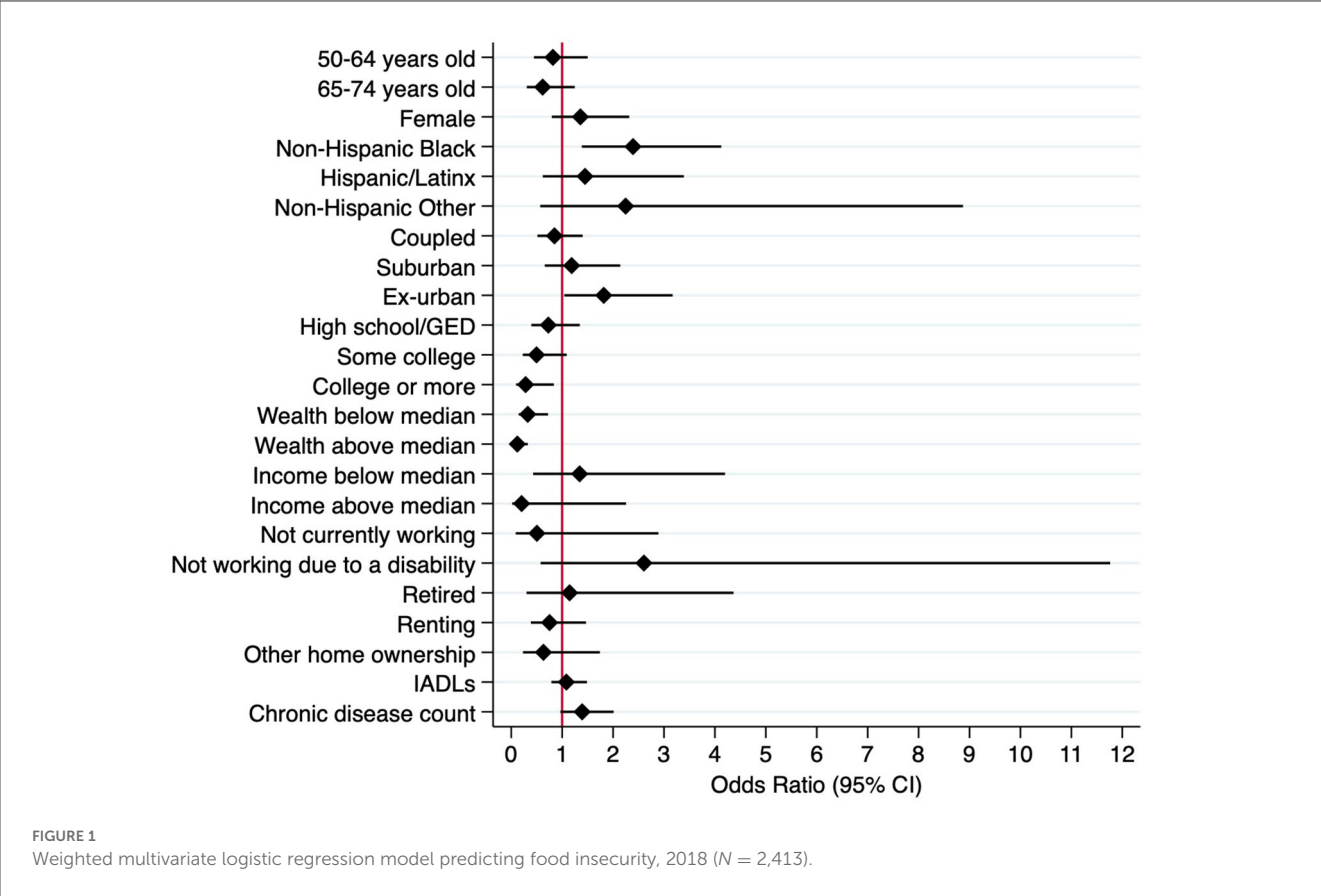


TABLE 3 Longitudinal predictors of food insecurity in 2020, population-weighted, Health and Retirement Study<sup>a</sup>.

	n	Model controlling for food insecurity in 2018 <i>n</i> = 2,086		Model excluding those with food insecurity in 2018 <i>n</i> = 1,981	
		OR (95% CI)	<i>p</i> -value	OR (95% CI)	<i>p</i> -value
IADLs worsen	256	4.82 (2.56,9.07)	0.000	4.89 (2.56,9.34)	0.000
IADLs improve	420	1.96 (0.96,4.00)	0.064	2.04 (0.95,4.40)	0.069
Work-disability onset	362	2.35 (1.32,4.15)	0.003	2.13 (1.18,3.83)	0.012
No longer report work-disability	168	1.20 (0.33,4.37)	0.780	1.37 (0.37,5.06)	0.637
No longer working	197	0.81 (0.28,2.32)	0.694	0.70 (0.21,2.29)	0.554
Newly retired	331	0.52 (0.17,1.62)	0.259	0.53 (0.16,1.74)	0.296
Back to work after retired	684	0.76 (0.41,1.41)	0.384	0.66 (0.34,1.26)	0.206
Continuously working	60	0.30 (0.07,1.29)	0.105	0.27 (0.06,1.15)	0.077
No longer coupled	733	1.00 (0.59,1.68)	0.987	1.03 (0.60,1.76)	0.914
Newly coupled	841	0.90 (0.49,1.64)	0.723	0.90 (0.48,1.67)	0.730
No longer homeowner	476	2.75 (1.66,4.55)	0.000	2.71 (1.61,4.54)	0.000
New homeowner	363	0.76 (0.33,1.77)	0.529	0.71 (0.28,1.79)	0.464
Food insecurity (2018)	150	1.45 (0.55,3.83)	0.450	—	—

Both models control for age, gender, race, urbanicity, income, education, wealth, and the number of health conditions in 2018.

the high transaction fees associated with selling a home (65) might affect financial—and therefore food—security among older adults. Further investigation of how housing transitions affect food insecurity is needed to identify risk and protective factors for food insecurity among older adults during COVID-19 and other disasters.

## 5. Limitations and directions for future research

Several limitations should also be considered when interpreting the results. Although prior studies have widely utilized the measure of self-reported food insecurity in the HRS (18, 30, 31, 66, 67), the measure is self-reported and has not been validated through more direct measures, such as food intake and expenditures. The self-reported measure may thus not provide an accurate estimation of the prevalence of food insecurity in comparison to these direct measures and thus such validation research is needed in future. The HRS Core interview does not include the USDA Household Food Security Survey, which is commonly utilized as a valid and standardized tool to assess food security status (54). The two-item measure adopted here and available in the HRS is similar to the USDA measure with both relying on self-reported recall of times they could not afford food and reduced desired food intake as a result. Caution is also needed for interpreting the identified changes in food security status as resulting from the COVID-19 pandemic due to challenges in comparing regression coefficients between models (68, 69). Another limitation to inferring causality relates to the imprecision of the measures of food insecurity. For example, in our measure

of food insecurity, respondents in 2020 were asked in the past 12 months whether they ever ate less than they felt they should because there was not enough money to buy food. This would include recall of time periods that preceded the pandemic. Though we suspect that there is a contemporaneous bias in how respondents answer such questions that may indicate their food security status in the pandemic, future studies evaluating changes from the pandemic should seek to restrict measures of food insecurity specifically during the period of the COVID-19 pandemic.

As the present study focuses on changes in food security early in the COVID-19 pandemic, future studies should investigate changes in food security throughout the COVID-19 pandemic and beyond. Such research should investigate the impacts of the intensification of drivers of food security observed in the United States and globally on older adults. Such drivers that have further contributed to the high cost and scarcity of nutritious foods—and growing inequalities in nutrition and food insecurity—include continued supply chain problems, economic shocks and growing inflation, conflict, and climate extremes (70). This future research will enhance our understanding of risk factors related to food insecurity over the course of the pandemic and the way in which COVID-related food insecurity influences the long-term health and wellbeing of older adults.

Lastly, due to the limitations of the data, some group sample sizes were small, while others were not examined in the study. The relatively large confidence intervals observed in certain groups (those not working due to a disability, non-Hispanic Other racial/ethnic groups) could be due to the smaller sizes of those groups. While we did find significant

differences in food security among these groups (compared to their respective reference groups), the uneven group sizes might have made our findings more conservative. Due to the limitations of race/ethnicity constructs and groupings in the survey design, we were unable to measure the disparate risk of food insecurity during the COVID-19 pandemic among Hispanic/Latinx and Asian subgroups based on countries of origin, as well as among Native American/Alaska Native groups and subgroups. A growing body of literature has revealed that the COVID-19 pandemic has exacerbated food insecurity risk among Native Americans, Asian Americans, and foreign-born Americans (22, 24, 52, 71). These disparities are presumably due to greater social vulnerability to disaster risk resulting from unequal access to resources and already difficult circumstances in the pre-pandemic context (22). Further research is needed to examine the risk and protective factors of food insecurity within these groups.

## 6. Conclusion

The current study highlighted the shift in sociodemographic and socioeconomic predictors of food insecurity among a sample of nationally representative middle-aged and older US adults before and during the early COVID-19 pandemic. COVID-19 food policies and intervention strategies that target older populations should focus more on individuals with disabilities and those vulnerable to economic hardship and housing instability. At a time of social distancing, access to food through the local community and delivery services is critically essential for older individuals. Policies to support local food pantries, food banks, and congregate meal settings—as well as those promoting the stability of neighborhood food supply more generally—can help expand access to community food resources. The increase in accessible and affordable online food shopping and food delivery services would benefit middle-aged and older adults with disabilities and mobility challenges. Older adults may have been particularly socially isolated during the pandemic to minimize the risk of COVID-19 infection. Promotion of more widespread screening for food insecurity and assistance in SNAP enrollment for older adults could be potentially achieved effectively in primary care and home care settings amid the pandemic. Future research is needed to assess the long-term effects of COVID-19 related to food insecurity on the health and wellbeing of older adults. National and community-focused food preparedness strategies

targeting groups vulnerable to food insecurity should be further evaluated and supported to prepare for future public health and natural disasters.

## Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: <https://hrs.isr.umich.edu/about>.

## Author contributions

EN planned the study, supervised the data analysis, and contributed to writing the manuscript. GJC performed statistical analyses and contributed to writing the manuscript. ZM contributed to the direction of the manuscript, performed statistical analyses, and contributed to writing and revising the manuscript. All authors contributed to the manuscript revision and read and approved the submitted version.

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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.

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# Excess mortality among older adults institutionalized in long-term care facilities during the COVID-19 pandemic: a population-based analysis in Catalonia

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**Objectives:** To assess excess mortality among older adults institutionalized in nursing homes within the successive waves of the COVID-19 pandemic in Catalonia (north-east Spain).

**Design:** Observational, retrospective analysis of population-based central healthcare registries.

**Setting and participants:** Individuals aged >65 years admitted in any nursing home in Catalonia between January 1, 2015, and April 1, 2022.

**Methods:** Deaths reported during the pre-pandemic period (2015–2019) were used to build a reference model for mortality trends (a Poisson model, due to the event counting nature of the variable “mortality”), adjusted by age, sex, and clinical complexity, defined according to the adjusted morbidity groups. Excess mortality was estimated by comparing the observed and model-based expected mortality during the pandemic period (2020–2022). Besides the crude excess mortality, we estimated the standardized mortality rate (SMR) as the ratio of weekly deaths’ number observed to the expected deaths’ number over the same period.

**Results:** The analysis included 175,497 older adults institutionalized (mean 262 days, SD 132), yielding a total of 394,134 person-years: 288,948 person-years within the reference period (2015–2019) and 105,186 within the COVID-19 period (2020–2022). Excess number of deaths in this population was 5,403 in the first wave and 1,313, 111, –182, 498, and 329 in the successive waves. The first wave on March 2020 showed the highest SMR (2.50; 95% CI 2.45–2.56). The corresponding SMR for the 2nd to 6th waves were 1.31 (1.27–1.34), 1.03 (1.00–1.07), 0.93 (0.89–0.97), 1.13 (1.10–1.17), and 1.07 (1.04–1.09). The number of excess deaths following the first wave ranged

from 1,313 (2nd wave) to −182 (4th wave). Excess mortality showed similar trends for men and women. Older adults and those with higher comorbidity burden account for higher number of deaths, albeit lower SMRs.

**Conclusion:** Excess mortality analysis suggest a higher death toll of the COVID-19 crisis in nursing homes than in other settings. Although crude mortality rates were far higher among older adults and those at higher health risk, younger individuals showed persistently higher SMR, indicating an important death toll of the COVID-19 in these groups of people.

#### KEYWORDS

long-term care, COVID-19, excess mortality, older adults, nursing home

## Introduction

Early after the first case of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in December 2019, the virus spread rapidly across the globe, leading to over 600 million cases and more than six million deaths directly attributed to COVID (1). However, excess mortality analyses, which account for both direct and indirect deaths, indicate that the total death of the global health crisis could reach nearly 15 million (2). Older adults have been the population group with higher frequency of severe illness, hospitalizations, and deaths (3). Moreover, long-term care (LTC) facilities have been one of the most affected settings by the COVID-19 pandemic and account for the highest mortality rates (4–7). These figures highlighted the need for specific COVID-19 management policies for the LTC setting (3) therefore, different institutions and societies, such as the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), and the American Geriatrics Society, among others, published guidance stating policies to protect LTC facilities, including residents, employees, and visitors (8–11).

During the first 2 years of the COVID-19 pandemic, the epidemiological and clinical characteristics of the disease have evolved because of the emergence of new strains, the introduction of vaccination and boosters, and the improvement of public health policies for containing the spread of SARS-CoV-2 in the community, healthcare centers, and LTC facilities (8–10, 12). However, most of the reports regarding the impact of COVID-19 to the LTC setting were focused on the first waves of the outbreak and there is little information on how the pandemic has evolved through the successive waves in this setting (4–7, 13–15).

To date, mortality of COVID-19 in the LTC setting has been primarily assessed using absolute mortality rates or comparing them between groups. Some studies, such as Veronese et al. (13) and Ballin et al. (5), compared mortality rates in LTC facilities between residents with and without COVID-19. In another study, Rescinti et al. (6) compared the mortality of residents and staff of LTC with that of community-dwelling older adults and adults not working in LTC facilities, respectively. While these reports provide a perspective of the relative impact of COVID-19 in LTC facilities compared with other population groups, mortality analyses in this setting are challenged by the high background mortality associated with clinical complexity of individuals institutionalized in LTC facilities (16). Therefore, an accurate assessment of mortality in this setting requires excess mortality analyses that take into account historical trends. This

approach has been used in some studies, although most of them were constrained to the first few months of the pandemic (4, 7, 14, 17), thus losing sight of the evolving nature of the COVID-19 throughout successive waves and delayed effects of COVID-19 on mortality.

In this population-based, retrospective analysis, we have analyzed excess mortality in all nursing homes in Catalonia (north-east Spain) throughout the successive waves that occurred in the first 2 years of the pandemic.

## Methods

### Study setting and data sources

This was a retrospective analysis of administrative healthcare records of older adults institutionalized in any of the nursing homes in Catalonia (north-east Spain) between January 1, 2015, and April 1, 2022. The pre-pandemic period (years 2015–2019) was used as a reference for mortality trends to estimate the excess mortality during the pandemic period (years 2020–2022). In our area, nursing homes are defined as any permanent or temporary place (either privately or publicly owned) for people without sufficient degree of autonomy to perform daily activities, who need constant supervision (irrespective of their healthcare needs), or live in a social-family situation requiring the replacement of their home.

Institutionalized individuals were identified from the pharmaceutical invoicing registry (PIR). Catalonia provides universal healthcare to the entire population, with drugs being co-paid by the public healthcare insurance (i.e., the Catalan Health Service). For expenditure control purposes, drug dispensations to individuals institutionalized in any type of LTC facility are tagged with a specific code in the PIR. For this analysis, we screened the PIR for individuals with the specific tag for nursing homes at any time within the investigated period. For homogeneity in the population analysis of residents in nursing homes, we excluded individuals younger than 65 years because they typically correspond to groups with severe disabilities and mental health conditions. Deaths were retrieved from the central insurance registry (RCA for the Catalan *Registre Central d'Assegurats*). The PIR and RCA registries are linked through a unique identification number for public insurance purposes.

The study protocol was approved by the Research Ethics Committee of the University of Vic—central University of Catalonia, which waived the obtention of individual informed consent. All data

used in this analysis were handled according to the General Data Protection Regulation 2016/679 on data protection and privacy for all individuals within the European Union and the local regulatory framework regarding data protection.

## Outcomes and variables

The primary outcome of the analysis was death by any cause while being institutionalized in a nursing home during the investigated period. Other variables included age, sex, and the comorbidity burden, summarized using the adjusted morbidity groups (AMG) case-mix tool. The AMG is a population-based risk stratification tool designed to stratify the general population according to a weighted count of all chronic and recent acute diagnoses present at a given time from all conditions listed in the International Classification of Diseases (version 10 clinical modification, ICD-10-CM) (18). The tool retrieves a single index that can be used for adjusting multivariate models and stratifying the population into mutually-exclusive risk groups. Groups are built based on the index distribution across the entire population as follows: baseline risk (healthy stage, including AMG scores up to the 50th percentile of the total population), low risk (50th to 80th percentiles), moderate risk (80th to 95th percentiles), high risk (95th to 99th percentiles), and very-high risk (99th percentile and above). The AMG has shown high prediction capacity of key health outcomes, including but not limited to death, non-scheduled hospital admissions, and visits to the emergency room (19, 20). Information on comorbidities used to estimate the AMG index was retrieved from the Catalan Health Survey system, which centralizes and stores information collected from all primary care visits and hospitalizations covered by the Catalan Health Service. This service provides universal healthcare to the entire population of Catalonia. Since the Catalan Health Surveillance System was designed for invoicing purposes, the registry undergoes regular audits for data quality. Patients in this registry are identified with the same number than in the PIR and RCA registries.

## Analysis

We built an analysis dataset of person-days by considering the first and last dispensation for a given individual tagged as nursing home within the investigated period. The crude weekly mortality rate was estimated using the average number of individuals institutionalized within the given week as the denominator, and the number of deaths among this group of people as the numerator.

To account for seasonality, the expected mortality rate was computed by a building a Poisson regression analysis of weekly mortality between the 2015–2019 period, adjusted by age, sex, and comorbidity burden, summarized using the AMG risk categories. The Poisson model was considered the most appropriate because the primary variable was a count of events within a given time interval. The resulting coefficients of the regression were applied to the characteristics of individuals institutionalized within the COVID-19 period to obtain the expected mortality rate. To verify the model for expected deaths, we first plotted the expected and observed deaths for the 2015–2019 period. The excess mortality during the COVID-19 period was plotted and quantified by the difference between the

observed and expected (central estimate, according to the model) number of deaths. We also estimated the standardized mortality rate (SMR) as the ratio of weekly number of deaths observed to the number of the expected deaths over the same period. In addition to the weekly excess mortality, we quantified it for each wave of the Catalan outbreak. The time intervals corresponding to each wave were defined based on the announcements of public health authorities in Catalonia. All analyses were conducted using R (21).

## Results

### Study population

Our analysis included 175,497 persons aged 65 or older institutionalized in a nursing home at some time point between January 01, 2015, and April 1, 2022. Participants were institutionalized for a yearly mean of 262 days (SD 132), yielding a total of 394,134 person-years: 288,948 person-years within the reference period (2015–2019) and 105,186 within the COVID-19 period (2020–2022). Adults younger than 65 years accounted for 61,512 person-years (11% of the initial registry, before selecting the analysis population of older adults). Overall, the number of individuals aged 65 years or older institutionalized in nursing homes in our area showed a decreasing trend throughout the entire period (Supplementary Figure S1 and Supplementary Appendix). Table 1 summarizes the main characteristics of the study population within the reference and COVID-19 periods. The corresponding values for each year are provided in Supplementary Table S1. Individuals institutionalized in a nursing home in our area were progressively older and more complex (i.e., higher comorbidity burden, based on the AMG strata) throughout the investigated period (Figure 1). The age and sex distribution within the two periods is shown in Supplementary Figure S2.

### Excess mortality

The Poisson regression model of expected deaths generally overlapped the observed death rate within the pre-COVID-19 period (Figure 2). The model revealed a seasonal pattern, with higher rates during the winter periods and—less pervasive—the summer period. Figure 3A illustrates the expected and observed mortality rates for the overall analysis population within the COVID-19 period. The corresponding estimate of SMR and excess deaths are shown in Figures 3B,C, respectively. Supplementary Table S2 shows the average daily rates, excess deaths, and SMR in each wave. The highest mortality rate and SMR were observed during the first wave of the COVID-19 outbreak in our area. The observed mortality exceeded the expected in all waves, except the 4th one, with an onset early after the start of the vaccination campaign in nursing homes.

The excess mortality analysis according to sex showed a similar trend for men and women (Supplementary Figure S3), although the SMR was slightly higher in men for all waves (Supplementary Table S3). Regarding age, older adults accounted for higher weekly mortality rates; however, the SMR tended to be higher in younger age groups (Supplementary Figure S4). This trend was confirmed in all waves separately, although differences were more extreme in the first wave,

TABLE 1 Characteristics of individuals aged &gt;65 years institutionalized in a nursing home within the investigated period.

	Overall	2015–2019	2020–2021	<i>p</i>
Yearly stay (days), mean (SD)	262 (132)	283 (124)	219 (138)	
Person-years	394,134	288,948	105,186	
Age (years), mean (SD)	85.1 (7.46)	84.9 (7.43)	85.8 (7.49)	<0.001
Age groups, <i>n</i> (%)				<0.001
65–69	15,338 (3.9)	11,830 (4.1)	3,508 (3.3)	
70–74	25,644 (6.5)	19,304 (6.7)	6,341 (6)	
75–79	41,274 (10.5)	30,483 (10.5)	10,790 (10.3)	
80–84	80,636 (20.5)	62,459 (21.6)	18,177 (17.3)	
85–89	113,621 (28.8)	83,002 (28.7)	30,619 (29.1)	
90–94	85,955 (21.8)	60,657 (21)	25,298 (24.1)	
>94	31,666 (8)	21,213 (7.3)	10,453 (9.9)	
Sex, <i>n</i> (%)				<0.001
Men	102,050 (25.9)	75,722 (26.2)	26,328 (25)	
Women	292,084 (74.1)	213,226 (73.8)	78,858 (75)	
Risk group of clinical complexity <sup>a</sup> , <i>n</i> (%)				<0.001
Baseline	6,495 (1.6)	4,121 (1.4)	2,374 (2.3)	
Low	42,164 (10.7)	31,430 (10.9)	10,734 (10.2)	
Moderate	172,125 (43.7)	128,094 (44.3)	44,030 (41.9)	
High	133,340 (33.8)	96,275 (33.3)	37,065 (35.2)	
Very high	40,010 (10.2)	29,027 (10)	10,983 (10.4)	
Mortality (% person-years)	97,421 (24.7)	64,723 (22.4)	32,698 (31.1)	<0.001

Frequencies of categorical variables correspond to person-years.

<sup>a</sup>Based on the adjusted morbidity groups (18, 19).

in which SMR was 3.596 (95% CI 3.028–4.271) for the 65–69 years age group and 2.378 (2.263–2.498) for the >94 years group (Supplementary Table S4). A similar phenomenon was observed for health risk, assessed using the AMG stratification tool: the highest mortality rates were observed in the high- and very high-risk groups; however, the SMR was overall higher in the baseline and low-risk groups (Supplementary Figure S5). The corresponding analysis according to waves revealed a remarkably higher SMR among baseline risk individuals compared with very high-risk ones during the first wave: 3.822 (3.303–4.423) vs. 2.02 (1.914–2.131) (Supplementary Table S6). These differences were less pervasive in subsequent waves.

## Discussion

Our retrospective analysis of mortality in nursing homes before and during the successive waves of the COVID-19 showed a persistent excess mortality in this setting during the entire investigated period. However, important differences were observed between waves, with the first wave remarkably outstanding over the subsequent ones. The different analytical approaches reported in the literature hamper direct comparison of excess mortality values. However, in line with other studies in LTC facilities (14, 15, 17), we found that excess mortality rates in this setting are generally higher than those observed in the overall population for the European area (2). Although we could not analyze the cause of death, the limited follow-up capacity due to staff

overburden in this setting during an outbreak is likely to increase also non-COVID-19 mortality, particularly associated with cardiovascular diseases (22, 23).

It is noteworthy that long-term care facilities are heterogeneous services that may differ between countries. If these differences also result in different profiles of residents (in terms of age, multimorbidity or disability), it is expected that they influence in a different way the mortality risk in the advent of a COVID-19 wave. In a population-based analysis in Catalonia, institutionalized older adults were older than the non-institutionalized counterpart (i.e., older than 65 years among the general population) (24). Although no exhaustive comparisons of LTC populations have been conducted across Europe or globally, a study comparing the characteristics of individuals institutionalized in LTC facilities in Catalonia and the UK showed similar age and similar levels of multimorbidity, dependency, and cognitive impairment between the two countries (25).

Importantly, mortality rates and excess mortality dropped in waves following the first one—but preceding the start of vaccination campaigns—, suggesting better knowledge and management of COVID-19. Although a mortality bias in this setting after the first wave cannot be ruled out, the remarkable decrease in excess mortality before vaccination suggest that containment measures implemented specifically in nursing homes at the end of the first wave (e.g., compartmentalization of affected areas, deployment of nurse case management team for enhancing integration with hospitals and intermediate care, inventory of nursing homes with limited resources for dealing with emerging outbreaks, among others) played an

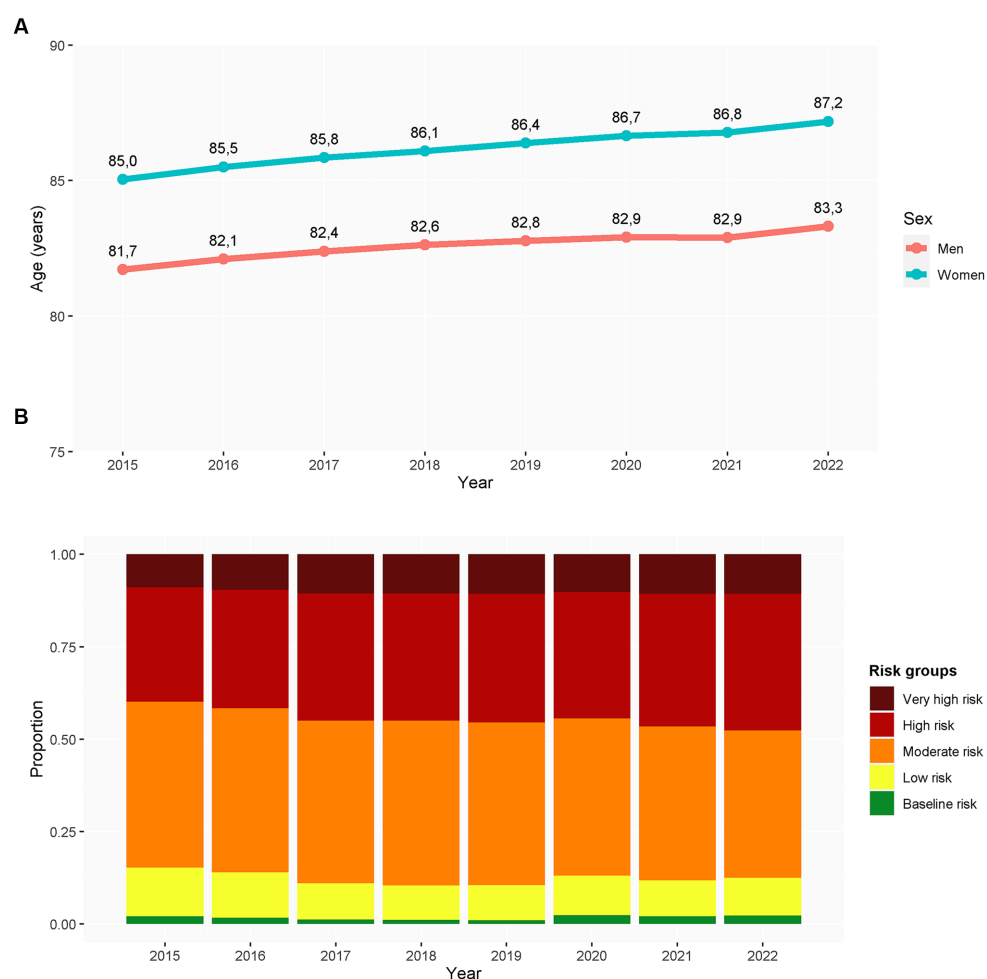


FIGURE 1

Evolution of age (A) and clinical complexity (B) of individuals older than 65 years institutionalized in nursing homes within the investigated period. The clinical complexity was assessed using the adjusted morbidity groups. Results are presented in person-years ( $N = 492,538$  person-years). Clinical complexity was measured based on the adjusted morbidity groups (18, 19).

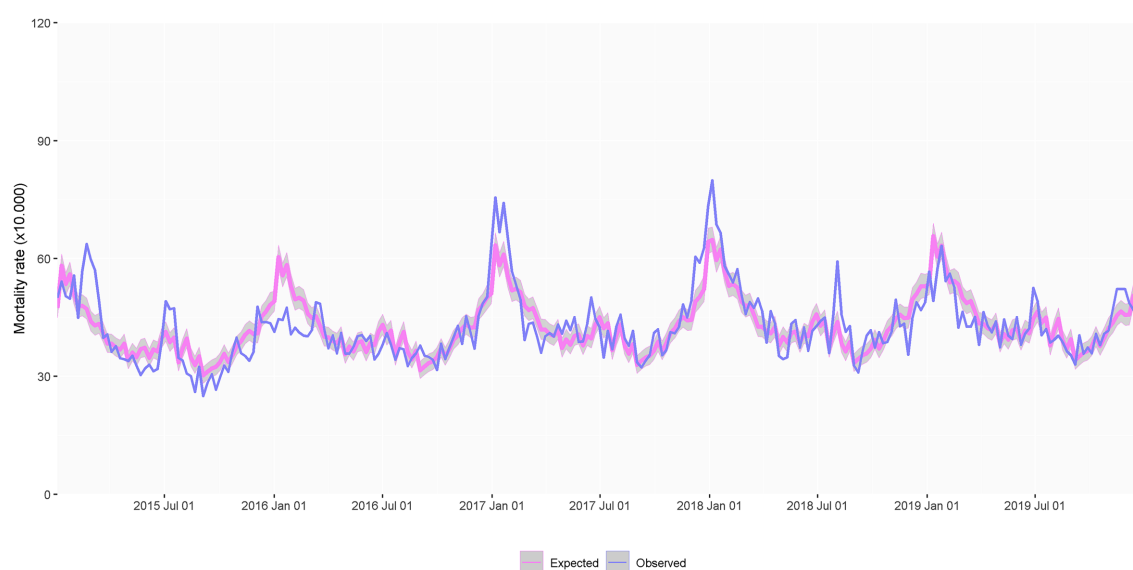


FIGURE 2

Observed and expected weekly death rate throughout the 2015–2019 period, used for developing the Poisson model of expected mortality, adjusted by sex, age, and clinical complexity (based on the adjusted morbidity groups) and accounting for seasonality ( $N = 369,016$  person-years).



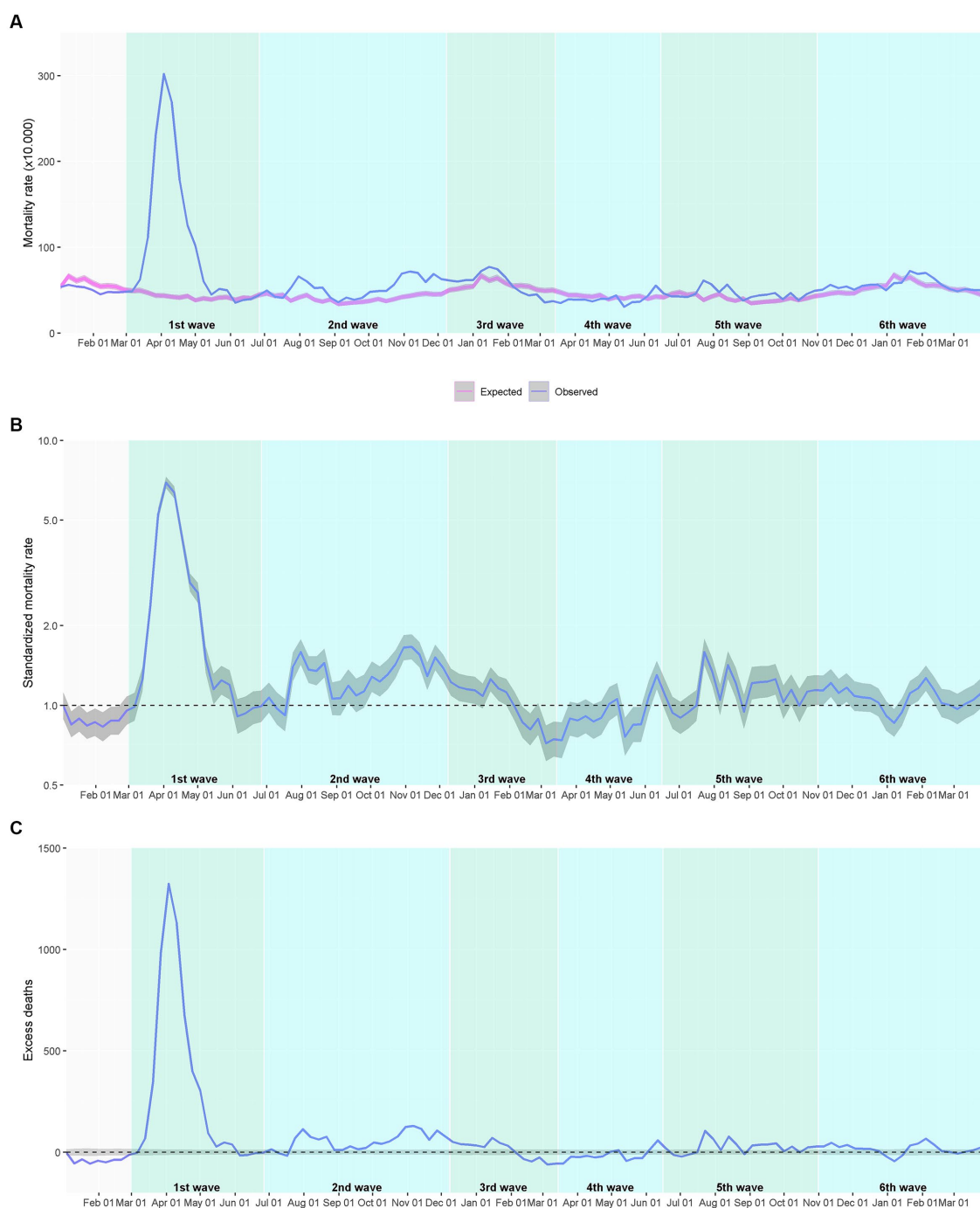


FIGURE 3

Mortality among individuals aged  $\geq 65$  years institutionalized in a nursing home during the COVID-19 outbreak. (A) Expected and observed weekly mortality rate. (B) Standardized mortality rate (blue line) with the 95% confidence interval (grey area); the dotted line shows the neutrality. (C) Estimated weekly excess deaths; the dotted line shows the zero excess threshold. The analysis of the investigated period (2020–2021) corresponds to 123,522 person-years.

important role in mortality prevention. Likewise, general public health measures implemented at the community level (e.g., social distancing, contact-tracing, mask wearing) likely reduced the risk of transmission from nursing home workers to residents. The decline in excess mortality was more pervasive in the 3rd wave, matching the start of vaccination campaigns, which prioritized individuals admitted to long-term care facilities.

An exception to the positive excess mortality observed throughout the investigated period is the negative excess and SMR lower than 1 observed between February and July 2021. Although our analysis does not allow establishing causal relationships, it is of note that the vaccination campaign started in January 2021, giving priority to individuals institutionalized in nursing homes. Therefore, the period of negative excess mortality overlapped the first 6 months following

vaccination in this setting. Excess mortality returned to positive values after this period, which seems consistent with the general recommendations of prioritizing the second booster vaccine in individuals who received the previous one more than 6 months ago (26). However, this negative excess mortality could also be attributed to the harvesting effect (i.e., a phenomenon observed during exogenous shocks, such as heat waves or cold spells, and characterized by an early mortality of frailest individuals, leaving to a relevant proportion of strong survivors and subsequent lower mortality rates within the period following the crisis) (27).

While the mortality rate is the epidemiological measure most frequently reported, it has to be appraised carefully in studies investigating LTC facilities because the high health risk typically observed in this setting is associated *per se* with a higher mortality rate than the general population. In this regard, we considered the standardized mortality rate (SMR) a more valuable measure to understand mortality observed during the COVID-19 pandemic relative to the historical trend for the same population group. This analysis revealed that while crude mortality rates were higher among older adults and those at higher health risk, younger and lower risk groups tended to higher SMR, particularly in the first wave. This finding suggests that in relative terms, the death toll was higher among groups with overall lower health risk, for which lower mortality would have been expected without a pandemic context. This phenomenon was also observed when assessing the effect of frailty in COVID-19 prognosis among hospitalized older adults (28).

Our analysis was strengthened by the population-based approach. Thanks to the integrated and centralized management of drugs, co-paid by the public health insurer, we could identify all individuals living in nursing homes (either private or public) in our country and link them with clinical and basic sociodemographic information. This advantage underscores the importance of data collection and interoperability, which if available in real time, could help monitoring of centers. However, our study has some limitations that should be taken into account when interpreting the results. First, we could stratify the population according to their clinical and demographic characteristics but not according to the type of nursing home, which may have also played a role in the observed mortality trends. Future studies including this perspective are warranted. Second, although we provide comparative information between waves, our analysis was not intended to understand the reasons behind these differences. Hence, although specific containment measures for nursing homes might have played a role, other factors relevant for explaining mortality, such as local COVID-19 incidence or the timings in the introduction of vaccines and boosters, may have also contributed to these differences (29). Finally, it is worth mentioning that the concept of nursing home may vary between countries. In our area, the lack of social/family support is an important driver for institutionalization (often with higher influence than the clinical condition); thus, excess mortality figures may differ in nursing homes primarily used for healthcare delivery.

In summary, the excess mortality and standardized mortality rate provide an accurate view of mortality associated with COVID-19 in the LTC setting, which takes into account the mortality trends typically high in this setting. Our analysis showed that mortality observed in the first wave of the COVID-19 clearly outstood over subsequent waves, although excess mortality was observed throughout the investigated period. Although crude mortality rates were far higher among older adults and those at higher health risk, younger individuals showed persistently higher SMR, suggesting an important

death toll of the COVID-19 in these groups of people. This finding encourages comprehensive shielding plans that take into account groups at different risk levels. Our report provides an accurate quantification of excess mortality in nursing homes during the COVID-19 and encourages using relative measures of mortality for assessments in this setting.

## 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.

## Ethics statement

The studies involving humans were approved by Research Ethics Committee of the University of Vic—Central University of Catalonia (Spain). The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and institutional requirements.

## Author contributions

LC, EV, SS, JC, GC-S, CP, and JA contributed to the study design and conception. LC, EV, MC, and MP contributed to data curation and analysis. LC, EV, SS, JC, GC-S, MC, MP, IC, CB, AV, PA, AP, CP, JP-J, and JA contributed to interpretation of the data and results and critically revised the manuscript draft for important intellectual content. LC, EV, GC-S, and JA contributed to the first manuscript draft. All authors contributed to the article and approved the submitted version.

## 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.

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2023.1208184/full#supplementary-material>

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# Medical and social factors influencing the utilization of healthcare services among older adults in Israel during the COVID-19 lockdown

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**Background:** The corona virus disease 2019 (COVID-19) pandemic significantly impacted older adults. However, most older communities focused on the medical issues. The aims of this study were to identify the medical and social factors linked with the usage of medical services during the COVID-19 lockdown in Israel.

**Methods:** The study was conducted Over two periods of time from February to April in 2019 (P1), before the COVID-19 and from February to April in 2020 (P2), during the first lockdown. The study was conducted on people aged 65 and older in Israel. The variable statistics were analyzed using frequency tabulation, cross-tabulation frequencies, and t-tests. Two hierarchical logistic regressions were conducted over four steps for each period.

**Results:** The participants (n=102,303) comprised 64.5% female (65,946) and 35.5% male (36,357) (mean age 80.5, SD= 7.46). It was found that participants who had not subscribed to the supportive community services were 7.47 times more likely to access medical services in P1 and 12.417 times more likely to access medical services during the lockdown. This variable was also found to be a strong predictor in the final model. The most significant variable for predicting the participants' needs during P2 was their previous needs in P1. Other social variables were living in assisted living home and living in community settlements. The presence of 12 diseases in this study did not predict service demand.

**Conclusion:** Community support reduces medical service demands during disasters and provides services for older adults. During pandemics, however, social services need to be expanded and made more easily accessible to older adults.

## KEYWORDS

medical factors, medical service, older adults, COVID-19, social factor



## Introduction

During the first COVID-19 pandemic lockdown, health systems were often unprepared (1, 2). Because the COVID-19 pandemic more significantly affected older populations, the mortality rate for those aged 80 or older was 54% that is 5.1 times more than those who died aged 30–59 (3), 15% of the first wave of death were aged above 60, the mortality rate in age group 60–69 years was 3.6% (4). The Israeli government issued guidelines on isolation (5, 6) that instructed older adults to isolate in their homes to avoid exposure (5, 7). This meant that isolated older adults had to ask for assistance to purchase food and medicines from their immediate family or other people (2, 8).

Older adults with chronic medical conditions were more prone to catching COVID-19, had slower recoveries, and were more likely to have complications (9, 10). Therefore, it was vital that these people abided by the COVID-19 control measures, such as social distancing (11), to avoid the risk of more severe symptoms and hospitalization. COVID-19 was generally contracted through close contact with symptomatic and asymptomatic carriers, with the mildest symptoms reported by around 81% of infected people being coughs, sore throats, fever, muscle pain, and pulmonary embolism. However, severe cases reported pneumonia, shortness of breath, and low blood oxygen saturation, and 5% of infected people suffered from severe respiratory failure and septic shock (4, 12, 13).

Most severe adult COVID-19 cases had common comorbidities. For example, many hospitalized diabetics were at risk of dying from the COVID-19 virus, 75% of hospitalized patients were also suffering from hypertension, and cases with diseases such as chronic obstructive pulmonary disease (COPD), obesity, and cardiovascular diseases tended to have more serious infections that could lead to severe lung infections (11, 12, 14). The cardiovascular complications in many severe COVID-19 patients included acute myocardial infarction, myocardial infarction, myocarditis, heart failure, arrhythmia, and thrombosis (11, 14). Consequently, the mortality rates were significantly higher in people who had one or more chronic diseases (12, 14).

Even prior to the onset of the Covid-19 pandemic, numerous countries had already devised novel primary community care models aimed at addressing the medical needs of their communities. These models encompassed routine medical check-ups, the creation of medical records, exercise recommendations, and the establishment of centers catering to the needs of older individuals (assisted living home), medical lectures, and nursing and doctor home visits. However, these supportive communities were more focused on medical issues (15), such as ambulance services, home doctor visits, and telehealth advice. One such company providing these services in Israel was “Natalie Medical Services.”

This study was based on COVID-19 medical data from Natalie Medical Services in Israel during the lockdown period and medical data from the previous year. The company provides medical and logistical services to subscribers who pay a fixed fee each month and provided at the subscriber's request (16). One of the services provided by Natalie Health Services is a supportive community service (16) that gives support, such as answering questions, giving advice, purchasing medicine and food, and other logistical or medical needs.

Therefore, this was a comprehensive longitudinal study based on data from the same Israeli population over two periods: before the start of the pandemic from February to April 2019 (P1), and during

the government-ordered COVID-19 lockdown from February to April 2020 (P2). The purpose of this study was identifying the medical and social factors linked with the usage of.

medical services during the COVID-19 lockdown in Israel.

Previous studies found that high social involvement and belonging to a community support network were associated with higher well-being (17–20). Community support emphasizes the sharing of information about diseases, dealing with risk factors, counseling for complications, and information provision about available medical resources (21). Social isolation has been associated with less efficient disease management (22–24). Various underlying diseases, the most common of which are hypertension, cardiovascular diseases, and blood diseases, result in a greater need for ongoing medical services. As viruses can have more serious effects on chronically ill patients, such as people suffering from diabetics, hypertension, and respiratory illnesses (25–29).

## Materials and methods

The institutional ethical review committee of Ariel University gave ethical approval for this study (AU-HEA-AZ-20200624) after permission was given to access the data from *Natalie Medical Services in Israel*. This study was based on the longitudinal observations of older adults in two periods: before the COVID-19 pandemic from February to April 2019 (P1), and during the first lockdown in Israel from February to April 2020 (P2). The data for this study were anonymized using the company's subscription number.

## Study population and sample

In the first period, the study population was *Natalie Medical Services in Israel* customers 65 and over, with the final study sample being participants who were presented in the data in both study periods.

After people who had canceled their subscriptions, passed away, had had their subscriptions frozen, or had missing data were removed, the sample comprised 102,303 participants (mean age- 80.5, SD- 7.46), and 64.5% (65946) of who were female and 35.5% (36357) of whom were male.

## Research tools

The study data collects customer information to monitor and supervise their needs and services. After anonymization, relevant variables from the Central Bureau of Statistics; residential socioeconomic status, sector, and religiosity; were added to the company subscription numbers (30).

## Variables

### Dependent variable

The indexes for these four variables had Cronbach's alpha scores at P1 of 0.693 and at P2 of 0.630. To construct the variable need index, the four variables: P1/P2 Emergency calls, P1/P2 Emergency Call



**TABLE 1** Dependent variables description referring to two time periods P1/P2.

Variable	Description	P1 values*	P2 values*
P1/P2 Emergency Calls	Calls to the emergency call center for medical reasons	0–114	0–472
P1/P2 Emergency Call Referrals	Number of referrals for people who called the emergency call center	0–226	0–294
P1/P2 Ambulance	Number of times a customer ordered an ambulance	0–18	0–16
P1/P2 Doctor Visits	Number of times a doctor visited a client during these two periods	0–102	0–111

\*Columns P1 and P2 represent pre COVID-19 period and during the lockdown period, Cronbach's alpha for P1 = 0.693 and for P2 = 0.630.

Referrals, P1/P2 Ambulance, P1/P2 Doctor Visits were first recoded into dichotomous variables; 0- no service demand and 1- service demand; after which the variables were summed into one complex index for each period with a value range of 0–4 (see [Table 1](#)).

## Independent variables and sociodemographic variables

[Table 2](#) presents the independent variables and the description value of each variable.

### Sociodemographic variables

The sociodemographic variables were as follows: gender; age at the start date of the study in 2019 grouped into three categories ([31](#)); younger older adults (65 until 75), middle-aged older adults (75 until 85), and older adults (85 and older); and family status divided into single, married, separated/ divorced, widowed, and not-reported. Of the sample 27,433 (26.8% of the sample) had missing family statuses. After cross-referencing with CBS data (2019), the additional sociodemographic variables derived from the respondent's residential address were: settlement religiosity (1. secular, 2. religious, and 3. ultra-orthodox) and socioeconomic situations, which was first classified as per the CBS coding into clusters from 1 to 10, with 1 representing very low socioeconomic status and 10 representing very high socioeconomic status and then divided into two categories: 1. lower class- scores from 1 to 6; 2. high class- scores from 7 to 10.

## Data analysis

SPSS™ Statistics 27.0 software was used for the data analysis. The variable statistics descriptions were generated using frequency tabulation, cross-tabulation frequencies, and t-tests, the results for which are shown in [Table 3](#). Hierarchical logistic regressions for each period were conducted, the results for which are shown in [Table 4](#). Cross-tabulation frequencies and chi-square significance were used to compare the independent groups, the results for which are shown in [Table 5](#).

## Results

[Table 3](#) presents the variables and the indexes used in the regression model and the percentages for each value.

[Table 4](#) shows the results for the hierarchical logistic regressions that predicted the needs before COVID-19 (P1) and during the first COVID-19 lockdown in Israel (P2). The analyses were conducted over four steps: 1. Sociodemographic variables as gender, age, family status, socioeconomic status (SES); 2. The sociodemographic variables were added to the social indices such as living in a communal settlement, living in an apartment building with supportive community services and in apartment buildings, living in assisted living homes, living in assisted living homes, suggesting that the older are not living in loneliness, social isolation, and they have limited social support ([32](#)). Data from the first step were entered, and the member variables were added; 3. the significant variables from the previous steps and the disease index were entered; and 4. the needs in the previous period (P1) were entered. The final model predicting the extent of the needs during the COVID-19 lockdown was relevant only to P2 and explained 38% of the variance.

In step 3 of both periods, customers who were not subscribed to the supportive community services (RR = 7.472,  $p < 0.001$ , CI 5.721, 9.760 in P1 and RR = 12.417,  $p < 0.001$ , CI 8.164, 18.884 in P2) were 7.472 times more likely to require medical services in P1 and 12.417 times more likely to require medical services during the COVID-19 lockdown. This variable continued to be a strong predictor in the final model (RR = 6.449,  $p < 0.001$ , CI 4.189, 9.930).

The final P2 analysis model found that the most significant variable for needs prediction during P2 was the previous needs in P1 (RR = 10.002,  $p < 0.001$ , CI 9.605, 10.416). Another social variable was living in an assisted living home (RR = 1.871,  $p < 0.001$ , CI 1.790, 1.995) and living in a community settlement (RR = 1.649,  $p < 0.001$ , CI 1.422, 1.913).

To understand the nature of these strong prediction variables on the need's requirements in P2, a comparison was conducted between the independent groups subscribed to the supportive community services in P1 ([Table 5](#)). It appears that there were significant differences between the groups for all study variables. Compared with people who chose not to subscribe to the supportive community service (SCS), more subscribers were: female, from the older group, married, from a high SES, living in a community settlement, living in apartment buildings, and had had no needs in the previous year. Higher P1 service need frequencies were female, from the middle-aged group, single, from a low SES, not living in community settlements, living in apartment buildings, had one or more diseases, and was unsubscribed to the SCS. The diseases recorded in the subscriber's medical records were diabetes, respiratory diseases, mental health diseases, post-surgery needs, neurological diseases, cardiovascular diseases, hypertension, blood diseases, cancer, intestinal diseases, skeletal and muscular diseases, and urinary system diseases. The social characteristics of the subscribers were: family status, living in community settlements, living in assisted living home, and belonging to a supportive community. Assisted living homes are designed for older adults who are independent and need less nursing help; they also empower the information of health, treatments, and health services. Older adults tend to use less information than younger adults, showing that the awareness of older adults about their rights is

TABLE 2 Independent variables description refers to residential configuration and background diseases.

Variable	Description	Category value
Supportive community services	Company service that ensured customers were contacted every week for assistance with non-medical needs, such as answering questions, counseling, purchasing food and medicines, and logistics	Yes- if this arrangement was supplied. No -if it was not supplied
Living in an assisted living home	If a customer lived in an assisted living home	Yes/No
Living in a community settlement	Determined based on the customer's home address and matching with the Israeli Central Bureau of Statistics (CBS) (2019)	Yes/No
Housing type	If the address had a floor number, the housing type was considered a building, with all others being considered as private homes	Private house/ Apartment building
Cancer		0 = no disease, 1 = have disease
Blood diseases	Anemia, iron deficiencies, and low hemoglobin	
Hypertension		
Cardiovascular illnesses		
Neurological disorders	Cerebral vascular disease, Parkinson disease, and epilepsy	
Post-surgery issues		
Psychiatric problems		
Pulmonary diseases	COPD and asthma	
Diabetes		
Digestive issues		
Skeletal and mobility issues		
Kidney and urinary problems		

TABLE 3 Variables and indexes socio-demographics, social, disease, and needs for services.

	Variables	Values	%	<i>n</i>
Socio-demographics	Gender	Female	64.5	65,946
		Male	35.5	36,357
	Age	65–119		
	Family status	Single	1.1	1,101
		Married	45.0	46,063
		Separated/ Divorced	4.4	4,491
		Widowed	22.7	23,215
		Not reported	26.8	27,433
	Socioeconomic status (SES) Clusters 1–10 dichotomized by the median	Low SES (1–6)	54.9	56,135
		High SES (7–10)	45.1	46,168
Social	Living in a community settlement	Yes	2.9	2,981
		No	97.1	99,322
	Living in an assisted living home	Yes	26.4	26,963
		No	73.6	75,340
	Supportive community services	0 = Subscribed	2.2	2,283
		1 = Not subscribed	97.8	100,020
	Living in apartment building	Yes	80.1	79,908
		No	19.9	19,911

(Continued)

TABLE 3 (Continued)

	Variables	Values	%	<i>n</i>
Disease	Diabetes	0 = no disease, 1 = disease	17.2	17,597
	Lung problems		8.7	8,903
	Psychiatric issues		2.6	2,699
	Post-surgery issues		5.3	5,440
	Neurological issues		9.1	9,265
	Cardiovascular issues		23.8	24,301
	Hypertension		41.0	41,902
	Blood		22.7	23,254
	Cancer		5.1	5,188
	Digestive issues		4.7	4,759
	Skeletal issues		5.8	5,891
	Disease index	Scale 0–11		
Needs for services in P1 and P2 scale	P1 needs and P2 needs: Medical calls (0,1), Emergency calls (0,1), Ambulance orders (0,1), Doctors home visits (0,1)	0 needs in P1	66.9	68,441
		1 or more needs in P1	33.1	33,862
		0 needs in P2	76.0	77,768
		1 or more needs in P2	24.0	24,535

SES= Socioeconomic status.

less compared to nursing people who need a close medical environment, as in a nursing home (33, 34).

## Discussion

A supportive community environment creates a lower demand for medical services and is necessary for situations when older adults need assistance (35–37). This study examined factors affecting the demand for medical services by older adults with different medical and social characteristics in Israel during the COVID-19 lockdown. This study was based on a large adult sample of 103,955 members of Natalie Health Services in both periods. It was hypothesized that the medical needs of patients who received social support would be lower during the first quarantine period.

The results from the two research periods showed that during the first COVID-19 lockdown period, the referral frequencies of older adults to health service providers for various social and medical issues were significantly lower compared with the corresponding period in 2019. As expected, the social factors like living in community settlement, and having a supportive community service reduced the need for services by 0.8 in P2, as was also observed in previous literature (38–40). This suggests that the availability of a supportive community environment and services played a role in reducing the need for medical services during the lockdown.

Supportive community service (16, 41) gives support, such as answering questions, giving advice, purchasing medicine and food, and other logistical or medical needs. The study revealed that individuals affiliated with supportive community services required fewer medical interventions in both time periods. This not only lessened the chances of complications but also lowered the demand for medical services. Furthermore, during the second period (P2), the need for medical care was notably reduced among individuals with

chronic illnesses. This decline could be attributed to their access to social services and support, potentially leading them to forgo seeking medical attention (42–46).

It is recommended that services like supportive community services should be provided to chronically ill people and social programs prioritized for people with more complex conditions to reduce the risk of complications and decrease the need for medical services potentially because they had access to social services and other forms of support. The significant differences between the groups suggested that the variances between these groups could be explain by the strong effects of supportive community services. To better serve vulnerable populations, governments and governmental organizations should enhance their engagement by allocating larger budgets for social programs. This step involves both strengthening current initiatives that support older individuals and chronic patients and fortifying these programs. The objective is to bolster their capacity to aid during emergencies, consequently mitigating the strain on medical services. Ultimately, reinforcing existing programs aimed at assisting the older adults and chronic patients not only diminishes the demand for medical services during crises but also guarantees essential support for these susceptible demographics.

## Conclusion

During the first quarantine period, the medical service consumption was lower. Chronic patients, especially those with hypertension, cardiovascular diseases, and polypharmacy, utilized medical services frequently. During medical crises, such as the COVID-19 pandemic, social services must be expanded and made more accessible to older adults. Organizations that provide medical services to chronic patients, such as health maintenance organization, HMO and national insurance services, should

TABLE 4 4 steps Hierarchical logistic regressions for needs predictions in both periods for the study variables.

	Measures	Values	Prediction of needs in P1 before COVID-19			Prediction of the needs in P2 during COVID-19 lockdown				
			Exp(B)/RR	CI		Explained var	Exp(B)/RR	CI		Exp var
Step 1	Gender	1 = Male,	0.946***	0.884	0.914	6.2%	0.984**	0.912	0.947	6.0%
	Age	2 = Female	1.437***	1.375	1.406		1.542***	1.470	1.506	
	Family status	From age 65 to	2.073***	1.938	2.004		1.943***	1.806	1.873	
	SES	119	1.115***	1.048	1.081		1.155***	1.079	1.116	
Step 2		0 = marital, 1 = Not marital				9.3%				9.6%
		0 = Higher, 1 = Lower								
	Gender	1 = Male, 2 = Female	0.898***	0.868	0.930		0.928***	0.893	0.964	
	Age	From age 65 to 119	1.268***	1.239	1.298		1.335***	1.301	1.369	
	Family status	0 = marital, 1 = Not marital	1.789***	1.725	1.855		1.645***	1.581	1.711	
	SES	0 = Higher, 1 = Lower	0.972	0.941	1.003		0.994	0.960	1.030	
	Supportive community service	0 = Belong, 1 = Not belong	5.761***	4.413	7.520		9.187***	6.054	13.943	
	Living in assisted living home	0 = No, 1 = Yes	1.926***	1.860	1.995		2.070***	1.993	2.149	
	Living in community settlements	0 = No, 1 = Yes	1.088	0.977	1.211		1.555***	1.363	1.775	
	Living alone	0 = No, 1 = Yes	1.152***	1.099	1.208		1.134***	1.078	1.194	
Step 3	Living in apartment building	0 = No, 1 = Yes	1.049*	1.004	1.096	13.4%	1.110***	1.057	1.165	15.1%
	Gender	1 = Male, 2 = Female	0.934***	0.902	0.968		0.972	0.935	1.011	
	Age	From age 65 to 119	1.202***	1.174	1.231		1.255***	1.223	1.289	
	Family status	0 = marital, 1 = Not marital	1.809***	1.743	1.877		1.670***	1.603	1.739	
	Supportive community service	0 = Subscribed, 1 = Not subscribed	7.472***	5.721	9.760		12.417***	8.164	18.884	
	Living in older adults homes	0 = No, 1 = Yes	2.148***	2.072	2.226		2.402***	2.311	2.497	
	Living in community settlements	0 = No, 1 = Yes	–	–	–		1.510***	1.321	1.726	
	Living alone	0 = No, 1 = Yes	1.138***	1.086	1.193		1.099***	1.045	1.155	
	Living in apartment building	0 = No, 1 = Yes	1.052*	1.008	1.097		1.108***	1.054	1.165	
	Disease	0 = No, 1 = Yes	1.231***	1.221	1.241		1.281***	1.270	1.292	

(Continued)

TABLE 4 (Continued)

	Measures	Values	Prediction of needs in P1 before COVID-19			Prediction of the needs in P2 during COVID-19 lockdown				
			Exp(B)/RR	CI		Explained var	Exp(B)/RR	CI		Exp var
Step 4	Age	From age 65 to 119					1.188***	1.154	1.224	<b>37.9%</b>
	Family status	0 = marital, 1 = Not marital					1.312***	1.255	1.370	
	Supportive community service	0 = Belong, 1 = Not belong					6.449***	4.189	9.930	
	Living in assisted living home	0 = No, 1 = Yes					1.871***	1.790	1.955	
	Living in community settlements	0 = No, 1 = Yes					1.649***	1.422	1.913	
	Living alone	0 = No, 1 = Yes					1.040	0.983	1.100	
	Living in apartment building	0 = No, 1 = Yes					1.107***	1.047	1.171	
	Disease	0 = No, 1 = Yes					1.205***	1.193	1.217	
	P1 needs	0 = No, 1 = Yes					10.002***	9.605	10.416	

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ ; SES, Socioeconomic status; Exp(B), Value of adjusted relative risk; CI, Confidence interval; Explained Variance, value of Nagelkerke  $R$  square.

TABLE 5 Comparison of study variables by those subscribed to the supportive community service versus the needs.

Variables	Values	Subscribed to SCS	Unsubscribed to SCS	*Sig.	No needs in P1	Needs in P1	*Sig.
Gender	Female	<b>71.4%</b>	64.3%	***	63.5%	<b>66.3%</b>	***
	Male	28.6%	35.7%		36.5%	33.7%	
Age groups	Younger	7.0%	29.6%	***	32.7%	21.7%	***
	Middle-aged	40.6%	46.2%		45.3%	<b>47.5%</b>	
	Older	<b>52.4%</b>	24.3%		22.0%	30.8%	
Family status	marital	<b>72.6%</b>	61.5%	***	67.8%	49.5%	***
	Not marital	27.4%	38.5%		32.2%	<b>50.5%</b>	
SES cluster	Low	33.9	45.4%	***	44.2%	<b>47.0%</b>	***
	High	<b>66.1%</b>	54.6%		55.8%	53.0%	
Community settlement	Yes	<b>24.7%</b>	2.4%	***	3.2%	2.4%	***
	No	75.3%	97.6%		96.8%	<b>97.6%</b>	
Buildings	Private house	15.5%	20.0%	***	20.9%	18.1%	***
	Apartment building	<b>84.5%</b>	80.0%		79.1%	<b>81.9%</b>	
Disease index	No disease	32.1%	46.5%	***	52.1%	34.1%	***
	One or more disease	<b>67.9%</b>	53.5%		47.9%	<b>65.9%</b>	
P1 needs	No needs	<b>95.1%</b>	66.3%	***			
	One need or more	4.9%	33.7%				
Supportive community services	Subscribed to SCS				3.2%	0.3%	***
	Unsubscribed to SCS				96.8%	<b>99.7%</b>	

Chi-square significance for differences between the independent groups. Modes are bolded. \*\*\* $p < 0.001$ ; SCS=Supportive community service.



activate and support social programs for complex patients to reduce the risk of complications and consumption of services. Supportive communities have a dual impact by decreasing the need for medical services during emergencies and providing vital assistance to older individuals. To achieve this, governments and government organizations should develop programs that boost social engagement, focusing on supporting older and chronically ill individuals in times of crisis. By implementing measures like fostering supportive community environments and offering services such as supportive community services, the pressure on medical services can be significantly alleviated, particularly during critical situations. Prioritizing social programs and support for vulnerable populations, such as older individuals and chronically ill patients, is crucial to ensuring their well-being and reducing the strain on medical services during challenging situations like a pandemic.

## Strengths and limitations

This study was based on a large group of older adults in Israel and was intended to prospectively evaluate the risk and protective factors related to their medical needs. The research design and sample were advantages that gave strong support to the study conclusions. However, as this was an observational study, the causal relations between the variables could not be confirmed because of the possible interference of confounder variables. Another limitation may stem from the medical conditions of those living in the assisted living home compared with those living in their own homes as the people living in assisted living home may have had more severe medical conditions. Another limitation arose due to the uncertainty surrounding the variable of assisted living homes. This uncertainty was because no significant differences were observed between individuals living in assisted living homes and those residing in nursing homes.

## Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: Data cannot be shared publicly as it is confidential to Natali privet company. The first author (OS) is the chief manager of “Natali Healthcare Solutions” call center. Natali’s CEO gave had

permission to use Natali’s database for this study. The database was collected as part of services provided by “Natali Healthcare Solutions” to its customers in Israel. The data underlying the results presented in the study are available from “Natali Healthcare Solutions.” The company URL: <http://Natali.co.il>. The authors do not have permission to share the data. OS: [ohads@natali.co.il](mailto:ohads@natali.co.il). Requests to access these datasets should be directed to OS, Natali Healthcare Solutions, [ohads@natali.co.il](mailto:ohads@natali.co.il).

## Ethics statement

The studies involving humans were approved by Ariel university AU-HEA-AZ-20200624. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants’ legal guardians/next of kin in accordance with the national legislation and institutional requirements.

## Author contributions

OS, AZ, and LK: investigation. OS: original draft preparation and data curation. LK and OS: formal analysis. OS, AZ, LK, YS, and MZ: conceptualization, review, and editing. AZ and YS: supervision. All authors have read and agreed to the published version of the manuscript.

## 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.

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# Impact of food insecurity and food environment on the diet quality of older African Americans during the COVID-19 pandemic

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**Introduction:** A high quality diet is vital in promoting wellbeing and ensuring good health, particularly for those living with chronic conditions. Older African Americans, already burdened with a higher prevalence of chronic conditions, also face a higher risk for suboptimal diets. The COVID-19 pandemic had lasting effects on access to healthy food for all Americans, but some demographic groups were disproportionately affected. Older African Americans, who already experienced reduced access to healthy food pre-pandemic, were particularly afflicted, but the full extent of the pandemic's impact on their food insecurity and food environment remains unclear.

**Methods:** To address this gap, we conducted a study among 102 older African Americans in South Los Angeles between October 2021 and July 2022 during the COVID-19 pandemic. Participants completed surveys on dietary intake, food insecurity, and neighborhood food environment. We measured dietary quality using the healthy eating index (HEI)-2015. The analysis included descriptive, bivariate chi-square, *t*-tests, analysis of variance, and multiple linear and logistic regression.

**Results:** While overall dietary quality was suboptimal, most participants met the guidelines for fruit and vegetable consumption. Food insecurity was associated with lower overall diet quality and lower total fruit and whole fruit intake. However, there was no association between food environment and diet quality.

**Discussion:** In light of our findings, further intervention is critical to improving diet quality, especially among older African Americans living with chronic conditions in the post-pandemic era.

## KEYWORDS

COVID-19, diet quality, food insecurity, food environment, African American, older adults, healthy eating index

## 1. Introduction

Chronic conditions such as heart disease, diabetes, and hypertension continue to rank as leading causes of morbidity and mortality among older Americans (1). There is well-established evidence that a high-quality diet plays an important role in preventing or slowing these diseases and promoting overall wellbeing (2–5). This is particularly important among older African Americans, who are disproportionately burdened with chronic conditions (1) and have historically reported suboptimal diets based on recommended guidelines (6–10).

Prior studies suggest that access to healthy food significantly influences in diet quality (11–15). However, it remains unclear how changes in the experiences of food insecurity and the food environment impacted the diet quality of older African Americans during the COVID-19 pandemic. This is of considerable importance because chronic diseases may be exacerbated by diet changes experienced during this pandemic.

Food insecurity is a condition in which an individual lacks consistent access to enough nutritious food to live an active and healthy life (16). It is often caused by a lack of financial resources or inadequate access to healthy and affordable food options. Food insecurity is associated with poor diet quality, prevalence of chronic disease, and higher mortality rates (17–21). On the other hand, the food environment refers to the physical environment that influences access to healthy food options in a particular area or community (15). It includes factors such as the availability and affordability of high quality food, as well as the types of food outlets (such as grocery stores, convenience stores, fast food restaurants, and farmers' markets) present in the area. Particularly for low-income and minority communities, limited access to affordable and nutritious food options may significantly impact dietary habits and health outcomes (22–24).

A longitudinal study by Leung et al., (19) found a positive relationship between food insecurity and poor diet quality among adults over the age of 60 years. Furthermore, a systematic review and meta-analysis of existing literature by Gundersen and Ziliak (20) demonstrated that food insecurity was consistently associated with worse physical and mental health outcomes, including chronic diseases. The link between food insecurity and chronic diseases such as heart disease, diabetes, and hypertension was also observed among low-income participants in the National Health and Nutrition Examination Survey (NHANES) (21). Recognizing the negative impact of food insecurity on disease outcomes is critical now more than ever, considering the escalation of food insecurity during and post the COVID-19 pandemic (25, 26).

The COVID-19 pandemic exerted a disproportionate impact on food environments and food insecurity, particularly among vulnerable populations such as older adults, low-income individuals, and minorities (17, 25, 27–32). Notably, Dubowitz et al. (28) reported that among African American residents in a low-income food desert neighborhood, food insecurity increased from 21% in 2018 to 36% in 2020 as a result of the pandemic. Additionally, several studies quantified the number of food outlet closures in locations around the US (33–35). In Flint, MI, 173 food venues closed during the pandemic, with only 17 new venues taking their place (33). Locations with predominantly African American populations had three times the rate of emergency food outlet closures as other locations (33). Similarly San Diego county lost a net of 8% of its stores that accept electronic benefits transfer (EBT) payments, including one full-service supermarket (35). These closures, coupled with supply-chain shortages and business restrictions, significantly impacted access to healthy food options (31, 32, 36). The repercussions of these changes in the food landscape pose substantial challenges to vulnerable communities already facing food insecurity.

Recognizing the potential compromise to diet quality during the pandemic and the subsequent potential impact on the health status of older African Americans, our study aimed to examine

the effects of food insecurity and food environment on their diet quality. Our hypothesis posited that (1) a lower food insecurity would be associated with higher diet quality, and (2) a favorable food environment would be associated with higher diet quality.

## 2. Materials and methods

### 2.1. Participants

The COVID-19, Food insecurity, Exercise, and Dietary history (C-FED) study was a cross-sectional sample of a larger intervention study focused on health behaviors in older African Americans in South LA during the COVID-19 pandemic (37). To be eligible for the parent study, participants had to identify as Black or African American and be at least 65 or 55 years old with a chronic condition. All participants enrolled in the parent study were eligible to take part in the C-FED study. A total of 118 participants opted to join the C-FED study and complete the study-related surveys between October 2021 and July 2022. Consistent with previous studies, we excluded individuals whose responses to the diet history questionnaire indicated improbable caloric intake (<500 kcal/day or >3,500 kcal/day for women; <800 kcal/day or >4,000 kcal/day for men) (38–40), resulting in an analytical dataset of 102 participants. Informed consent was obtained prior to their participation. The C-FED study was approved by the Charles R. Drew University of Medicine and Science IRB.

### 2.2. Surveys

Details on the methodology and design of the C-FED study are presented in a previous manuscript (37). Participants completed surveys on their own, through an online link, over the phone with a trained research assistant, or in person with a trained research assistant. The C-FED surveys consisted of the Diet History Questionnaire (DHQ) III, the National Center for Health Statistics six-item short form food security survey, and three questions about food environment. Socio-demographic and health information were obtained from the parent study questionnaires. Socio-demographic information included age, gender, education level, income, and living arrangement. Education level was categorized into three groups: high school degree or less, associate degree or some college, and college or post-graduate degree. Annual income was dichotomized using a cutoff of \$50,000. For living arrangement, participants were asked if they lived alone (yes/no). Health information consisted of self-reported health, BMI, and chronic conditions. Health rating options included poor, fair, good, very good, and excellent. We combined groups with small numbers, resulting in the categories poor-fair, good, and very good-excellent. BMI was categorized according to clinical guidelines into healthy (18.5–24.9), overweight (25.0–29.9), and obese ( $\geq 30$ ). We constructed the variable number of chronic health conditions by counting the number of health conditions that participants listed. This variable was categorized into 0, 1, or 2, and 3+ health conditions.



## 2.3. Food insecurity

The food insecurity questionnaire reflects household level food insecurity. This measure has been previously validated as correctly classifying 97.7% of households in the U.S. (41, 42). It consists of six questions that ask about running out of food and skipping or cutting the size of meals. The total food insecurity score is calculated as the total number of items endorsed by the participant, such that the total possible score ranges from 0 to 6. A score of 0 indicated full food security, while scores ranging from 1 to 6 indicate increasing levels of food insecurity. We used a cutoff of 1 to dichotomize this variable into those with food insecurity (code = 1) and without food insecurity (code = 0).

## 2.4. Food environment

We asked three questions related to the food available in the neighborhood taken from the PhenX Toolkit (<https://www.phenxtoolkit.org/protocols/view/210701>). An assessment of these questions reported an internal reliability of 0.78 and test-retest reliability of 0.69 (43). Participants were instructed to consider their neighborhood as within 1 mile of their home. Participants were asked to rate their level of agreement with (1) The fresh fruits and vegetables in my neighborhood are of high quality, (2) A large selection of fresh fruits and vegetables is available in my neighborhood, and (3) A large selection of low-fat products is available in my neighborhood. Responses were on a 5-point Likert scale ranging from strongly disagree to strongly agree. Following instrument guidelines, we created an overall food environment score by taking the average of the scores of the three questions and rounding to the nearest integer. All food environment variables were categorized into three groups: disagree (scores < 3), neutral (score = 3), and agree (scores > 3).

## 2.5. Outcome variables: diet quality

The DHQ is a comprehensive diet inventory. Participants were asked about the frequency and quantity of all types of foods consumed over the past 12 months. Diet quality was measured using the Healthy Eating Index-2015 (HEI), which was calculated based on responses on the DHQ. The HEI is a validated construct for assessing dietary intake (44). It consists of the sum of 10 sub scores, each of which reflect consumption of a particular food group or food category. A key feature of HEI is that scores are based on density, so it reflects the balance of food consumed across food groups. Thus, the total score reflects diet quality, as opposed to quantity.

The total score ranges from 0 to 100, with 100 reflecting the ideal diet according to the dietary recommendations of the USDA. The USDA suggests the following grading for total HEI scores: 90–100 = A; 80–89 = B; 70–79 = C; 60–69 = D; <60 = F (45). In addition, the score for overall HEI was normally distributed using the Shapiro-Wilk test and used in the analysis as continuous variable.

We focused on the diet quality indices that correspond to the neighborhood food environment questions: HEI sub scores for total fruit, whole fruit, vegetable, percent of calories from total fat, and percent of calories from saturated fat. Total fruit score includes 100% juices, while the whole fruit score includes all forms of fruit except juice. All the included HEI sub scores range from 0 to 5, with 5 indicating highest quality. Because the distributions of the HEI sub scores were highly skewed, we categorized these variables into those who achieved the maximum possible score (5) and those who did not (<5). The percentage of calories consumed from fat and from saturated fats were normally distributed per Shapiro-Wilk Tests and treated as continuous variables.

## 2.6. Statistical analysis

Descriptive statistics were used to depict the population characteristics. Categorical data were presented as number and percent. Continuous data were presented as mean and standard deviation for normally distributed variables and median and inter quartile range for skewed variables. For bivariate analyses, we used chi-squared tests to test for statistical significance between categorical variables, and *t*-test or analysis of variance (ANOVA) for associations between categorical and continuous normally distributed variables. We used multiple regression to test for statistical associations of food insecurity and food environment with diet quality. We used the overall food environment score in multiple regressions and controlled for variables that could be associated with diet quality: age, gender, education, living arrangement, physical health, BMI, and number of chronic conditions. Age was included in the model as a continuous variable; the other variables were included as categorical variables. To avoid multicollinearity, we did not include income in the models, due to its strong correlation with food insecurity. Our small sample size did not provide us with the power to investigate interactions.

The diet quality outcomes included total HEI, HEI sub scores of fruit, whole fruit, and vegetables, and percent of calories from fats and from saturated fats. Linear regression was used where the dependent outcome was a continuous normally distributed variable (total HEI, percent calories from saturated fat, and percent calories from fat), and logistic regression was used for categorical binary outcomes (HEI sub scores of fruit, whole fruit, and vegetables). For linear regressions, we present adjusted B coefficient and standard error (SE); for logistic regressions we report adjusted odds ratio and 95% confidence interval. The percent missing for any given variable was <5%, except for education level which was missing for 8%. We used listwise deletion for cases with missing data in multivariable regressions. Analyses were done using SAS 9.4, and a *p* < 0.05 was considered statistically significant.

## 3. Results

### 3.1. Participant characteristics

Participant ages were nearly evenly distributed (Table 1). Most participants were female (71%), did not live alone (70%),



TABLE 1 Characteristics of the sample.

Characteristic	Mean	SD
Age (N = 102)	68.98	8.58
	Number	%
<b>Gender (N = 102)</b>		
Male	30	29.41
Female	72	70.59
<b>Age (N = 102)</b>		
55-64	32	31.37
65-74	47	46.08
75+	23	22.55
<b>Lives alone (N = 102)</b>		
No	71	69.61
Yes	31	30.39
<b>Education (N = 94)</b>		
High school degree or less	33	35.11
Associate degree or some college	39	41.49
College or post-graduate degree	22	23.40
<b>Annual income (N = 97)</b>		
<\$50,000	73	75.26
>\$50,000	24	24.74
<b>Self-rated health (N = 99)</b>		
Fair or poor	35	35.36
Good	37	37.37
Very good or excellent	27	27.27
<b>Body mass index (BMI) (N = 97)</b>		
Healthy (<25)	23	23.71
Overweight (25–<30)	29	29.90
Obese (30+)	45	46.39
<b>Number of chronic conditions (N = 100)</b>		
0	6	6.00
1 or 2	50	50.00
3+	44	44.00

\*Totals in the table vary due to missing data.

and had relatively low incomes with 75% reporting an annual income <\$50,000. Thirty-five percent had an education level of high school degree or less, while 23% had a college or post-graduate degree. While 65% rated their health as very good, good, or better excellent, 76% were overweight or obese, and 94% had at least one chronic condition, with 44% having 3 or more. Sixty-three percent reported having hypertension, 25% COPD or asthma, 23% diabetes, and 9% heart disease.

TABLE 2 Dietary characteristics of the sample (N = 102).

	Median	IQR
Total protein (g)	60.38	45.71
Total fat (g)	50.95	31.09
Total carbohydrates (g)	196.93	125.39
	Average	SD
Total calories (kcal)	1,532.72	650.16
% calories from fat	31.85	7.43
% calories from saturated fat	9.51	2.85
Total healthy eating index (HEI) score	67.97	8.82
	#	%
<b>Healthy eating index (HEI) score</b>		
A (90–100)	0	0
B (80–89)	7	6.86
C (70–79)	42	41.18
D (60–69)	34	33.33
F (0–59)	19	18.63
<b>Total fruit HEI sub score</b>		
Meets guideline (5)	71	69.61
Does not meet guideline (<5)	31	30.39
<b>Whole fruit HEI sub score</b>		
Meets guideline (5)	80	78.43
Does not meet guideline (<5)	22	21.57
<b>Vegetable HEI sub score</b>		
Meets guideline (5)	40	39.22
Does not meet guideline (<5)	62	60.78
<b>Food insecurity</b>		
Food secure (0)	71	69.61
Food insecure (1–6)	31	30.39
<b>The fresh fruits and vegetables in my neighborhood are of high quality</b>		
Disagree (<3)	16	15.84
Neutral (3)	15	14.85
Agree (>3)	70	69.31
<b>A large selection of fresh fruits and vegetables is available in my neighborhood</b>		
Disagree (<3)	16	15.84
Neutral (3)	11	10.89
Agree (>3)	74	73.27
<b>A large selection of low-fat products is available in my neighborhood</b>		
Disagree (<3)	17	16.83
Neutral (3)	15	14.85

(Continued)

TABLE 2 (Continued)

	#	%
Agree (>3)	69	68.32
Average food environment score		
Disagree (<3)	17	16.83
Neutral (3)	9	8.91
Agree (>3)	75	74.26

## 3.2. Characteristics of participant diets

Participants consumed an estimated average ( $\pm$ SD) of 1,533 ( $\pm$ 650) calories per day (Table 2). Approximately 32% ( $\pm$ 7%) of calories came from fat, with 10% ( $\pm$ 3%) from saturated fat. Medians (inter-quartile range) for consumption of proteins, fats, and carbohydrates were 60 (46), 51 (31), and 197 (125) grams, respectively. The average total HEI score was 68, which would earn a “D” by suggested USDA grading criteria (Table 2). Only 7% of participants had a total HEI score that would earn an “A” or “B”. Based on HEI component sub scores, most participants met the guidelines for total fruit (70%) and whole fruit (78%) consumption, while 39% met the guidelines for vegetable consumption. Most participants (70%) were food secure, but 30% had some level of food insecurity. Food environment was generally favorable. The majority of participants agreed with the statements about their neighborhood: the fresh fruits and vegetables were of high quality (69%); a large selection of fresh fruits and vegetables were available (73%); and a large selection of low-fat products were available (68%).

## 3.3. Associations between diet quality and food access (food environment and food insecurity)

### 3.3.1. Bivariate analyses

Food insecurity was significantly associated with total HEI ( $p = 0.0052$ ) and with the total and whole fruit HEI sub scores ( $p = 0.0090$ ,  $p = 0.0240$ , respectively) (Table 3). However, food insecurity was not significantly associated with percent of calories consumed from fats, or vegetable HEI. There was no significant association between the food environment and total HEI, % of calories consumed from fats, fruit HEI, or vegetable HEI (Table 4).

### 3.3.2. Multi-variable analyses

After controlling for age, gender, education, living arrangement, physical health, BMI, and number of chronic conditions, we still found no significant associations between the food environment and total diet quality or diet quality components (Table 5). The significant association between food insecurity and total HEI ( $p = 0.048$ ), and the total fruit ( $p = 0.049$ ) and whole fruit HEI ( $p = 0.030$ ) sub scores persisted (Table 5). Of note, none of the controlled variables were significantly associated with total HEI, vegetables, or percent calories from saturated fats. Participants

who lived alone were significantly less likely to meet the guidelines for total fruits ( $p = 0.007$ ) and whole fruits ( $p = 0.018$ ). Compared to those with high school education or less, those with a college degree consumed significantly more calories from fat ( $p = 0.022$ ).

## 4. Discussion

Pre-pandemic studies found that older African Americans had poor overall diet quality and did not meet fruit, vegetable, and low-fat guidelines based on USDA recommendations (3, 7–9, 46–48). These findings are crucial because poor diet quality is associated with poor outcomes, including all-cause mortality (49–53). While studies on dietary habits during the COVID-19 pandemic have yielded mixed results (54–56), research specifically on older African Americans remain limited (57). Our study fills this gap by providing insights into the diet quality of older African Americans during the pandemic.

Our findings indicate that during the pandemic, older African Americans had poor diet quality. Specifically, the average total HEI score was 68, which would earn a “D” grade based on suggested USDA scoring. Only 7% of participants had a total HEI score that would earn an “A” or “B,” highlighting the pressing need for dietary improvements in this population. In contrast, over 60% of participants had fruit and vegetable scores that met the guidelines and received the maximum score of 5, which would earn an “A”. The Dietary Guidelines for Americans recommend that adults get 20–35% of their calories from fats and limit saturated fats to <10% of their caloric intake (58). While participants were close to the suggested limits for fat and saturated fat, with averages of 32.9% and 9.5% of calories coming from fat and saturated fat, respectively, they did meet the guidelines. Because the total HEI quality score is computed from all food sources, including fruits and vegetables, this finding suggests deficiencies in the other types of foods consumed.

Our findings underscore the complex and multifaceted determinants of dietary behavior during the pandemic. Our study focused on the impact of food insecurity and the food environment on diet quality. Building upon our previous work, which identified how attitudes toward COVID-19 influenced diet quality in underserved older African Americans (59), the current study expands our understanding of associations between food insecurity, the food environment, and diet quality in this vulnerable population during the pandemic.

### 4.1. Diet quality and food insecurity

Before the COVID-19 pandemic, food insecurity was already more prevalent among African Americans and had been linked to poorer diet quality (12, 19, 20). The pandemic further exacerbated this issue, with widespread reports of food insecurity among older adults, and particularly impacting racial/ethnic minority groups (28, 29, 60, 61). Dubowitz et al. (28) examined the impact of COVID-19 shutdowns on food insecurity among predominantly African American adults living in an under-resourced community. They found that despite steady declines since 2011, food insecurity increased from 21% in 2018 to 36% in 2020 and skyrocketed to 80%

TABLE 3 Bivariate associations between food insecurity and diet quality (*N* = 102).

Diet quality	Food insecurity				
	Food secure		Food insecure		<i>p</i> -value
	mean	SD	mean	SD	
Total healthy eating index (HEI)	69.57	7.77	64.32	10.05	0.0052*
Percent calories from saturated fat	31.85	7.58	31.86	7.20	0.9953
Percent calories from fat	9.22	2.72	10.18	3.08	0.1204
	#	%	#	%	<i>p</i> -value
<b>Total fruit HEI sub score<sup>#</sup></b>					0.0090*
Meets guideline (5)	55	77.46	16	51.61	
Does not meet guideline (<5)	16	22.54	15	48.39	
<b>Whole fruit HEI sub score</b>					0.0240*
Meets guideline (5)	60	84.51	20	64.52	
Does not meet guideline (<5)	11	15.49	11	35.48	
<b>Vegetable HEI sub score</b>					0.3416
Meets guideline (5)	30	42.25	10	32.26	
Does not meet guidelines (<5)	41	57.75	21	67.74	

<sup>#</sup>Whole fruits + juice.

\**p* < 0.05.

TABLE 4 Bivariate associations between food environment and diet quality (*N* = 101).

Agreement with availability and quality of food environment (average score)				
Diet quality	Disagree	Neutral	Agree	<i>p</i> -value
	Mean ± SD	Mean ± SD	Mean ± SD	
Total healthy eating index (HEI)	68.2 ± 8.1	65.5 ± 10.9	70.3 ± 9.7	0.3258
Percent calories from fat	9.5 ± 2.7	10.4 ± 2.9	8.5 ± 3.4	0.2128
Percent calories from saturated fat	31.7 ± 6.8	34.0 ± 7.9	30.0 ± 9.9	0.3397
	Number (%)	Number (%)	Number (%)	<i>p</i> -value
<b>Total fruit HEI sub score<sup>#</sup></b>				0.8107
Meets guideline (5)	10 (62.5)	10 (71.4)	50 (70.4)	
Does not meet guideline (<5)	6 (37.5)	4 (28.6)	21 (29.6)	
<b>Whole fruit HEI sub score</b>				0.9436
Meets guideline (5)	12 (75.0)	11 (78.6)	56 (78.9)	
Does not meet guideline (<5)	4 (25.0)	3 (21.4)	15 (21.1)	
<b>Vegetable HEI sub score</b>				0.3611
Meets guideline (5)	4 (25.0)	7 (50.0)	28 (39.4)	
Does not meet guideline (<5)	12 (75.0)	7 (50.0)	43 (60.6)	

<sup>#</sup> Whole fruits + juice.

due to the pandemic. This heightened level of food insecurity is a critical concern, as previous research has associated food insecurity with chronic disease (3, 21, 62–65).

In previous studies, food insecurity was found to be associated with lower consumption of fruits and vegetables and recommended nutrients, as well as a higher likelihood of consuming a high-fat, and high-calorie diet (11, 14, 23, 66–69). However, our study found that food insecurity was specifically associated with lower

consumption of whole and total fruits, but not vegetable or fat consumption. The observed association between food insecurity and reduced consumption of whole fruits underscores the necessity for focused interventions to enhance access to these nutritious options, which offer the added benefit of high fiber content. Moreover, our study revealed that fewer older African Americans met the guidelines for vegetable consumption compared to those meeting the guidelines for fruits, emphasizing the significance of

TABLE 5 Multivariable<sup>†</sup> associations between food insecurity and food environment and diet quality: linear and logistic regressions (N = 85).

	Diet quality																	
	Total HEI			Total fruits <sup>#</sup>			Whole fruits			Vegetables			% calories from fat			% calories from saturated fat		
	B (SE)	p		AOR (95% CI)	p		AOR (95% CI)	p		AOR (95% CI)	p		B (SE)	p		B (SE)	p	
Food insecurity																		
Secure	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Insecure	−4.18 (2.08)	0.048*		0.31 (0.10–0.99)	0.049*		0.22 (0.05–0.86)	0.030*		0.73 (0.23–2.29)	0.592		0.98 (0.67)	0.148		−0.33 (1.74)	0.849	
Food environment (agreement that food environment is good)																		
Agree	Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref		Ref	
Neutral	0.97 (3.06)	0.753		0.34 (0.06–2.00)	0.234		0.37 (0.05–2.71)	0.329		0.79 (0.15–4.12)	0.783		−1.28 (0.98)	0.197		−1.50 (2.55)	0.558	
Disagree	1.74 (2.75)	0.530		1.03 (0.21–5.17)	0.969		0.99 (0.15–6.41)	0.994		0.82 (0.18–3.79)	0.799		0.08 (0.88)	0.930		2.12 (2.29)	0.359	

\*P &lt; 0.05.

<sup>#</sup>Whole fruits + juice.<sup>†</sup>Controlling for age, gender, education, living arrangement, physical health, Body Mass Index (BMI), and number of chronic conditions. None of the controlled variables were statistically associated with Total HEI, Vegetables; and % calories from saturated fats. Living arrangement (living alone) was negatively associated with Total Fruits (p = 0.007) and Whole Fruits (p = 0.018). Education was positively associated with Calories from fat (p = 0.022).

HEI, Healthy Eating Index.

B, Beta Coefficient.

SE, Standard Error.

Ref, Reference.

interventions targeting vegetable intake as well. Although our study did not find a significant association between food insecurity and vegetable or low-fat food consumption, we interpret this result with caution due to our smaller sample size. Indeed, the lack of association might also be attributed to the lower efforts to meet overall dietary guidelines.

Overall, these findings underscore the critical importance of addressing food insecurity and improving access to nutritious foods, especially fruits and vegetables, to enhance the diet quality and overall health outcomes for older African Americans.

## 4.2. Diet quality and the food environment

In addition to the high prevalence of food insecurity, African Americans were already facing other challenges that contributed to poor diet quality before the pandemic, such as a lack of access to healthy food options, including fruits, vegetables and low-fat options (15, 24, 70). A study conducted by Zenk et al. (70) found that older African Americans had limited access to supermarkets and grocery stores that offer fresh and healthy food options, leading to what has been termed as “food deserts”. Interestingly, in our study, the availability or absence of healthy foods in the neighborhood did not impact the diet quality of our participants. It is worth noting that during the pandemic, local government initiatives such as the Senior Meal Emergency Response Program were put in place to increase access to food. Such efforts may have impacted participants’ perceptions of food availability. However, we did not assess individuals’ participation in these programs.

Our findings suggest that the mere availability of food and/or high quality foods in the neighborhood does not translate to healthy diets. This finding is consistent with previous literature (71, 72). The consumption of healthy diets is influenced by additional factors such as cost, skills, and availability of food preparation time, and transportation (11, 71, 73). A systematic review of the contribution of food prices on diet quality found that foods of lower nutritional value and lower-quality diets were generally more affordable per calorie and tended to be selected by groups of lower socioeconomic status (11). Furthermore, numerous other factors can hinder the consumption of healthy diets. In a qualitative study, African American adults noted that barriers to healthy eating included a perception of departing from the cultural heritage, lack of support from family and friends, lack of information, and preferences for the taste of foods considered unhealthy (74). Additionally, older African Americans managing hypertension reported challenges sorting through dietary advice from different sources and implementing dietary changes that would support multiple chronic conditions (75).

Addressing the complexities of the dietary behaviors of older African Americans requires a comprehensive approach that considers various factors, including affordability, accessibility, cultural influences, and social support. By understanding these multifaceted barriers, we can design targeted interventions to foster healthier dietary behaviors and improve overall health outcomes within this vulnerable population.

### 4.3. Influence of the pandemic

Restrictions during the pandemic caused disruptions in the food supply chain, reduced workforce, and shopping limitations, which affected the availability and affordability of healthy food options in some neighborhoods (76–81). Economic instability caused by the pandemic increased the risk of food insecurity for many households, which was especially pronounced in communities of color that already face higher rates of food insecurity and limited access to healthy food options due to systemic inequities and structural racism (30).

Older adults were particularly affected by the pandemic's restrictions, facing challenges in grocery shopping and limited access to fresh and nutritious foods. As a result, reliance on pre-packaged meals, often high in unhealthy ingredients, increased due to their longer shelf-life (78, 79). For older African Americans, who are more likely to live in food deserts and have limited access to healthy and affordable food options, the closure of senior centers and other community sites that provide free or reduced-price meals contributed to food insecurity. Furthermore, in the thick of the pandemic, reliance on food delivery put older African Americans at a disadvantage as they are less likely to have access to reliable internet, technology equipment and skills to make this possible (77, 82).

A systematic review by Trude et. al. (77) highlighted the barriers and facilitators of access to healthy food in low-income households during the COVID-19 pandemic. The primary barriers to equitable access were cost and limited availability of online grocery opportunities in food deserts. Although the perception of lack of control in food selection discouraged online grocery shopping, convenience and lower perceived stress were reported as benefits. However, older adults who lacked access to online grocery shopping during the extreme period of the pandemic shopped less frequently and/or relied on others to shop for them (78).

Our study shows that the diet of underserved older African Americans was far from optimal during the thick of the COVID-19 pandemic despite meeting some diet quality indices. Given the established link between poor overall diet quality and chronic disease (2, 3), this is particularly important in our cohort, which had a noteworthy prevalence of overweight or obesity (76%), hypertension (63%), COPD or asthma (25%), diabetes (23%) and heart disease (9%).

### 4.4. Limitations and strengths

Although our participants met the requirement for total fruit and total vegetable consumption, this was not enough to improve their overall diet quality. Additionally, the neighborhood availability of healthy fruits, vegetables, and low-fat products did not impact their overall diet quality. These findings should be interpreted with caution as the individual, community, and national responses to support older adults temporarily during the pandemic were not considered in this study. Additionally, our smaller sample size and convenience sample may limit generalizability. There is also a possibility of recall bias due to the self-reporting of the variables. Despite these limitations, a strength of our study is that it illuminates the comprehensive dietary quality

in older African Americans, a marginalized and understudied population. Additionally, our study used validated, standardized questionnaires and a detailed dietary intake methodology. Our study emphasizes the need for further investigations into the influence of access to healthy food on diet quality post-pandemic. As one of the few studies focusing on this population, our results have implications for future interventions targeting diet quality in underserved older African Americans.

## 5. Conclusion

Factors associated with suboptimal diets in older African Americans during the COVID-19 pandemic are complex and multifaceted, encompassing both individual and environmental influences. Our research contributes valuable insights into the dietary challenges faced by this vulnerable population, highlighting the need for targeted interventions addressing access, affordability, and education on healthy food choices. As we navigate the post-pandemic era, it is imperative to recognize the importance of promoting equitable access to nutritious food options, particularly for older African Americans who are disproportionately affected by food insecurity and limited access to healthy foods.

Future research should further investigate the influence of individual and environmental factors on dietary quality among underserved older African Americans, considering broader support systems and societal responses. By understanding these multifaceted determinants, we can develop more effective strategies to improve diet quality, enhance health outcomes, and promote overall wellbeing within this vulnerable population. Addressing these disparities will require a comprehensive and collaborative approach involving policymakers, community organizations, healthcare providers, and other stakeholders.

## Data availability statement

The datasets presented in this article are not publicly available as they are still in progress. Queries and requests to access the finalized datasets should be directed to [lucykibe@cdrewu.edu](mailto:lucykibe@cdrewu.edu).

## Ethics statement

This study was approved by the Institutional Review Board of Charles R. Drew University of Medicine and Science. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

LK: Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing—original draft, Writing—review & editing. KS: Conceptualization, Data curation, Formal analysis, Methodology, Validation, Visualization, Writing—original draft, Writing—review & editing. MB: Methodology, Supervision, Writing—review & editing. MS:



Conceptualization, Data curation, Supervision, Validation, Writing—review & editing.

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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.

One of the authors declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

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# Leadership in healthcare during a pandemic: for a systems leadership approach

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## KEYWORDS

leadership, social determinants of health, pandemic, systems approach, public health

## 1 Introduction

During the COVID-19 pandemic, it became clear that the need for leadership and leadership development is more important than ever. The leadership and policy failures during the COVID-19 pandemic are estimated at \$125–200 billion in incremental costs to annual health care expenditures in United States alone (1). There have been several pandemics in the past 20 years and it is essential that these leadership failures are addressed for future pandemics (2). On September 19, 2023, the United Nations unanimously adopted the Political Declaration on Pandemic Prevention, Preparedness, and Response (PPPR), affirming that pandemics call for timely, urgent, and continued leadership (3). According to the World Health Organization, leadership and governance are two of the six building blocks of health systems. The other building blocks are service delivery, health workforce, health information, medical technologies, and health financing (4).

The concept of leadership has been under scrutiny for many years, moving from a leader-centric to a people-oriented approach. Crisis leadership is one such a leader-centric approach. Crisis leadership in various pandemic situations, as per Sriharan et al.'s review, entails performing tasks such as preparation, planning, communication and collaboration (1). Healthcare leaders are responsible for identifying the crisis early, developing emergency preparedness protocols, monitoring crises, implementing protocols, allocating resources, and developing contingency plans (1). They are expected to provide empathy and awareness, inspire and influence decision-making, provide systems thinking and sense-making, develop tacit skills, and build political collaboration (1). Although these are sensible traits to develop in healthcare leaders, leadership studies have moved beyond simply a laundry list of amiable traits toward a systems thinking approach.

### 1.1 Discussion: a systems leadership and critical theory approach

Public healthcare systems require a systems leadership approach (5, 6). A systems leadership approach entails acknowledging that healthcare systems are complex (5, 6). The complexity of healthcare systems lies in the constant interplay between people, culture, economics, and the healthcare infrastructure. People are central to healthcare systems and are thus the drivers of the system (4). Their agency, mindsets and power discourses are thus driving factors within this system (5). A systems leadership approach differs from older concepts of leadership in that it goes beyond organizational and professional boundaries in order to address “wicked problems.” (7). It is a collective approach, meaning many people working at different levels and in different places, crossing boundaries (7).



A systems leadership approach is especially practical within the African context. This was echoed at the 3rd International Conference on Public Health in Africa that took place at Mulungushi International Conference Center, Lusaka, Zambia, from November 27–30, 2023. Ambassador Lewis Brown, a former Minister of Information, Cultural Affairs, and Tourism in Liberia, delivered his keynote speech, “*Transformative Leadership for Health in Africa*”, emphasizing that Africa simply cannot, should not, and will not let others do what they must do for themselves, they must seek solutions for Africans by Africans and develop a continental strategy. Constructing public health institutions to address Africa’s leadership in health diplomacy should be prioritized. It was acknowledged that the size of the public healthcare challenge in Africa is not to be underestimated. For example, 94% of cases of malaria worldwide are in the WHO African region. (8) Another 12.7 million children in Africa missed out on one or more vaccinations in the past 3 years (9). Furthermore, it is expected that in Southern Africa people over the age of 60 will triple between 2020 and 2050. Ambassador Brown emphasized the importance of maximizing technologies, scaling up, investing in human capital and capacity building, supporting community healthcare workers, preparing for the changing landscape of climate migration, and using evidence-based approaches. He asked the audience to imagine what the future of health would look like and who would be waving the public health flag in the future. He emphasized that public health systems should not wait for patients to come to them but that they must go to them. He said that one of the biggest priorities should be shaping political reforms that are able to prioritize the equitable allocation of resources. He urged people to not have a negative connotation for politics, stating that public health must become an inclusive culture and not a disconnected refuge for scientists. People should feel taken care of from the cradle to the grave. To accomplish all of this, he said that it is of utmost importance to strengthen without compromising African agency as well as leadership and accountability. He envisions a new public health order whereby leadership will mean renewing Africa’s position as secure in healthcare politics and encouraging other global bodies to do the same. He ended by stating that the time for this is now, as many lives, including all the lives in this room, depend on it.

This definition of leadership aptly sums up a systems leadership approach:

“Leadership is a social process of influence – there are things people can do to enhance specific skills and their ability to cope with situations but the processes and outcomes of leadership remain socially embedded – the result of a complex interaction between a multitude of factors. Thus who becomes a leader how they behave, and what they do are all determined by social and cultural factors as by any individual characteristics – Church, Hitler, Stalin, Gandhi and King were all products of their time, place and culture” (10).

Cultural factors, political factors, and structural factors play a role in shaping leadership competencies; however, due to the complexity of health systems, no causal relationships are established (1). For future pandemic preparedness, cultural, political, and structural factors need to be accounted for. According to Sriharan et al., cultural factors have to do with the way in which people communicate, collaborate, build relationships, and make

decisions (1). They found that improved trust between leaders and stakeholders improved collaboration. Improved collaboration can be achieved through transparent communication (1). Gender roles also form part of the cultural context of leadership, which is ultimately formed by social norms and plays an important role too. Political factors include power dynamics among various levels of governance and the leader’s ability to influence resource allocation (1). Distrust was also featured as a major stumbling block by means of public trust in communications by public health care leaders (1). Structural factors such as lack of team cohesiveness and centralized control delaying decision-making were also influential (1). Cultural, political, and structural factors should thus be addressed by better training to prepare the workforce (1). An example of this is the Albert Luthuli Leadership Platform for Health, situated at the University of Pretoria, which aims to reimagine health leadership by offering courses in global health leadership.

Ultimately, healthcare systems are an intersection between systems and the lifeworlds of people living within these systems. The theory of lifeworld and systems, can be attributed to Habermas’ communicative action and discourse ethics theories, which stemmed from the development of critical theory. Critical theory emerged during the enlightenment period. It is a socio-philosophical school of thought. Critical theory aims to “analyze social conditions, to criticize the unjustified use of power, and to change established social traditions and institutions so that human beings are freed from dependency, subordination, and suppression. Critical theory is oriented toward the development of a more humane, rational, and just society” (11). Habermas in the 1950s contributed significantly to this approach. In his Theory of Communicative Action, he refers to the work of Parsons, Weber, and Schutz, distinguishing between lifeworld and system (11). Lifeworld is the social world that is based on the taken-for-granted social skills and knowledge of members within the lifeworld (11). It is constructed and maintained through interactions and conversations between ordinary people, thereby building on communicative reason in order to establish a shared understanding of the world as a meaningful place (11). Whereas, system, is the result of differentiation and specialization in modern society (11).

## 1.2 Discussion: example of a systems leadership thinking approach in the South African public healthcare context

During the COVID-19 pandemic in South Africa, forensic pathologists reportedly saw many forgotten populations suffering in the form of being isolated and unable to access necessary medical care. In a global aging population, South Africa has the fastest-growing older adult community, where 8.1% of population is more than 60 years old (12). The Older Persons Act 13 was adopted in 2006 and aims to deal effectively with the plight of older persons by establishing a framework aimed at the empowerment and protection of older persons and at the promotion and maintenance of their status, rights, wellbeing, safety, and security. In terms of family law, an older person is the person who, in the case of a



male, is 65 years of age or older and, in the case of a female, is 60 years of age or older. An abuse of an older person occurs when any person, in a relationship where there is an expectation of trust, does something or fails to do something that causes harm or distress or is likely to cause harm or distress to an older person.

In 2021, President Cyril Ramaphosa was appointed by the African Union Bureau of Assembly of Heads of States and Government as its champion on COVID-19, establishing the African COVID-19 Response (13). His approaches included developing an endorsed continental strategy for the COVID-19 outbreak, establishing the Africa Task Force for Coronavirus, developing and establishing the African Medical Supplies Platform, establishing the COVID-19 African Vaccine Acquisition Task Team to secure financing for and acquire vaccines, coordinating communications and contributions across the continent on COVID-19 matters (13).

There are mixed responses regarding whether Cyril Ramaphosa's leadership approach was good or bad; this can be based on biases and perceptions. Leadership scholarship studies differentiate between leadership development and unpacking the phenomenon of leadership. In a world where we easily call out a good or bad leader, critical leadership scholarly studies are necessary to help guide our perceptions and evaluations. This is especially important in these times. The social determinants of health and a global aging population have indicated that the world we live in is increasingly complex. We therefore need understanding and approaches that consider this complexity without complicating things.

## 2 Practical steps toward a systems leadership approach

Six practical points have been identified by Bigland et al. that may aid South Africa and other countries in future systems leadership approaches (6). First is a call to develop a call to action for gathering a "coalition of the willing". A coalition of the willing includes a wide variety of people, including the actual population. Second, there is a need for a dedicated system coordinator role; this enables efficient decision-making. Third, relationship building by incorporating trust and sharing vulnerabilities should be incorporated. Fourth, building resilient systems by being flexible and adapting behaviors to the context needs to be prioritized. Fifth, being able to hold space for paradoxes around power, uncertainty and conflict within the systems is critical. These paradoxes should not be seen as something to overcome but as something to be worked with constructively and dynamically to drive meaningful

action and progress. This means that issues need to be recognized and that leaders need to be trained to work with confidence in spaces of uncertainty. Lastly, the ways in which the effectiveness of systems is measured should be widened to include a wider diversity of experiences. For example, a sense of pleasure and shared endeavor among colleagues should be highly valued.

Pandemic preparedness will surely remain essential in the coming years, and a systems leadership approach may prove invaluable in ensuring that the leadership failures of the past are not repeated. A "coalition of willing", people who are willing to work toward more just and equitable systems are what may make the difference, as we aim to fly the public health flag for all into a future where more people are able to flourish and lead meaningful lives. Questioning the dominant discourses and power structures within these systems is also essential if we are to truly build resilient systems.

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# Racial disparities and socioeconomic factors associated with post-acute rehabilitation facility utilization among Nevadans with Alzheimer's disease and related disorders and extremity fractures: insights of age-friendly and dementia-friendly state planning in U.S.

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**Background:** Falls and extremity fractures often occur in people living with Alzheimer's disease and related disorders (ADRD). In post-fracture care, these patients are cared for either at rehabilitation facilities or their homes. The coronavirus disease 2019 (COVID-19) pandemic limited the utilization of rehabilitation facilities. In areas with provider shortages, this trend poses a risk of disability and caregiver burdens, particularly in racial minorities who under-utilize rehabilitation facilities.

**Objective:** To assess racial disparities in post-acute care (PAC) at rehabilitation facilities among people living with ADRD and extremity fractures during the COVID-19 pandemic.

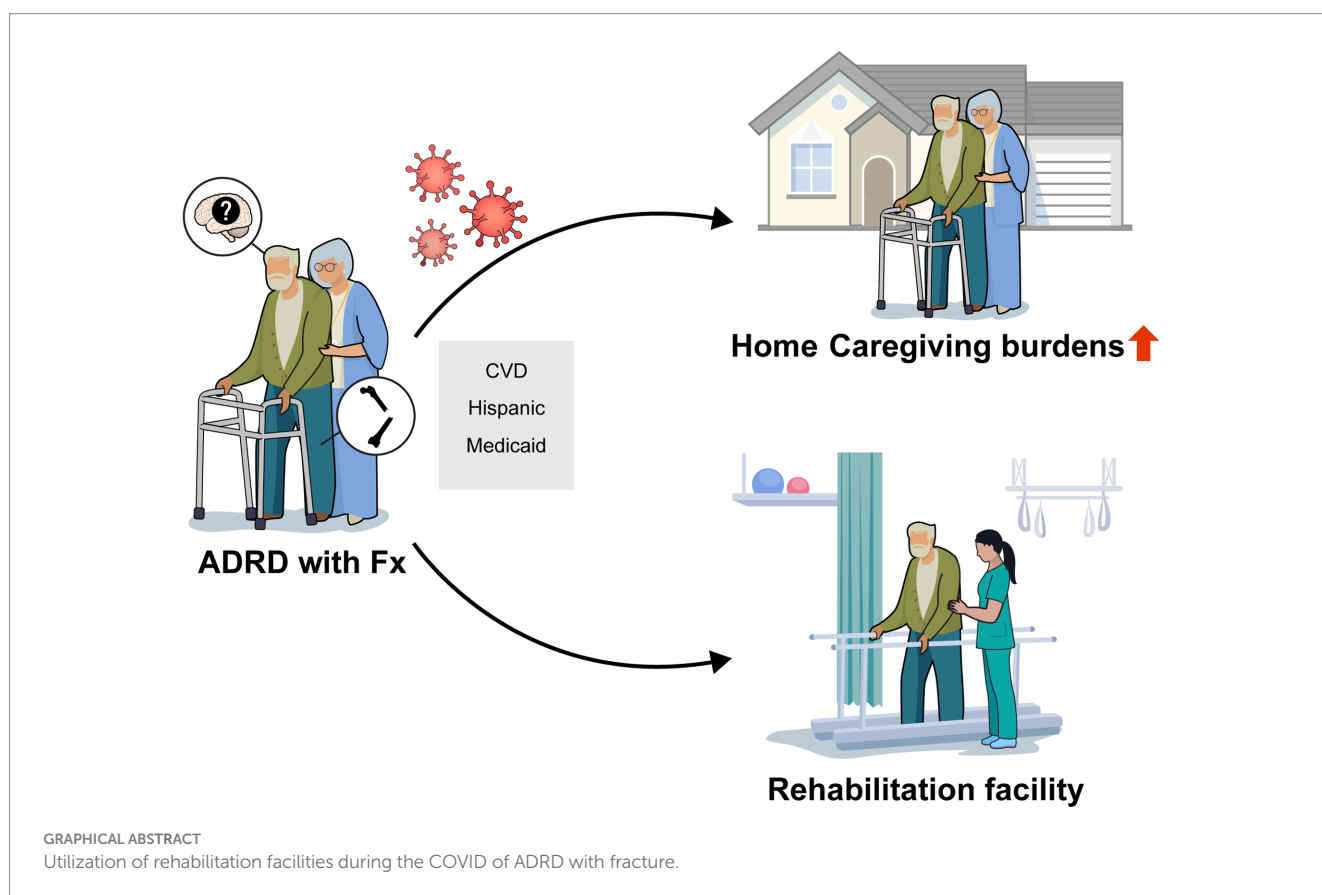
**Methods:** We summarized the PAC locations by (1) rehabilitation facilities (skilled nursing facilities and inpatient rehabilitation facilities) and (2) homes (homes with self-care and homes with services) for each study year. We observed the yearly percentage trends in PAC at rehabilitation facilities over the total post-acute discharge period. We assessed demographics (age, sex, and race), clinical comorbidities (fracture sites), utilization factors (pay source and hospital location), and COVID-19 pandemic status (pre-/post-pandemic years). We used multivariate logistic regression to estimate the association between these factors and PAC in the rehabilitation facilities.

**Results:** The proportion of individuals receiving PAC declined in rehabilitation facilities, whereas the proportion of individuals receiving PAC at home with services continuously increased. Being Hispanic, presence of cerebrovascular disorder (CVD), use of Medicaid services, and the COVID-19 pandemic were associated with lower probabilities of utilizing rehabilitation facilities.

**Conclusion:** Among the individuals with ADRD and extremity fractures, the proportion of those who underutilized rehabilitation facilities was higher in Hispanics compared with other races. Caregiving for Hispanics, presence of CVD, and use of Medicaid services were associated with the risk of disability and caregiver burden, due to shifting trends from rehabilitation facilities to homes with services. Geriatric workforce education should be prioritized to enhance the competencies of healthcare providers serving these individuals to relieve caregiver burdens in areas with provider shortage.

#### KEYWORDS

Alzheimer's disease, age-friendly, dementia-friendly, fracture, health disparity, post-acute care, rehabilitation facilities



## 1 Introduction

More than 6 million people are living with Alzheimer's disease and related disorders (ADRD) in the United States (US) (1). In the recent Agency for Healthcare Research and Quality systematic review, the overwhelming majority were disconnected from the delivery of system care for ADRD, which then led to low-value care with high burdens of healthcare and societal costs (2). The estimated annual cost of Medicare beneficiaries with ADRD (USD 43,644) was approximately three times

the cost of those without ADRD (USD 14,660) in 2023 (1). People living with ADRD have been reported to be at high risks of falls, fractures, disability, and long-term facility stay, compared with those without ADRD (3). Living with ADRD increases post-acute care (PAC) requirements for recovering from extremity fractures because of the difficulty in following rehabilitation and precaution instructions related to communication challenges and behavioral symptoms (4–7). The coronavirus disease 2019 (COVID-19) pandemic has changed the delivery landscape of PAC utilization (8). Long-term care (LTC) and

skilled nursing facilities (SNFs) for Medicare beneficiaries have been associated with adverse health outcomes, such as increased mortality and limited logistics due to decreased transfer between acute care hospitals and SNFs (8). These trends may result in spillover effects, such as unpaid dementia caregiver's emotional distress and negative mental and physical health outcomes—monetary values triggered by the COVID-19 pandemic (1). These effects are expected in socially disadvantaged populations, such as Hispanics or Medicaid beneficiaries, who are known to underutilize SNFs for PAC, compared with non-Hispanic Whites or Medicare beneficiaries (9–12). The state of Nevada has the third fastest growing incidence rate of ADRD and the highest growing rate of ADRD-related health care expenditures in the U.S. (1). Similar to traditional provider shortage states sharing similar demographics (a population range of 3–5 million and larger surface area of rural areas), the State of Nevada had the fewest primary care providers *per capita* in the U.S. (13). Caregiving burdens in unpaid family members or other caregivers of people living with ADRD may be triggered when the extremity fracture recovery process occurs at home instead of an SNF in a provider shortage area, State of Nevada. Therefore, we aimed to evaluate racial disparities and socioeconomic factors associated with the PAC utilization at rehabilitation facilities among people with ADRD and extremity fractures in the State of Nevada. Thus, our examination provides the workforce education and policy-making insights of planning the establishment of an age-friendly and dementia-friendly state in a provider shortage area.

## 2 Materials and methods

### 2.1 Data source and study population

The publicly available State Inpatient Database (SID) was used. The SID contains more than 95% of the hospital discharge information from all community hospitals in the participating states. The SID was originally developed for the Healthcare Cost and Utilization Project (HCUP) by the Agency for Healthcare Research and Quality (14). The SID includes de-identified patient-level information on demographics, diagnostic and procedure codes, and discharge location (14). The Nevada SID files were constructed from hospital discharge files received from the University of Nevada, Las Vegas (UNLV) and the Center for Health Information Analysis (CHIA) under the authority of the Nevada Division of Healthcare Financing and Policy (14). The CHIA provided the HCUP with inpatient data from acute-care general, specialty, and rehabilitation hospitals in Nevada. The study period was from 2018 to 2021. The number of participating hospitals was 50, and the total number of discharged patients was approximately 360,000 annually. Among them, 24,532 patients aged 65 years or older were discharged from the hospital after being admitted for upper and lower extremity fractures. The number of patients with ADRD was 4,310. We identified extremity fractures and ADRD using the International Classification of Diseases, 10th revision, Clinical Modification (ICD-10-CM), as shown in [Supplementary Table 1](#) (15, 16).

### 2.2 Measured outcomes and variables

The measured outcome was PAC location after extremity fractures: rehabilitation facilities (SNFs and inpatient rehabilitation facilities) and homes (homes with self-care and homes with services) in each year of

the study. We excluded less than 1% of patients discharged, including those who used other intermediate care facilities and those who left against medical advice. We evaluated trends in PAC in rehabilitation facilities and homes over the total PAC discharge period. We measured patient-level characteristics including demographics (age, sex, and race), clinical factors (comorbidities and fracture locations), utilization factors (pay source and hospital location), and COVID-19 pandemic status (pre-/during pandemic years). Choice of the above comorbidities was relevant to previous literature related to either extremity fractures or discharge to PAC (3, 4, 6, 7, 10). Pre-COVID-19 was defined as the period from January 2018 to December 2019, and post-COVID-19 was defined as the period from January 2020 to December 2021. Age was divided into three categories: 65–74 years, 75–84 years, and  $\geq 85$  years. Race was classified as non-Hispanic White person or Black person; Hispanic; Asian, Hawaiian, and Pacific Islander (AHPI); and others. Pay sources were divided into four groups: Medicare, Medicaid, private insurance, and other insurance services and self-payments. “RL\_RUCC” variable contained a uniform code for hospital location and was divided into metro/urban (1–7) and rural (8, 9) areas (17). Rural–Urban Continuum Codes (RUCC) subdivides counties into 10 categories distinguished by population size in census-defined urbanized areas and by adjacency to metropolitan areas. To be adjacent, counties must be contiguous and have at least 2% of the resident labor force commuting to a central metropolitan county. A county-based system such as RUCC, which attempts to describe the diversity in settlement patterns in a relatively large area by a single number, may not provide an accurate depiction. However, because county boundaries do not change much, every county will be represented by a measure, even after an extended period of time. RUCC was developed in the U.S. Department of Agriculture's Economic Research Service, as a refinement of the Office of Management and Budget (OMB) Metropolitan Statistical Area (MSA) definition (17). Bone mineral disorder, cerebrovascular disease (CVD), and substance use disorder (SUD) were assessed as comorbidities of extremity fracture (3, 4, 6, 7, 10). Extremity fracture location was divided into upper and lower extremities. The codes for each condition were selected accordingly ([Supplementary Table 1](#)).

### 2.3 Statistical analysis

Bivariate analysis with Pearson's chi-square test was used to compare demographics, clinical factors, and utilization factors by race. Multivariate regression analysis was conducted to evaluate factors affecting PAC at rehabilitation facilities. Estimation was performed using odds ratios (OR) and the corresponding 95% confidence intervals (CIs). Analyses were adjusted for all covariates, and two-sided  $p < 0.05$  was considered statistically significant. Analyses were performed using the SAS software, version 9.4 (SAS Institute, Cary, NC, USA) (18). As the Nevada SID database provides administrative de-identified data, the requirement of Institutional Review Board approval and written informed consent was waived by the ethics committee of the UNLV (IRB no. 1098939-3).

## 3 Results

Non-Hispanic White persons had the highest proportion of male individuals, while AHPIs had the highest proportion of female individuals. Non-Hispanic White persons and Black persons had the



highest proportion of those who used Medicare (90%), while Hispanics had the highest proportion of those who used Medicaid. Private insurance was commonly reported among AHPIs. Regarding residential areas, the proportion of Black persons living in urban areas was the highest (approximately 96%), while the proportion of White persons living in rural areas was relatively high compared with other races. CVD rates were higher among Black persons than among other races. SUD was relatively lower in Hispanics and Asians, compared with White persons and Black persons (Table 1).

PAC at rehabilitation facilities decreased overall since the COVID-19 pandemic. The decrease was the greatest in non-Hispanics White persons (Figure 1 and Table 2). Table 3 presents regression results, predictors of PAC utilization at rehabilitation facilities by COVID-19 pandemic, demographics, and clinical and utilization factors. COVID pandemic was associated with lower probability of utilizing facilities as PAC locations (OR 0.771, 95% CI 0.668 to 0.890,  $p < 0.001$ ). Approximately 43% fewer Hispanics than non-Hispanics

(White persons) were transferred to a PAC location ( $p = 0.002$ ). More patients with lower extremity fractures were transferred for PAC ( $p < 0.001$ ). The patients with CVD as a comorbidity were approximately 24% less likely to be transferred ( $p = 0.030$ ). Medicaid beneficiaries were approximately 60% less likely than private insurers to be transferred to a PAC location ( $p = 0.031$ ).

## 4 Discussion

A decline of more than 20% in the utilization rate of rehabilitation facilities during the COVID-19 pandemic was observed across all racial groups in our study. This trend has been observed in other studies on limiting SNF transition during the COVID-19 pandemic (19). Although the association was statistically marginal, the COVID-19 pandemic triggered the limitation of rehabilitation facility utilization by the AHPI populations. Traditionally, for example, Native Hawaiians have been

TABLE 1 Descriptive analysis of demographics, clinical factors, and utilization factors by race groups (N, %).

	Non-Hispanic Whites <i>n</i> = 3,403	Blacks <i>n</i> = 198	Hispanics <i>n</i> = 240	AHPI <i>n</i> = 190	Other races <i>n</i> = 279	<i>p</i> -value
<b>Demographics</b>						
Age (mean, standard deviation)	82.80 (6.68)	81.30 (7.18)	82.90 (6.32)	84.53 (5.60)	82.49 (7.30)	<b>&lt;0.05</b>
Gender						
Male ( <i>n</i> = 1,346)	1,101 (32.35)	54 (27.27)	60 (25.00)	39 (20.53)	92 (32.97)	<b>&lt;0.05</b>
Female ( <i>n</i> = 2,964)	2,302 (67.65)	144 (72.73)	180 (75.00)	151 (79.47)	187 (67.03)	
<b>Clinical factors</b>						
BMD ( <i>n</i> = 715)	546 (16.04)	30 (15.15)	53 (22.08)	35 (18.42)	51 (18.28)	0.12
CVD ( <i>n</i> = 311)	238 (6.99)	30 (15.15)	11 (4.58)	13 (6.84)	19 (6.81)	<b>&lt;0.05</b>
SUD ( <i>n</i> = 444)	372 (10.93)	22 (11.11)	11 (4.58)	8 (4.21)	31 (11.11)	<b>&lt;0.05</b>
<b>Utilization factors</b>						
Pay source						
Medicare ( <i>n</i> = 3,879)	3,084 (90.63)	179 (90.40)	206 (85.83)	164 (86.32)	246 (88.17)	<b>&lt;0.05</b>
Medicaid ( <i>n</i> = 27)	11 (0.32)	0 (0.00)	12 (5.00)	0 (0.00)	4 (1.43)	
Private ( <i>n</i> = 266)	197 (5.79)	11 (5.56)	15 (6.25)	19 (10.00)	24 (8.60)	
Other ( <i>n</i> = 138)	111 (3.26)	8 (4.04)	7 (2.92)	7 (3.68)	5 (1.79)	
Hospital location						
Metro/urban ( <i>n</i> = 3,548)	2,753 (80.90)	191 (96.46)	213 (88.75)	166 (87.37)	225 (80.65)	<b>&lt;0.05</b>
Rural ( <i>n</i> = 762)	650 (19.10)	7 (3.54)	27 (11.25)	24 (12.63)	54 (19.35)	
PAC locations						
Rehabilitation facilities						
SNF ( <i>n</i> = 2,104)	1730 (61.52)	84 (48.55)	94 (45.63)	80 (49.38)	116 (50.43)	<b>&lt;0.05</b>
IRF ( <i>n</i> = 536)	407 (14.47)	32 (18.50)	30 (14.56)	27 (16.67)	40 (17.39)	
Home						
Self-care ( <i>n</i> = 304)	229 (8.14)	18 (10.40)	23 (11.17)	15 (9.26)	19 (8.26)	
With services ( <i>n</i> = 639)	446 (15.86)	39 (22.54)	59 (28.64)	40 (24.69)	55 (23.91)	

AHPI, Asian, Hawaiian, Pacific Islanders; BMD, bone metabolic disorder; CVD, cerebrovascular disease; IRF, inpatient rehabilitation facilities; PAC, post-acute care; SNF, skilled nursing facilities; SUD, substance use disorder. Bolded *p*-value is statistically significant.

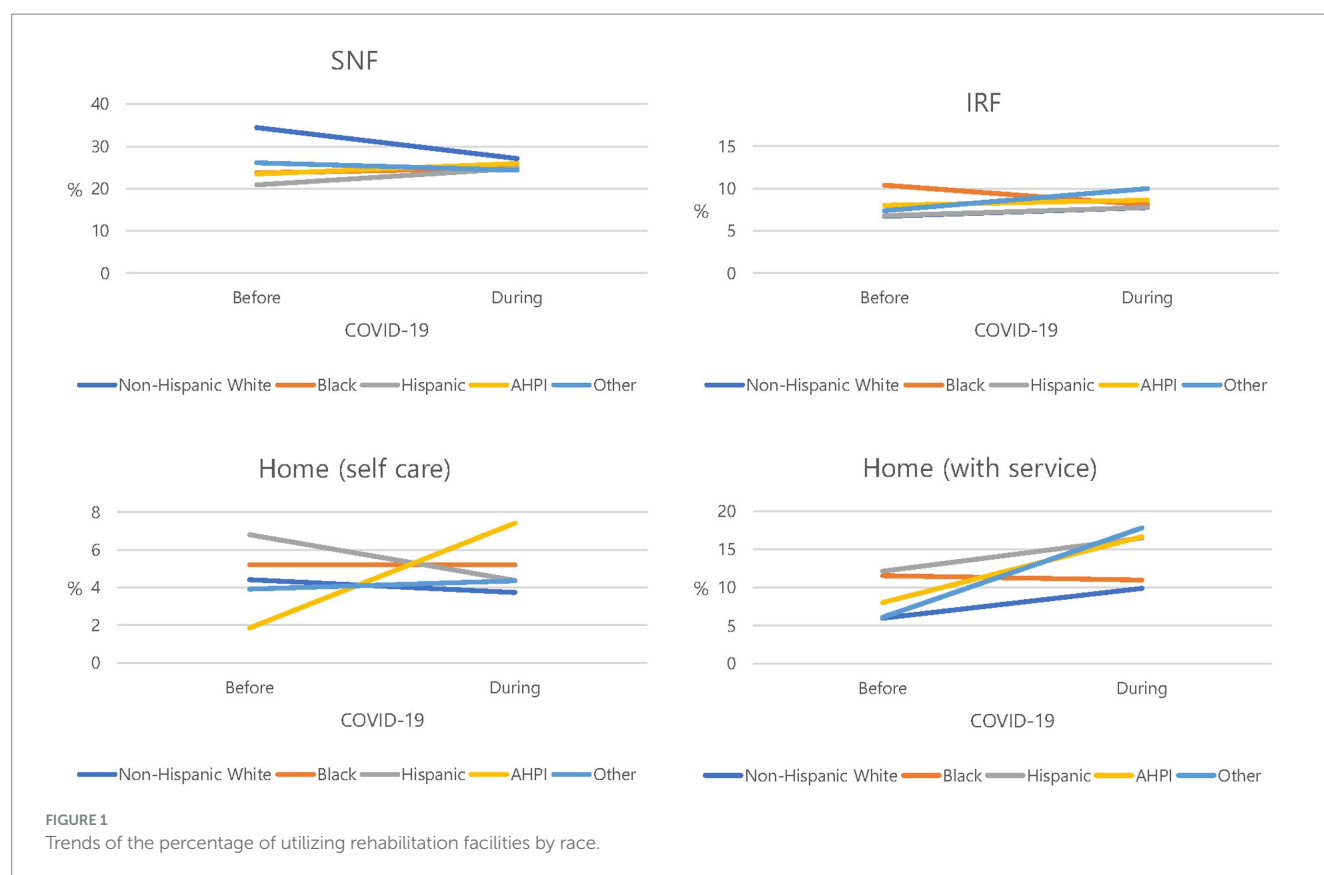


TABLE 2 Comparison of post-acute care locations before and during COVID-19 pandemic by race (N, %).

	Non-Hispanic Whites <i>n</i> = 3,403		Blacks <i>n</i> = 198		Hispanics <i>n</i> = 240		AHPI <i>n</i> = 190		Other races <i>n</i> = 279	
	Before	During	Before	During	Before	During	Before	During	Before	During
<b>PAC locations</b>										
Rehabilitation facilities										
SNF ( <i>n</i> = 2,104)	968 (34.42)	762 (27.10)	41 (23.70)	43 (24.86)	43 (20.87)	51 (24.76)	38 (23.46)	42 (25.93)	60 (26.09)	56 (24.35)
IRF ( <i>n</i> = 536)	189 (6.72)	218 (7.75)	18 (10.40)	14 (8.09)	14 (6.80)	16 (7.77)	13 (8.02)	14 (8.64)	17 (7.39)	23 (10.00)
Home										
Self-care ( <i>n</i> = 304)	124 (4.41)	105 (3.73)	9 (5.20)	9 (5.20)	14 (6.80)	9 (4.37)	3 (1.85)	12 (7.41)	9 (3.91)	10 (4.35)
With services ( <i>n</i> = 639)	168 (5.97)	278 (9.89)	20 (11.56)	19 (10.98)	25 (12.14)	34 (16.50)	13 (8.02)	27 (16.67)	14 (6.09)	41 (17.83)
<b>p-value</b>	<b>&lt;0.001</b>		0.914		0.506		0.118		<b>0.014</b>	

AHPI, Asian, Hawaiian, Pacific Islanders; IRF, inpatient rehabilitation facilities; PAC, post-acute care; SNF, skilled nursing facilities. Bolded *p*-value is statistically significant.

heavily relying on female caregivers and home-oriented caregiving from their cultural context of underutilizing facilities at PAC locations (20). Reports of racist and xenophobic incidents directed toward persons perceived to be of Asian descent, especially older adults, increased (21, 22). In our study, both being Hispanic and a Medicaid beneficiary played dual roles in the underutilization of rehabilitation facilities. Moreover,

Hispanics were more likely to be Medicaid beneficiaries compared to non-Hispanic white counterparts. This pattern has also been observed in other studies that assessed SNF utilization patterns (9–12, 23). A study has also revealed that Hispanics are less likely to have access to high-rated Medicare Advantage (MA) plans and are more likely to shift to either low-rate MA plans or Medicaid enrollment (24). Along with Hispanics'

TABLE 3 Predictors of post-acute care at rehabilitation facilities by COVID-19 pandemic, demographics, clinical, and utilization factors.

	Referent	95% confidence intervals			p-value
		Odds ratio	Lower limit	Upper limit	
<b>COVID pandemic (2020, 2021)</b> <b>n = 1,897</b>	Before COVID (2018, 2019) <i>n</i> = 2,413	0.771	0.668	0.890	<b>&lt;0.001</b>
<b>Demographics</b>					
Age	65–74 ( <i>n</i> = 1,749)				
75–84 ( <i>n</i> = 1,387)		1.153	0.927	1.434	0.234
85–90 ( <i>n</i> = 1,174)		0.982	0.796	1.211	0.801
Gender	Male ( <i>n</i> = 1,346)				
Female ( <i>n</i> = 2,964)		1.042	0.907	1.198	0.592
Race	Non-Hispanic Whites ( <i>n</i> = 3,403)				
Blacks ( <i>n</i> = 198)		0.771	0.507	1.174	0.275
<b>Hispanics (n = 240)</b>		0.575	0.384	0.859	<b>0.002</b>
AHPI ( <i>n</i> = 190)		0.982	0.602	1.601	0.097
Other races ( <i>n</i> = 279)		1.011	0.677	1.512	0.070
<b>Clinical factors</b>					
Fracture location					
Upper extremity ( <i>n</i> = 1,085)		1.065	0.722	1.576	0.524
<b>Lower extremity (n = 3,225)</b>		1.756	1.223	2.531	<b>&lt;0.001</b>
Comorbidity					
BMD ( <i>n</i> = 715)		0.965	0.813	1.146	0.674
<b>CVD (n = 311)</b>		0.761	0.598	0.968	<b>0.030</b>
SUD ( <i>n</i> = 444)		1.219	0.980	1.516	0.076
<b>Utilization factors</b>					
Pay source	Private ( <i>n</i> = 266)				
Medicare ( <i>n</i> = 3,879)		1.267	0.984	1.631	0.066
<b>Medicaid (n = 27)</b>		0.405	0.170	0.966	<b>0.031</b>
Other ( <i>n</i> = 138)		1.417	0.902	2.225	0.120
Hospital location	Metro/urban ( <i>n</i> = 3,548)				
Rural ( <i>n</i> = 762)		1.008	0.852	1.193	0.841

AHPI, Asian, Hawaiian, Pacific Islanders; BMD, bone metabolic disorder; CVD, cerebrovascular disease; IRE, inpatient rehabilitation facilities; PAC, post-acute care; SNF, skilled nursing facilities; SUD, substance use disorder. Bolded *p*-value is statistically significant.

strong family and social ties, Hispanics have been reported as their fewer financial resources account for disparity of rehabilitation facilities utilization (12, 25). However, the interpretation of this shift is largely unclear and requires further investigation.

In this study, the PAC transition rate was high among patients with lower-extremity fractures. This is because the part that has the most direct effect on activities of daily living is the lower extremity. Therefore, it is thought that patients with lower extremity fractures with functionally restricted movement will undergo more PAC transitions to rehabilitation facilities than to their homes. In addition, because the severity is likely to increase, PAC transition rates are expected to increase. Those with CVD underutilized rehabilitation facilities in this study. It is speculated that rehabilitation potential is lower when stroke and its sequelae add to the burden of extremity fractures. The burdens of managing both conditions increase the risk of disability and caregiver burden after discharge from the hospital. This finding highlights the importance of timely and

coordinated care, in this case, using a multifaceted and innovative home/community-based approach, such as the Guiding an Improved Dementia Experience (GUIDE) model (26). The innovative GUIDE model delivers on the Biden Administration's April 2023 Executive Order 14095 by advancing access equity of the underserved communities, racial and ethnic minorities' ADRD caregivers and enhancing equal access, especially, home and community-based care services (26). The number of beds in nursing homes, including LTC facilities and SNFs, in the US has decreased by approximately 25% over the past decade with the increase in the availability of home-and community-based services (27). This trend of decline in the number of nursing home beds has worsened since the beginning of the COVID-19 pandemic. However, the supply of these services still lags behind the demand (27). The lack of access to SNFs, particularly among racial and ethnic minorities and Medicaid beneficiaries, may lead to the need for more complex care in individuals at a greater risk of adverse outcomes, caregiving burdens related to

hospitalizations, and responsive increases in healthcare costs among people living with ADRD (1, 4). These findings highlight the importance of educating the geriatric healthcare workforce that serves socially disadvantaged populations, Hispanics, and Medicaid beneficiaries, to mitigate concentrated caregiving burdens (16). Cultural and linguistic sensitivity geriatric workforce training includes familism, language, literacy, older adult justice, and logistical barriers (28). Collaborative primary care for individuals with ADRD, Healthy Aging Brain Center, demonstrated improved care coordination and resulted in producing net savings by reducing unnecessary hospitalization and ED visits due to caregiver burdens (29). Adult day care center-based virtual training for low-income ADRD caregivers may enhance the capacity of coping skills of caring for those with limited physical function (30). By promoting coordination of care planning with ADRD caregivers, primary telehealth may avoid unnecessary hospitalizations or emergency department visits of ADRD individuals (31). The evidence-based Age-Friendly Health System frameworks, 4M (what matters, mobility, medication, and mentation), has been applied for training the geriatric healthcare workforce effectively, and it is locally adaptable, especially for racial and ethnic minority older adults in the State of Nevada (31–33). In addition, telehealth as primary care has been delivered to people living with ADRD in areas with provider shortages and has achieved more efficient care coordination by reducing healthcare costs by 20% (31). Planning strategies of establishing age-friendly and dementia-friendly states are prioritized to the workforce capacity enhancement and innovative access to care development (i.e., telehealth) that is more practical to accomplish rather than structural investment (i.e., increase of hospital beds) in a provider shortage area like the State of Nevada (32, 34). Our study has a great advantage in that a representative national database, the SID, was used. In addition, this is the first study to be conducted on PAC transition in patients with ADRD and fractures. However, this study has some limitations. First, the number of people living with ADRD may have been underreported in the SID. For example, the ADRD diagnosis rate is low in acute hospital care due to a lack of interoperability in outpatient care, and cognitive function screening has been under-implemented in provider shortage areas. Second, the ADRD degree was not determined; controlling for the ADRD degree may have helped to understand the dynamics of PAC transition after extremity fracture. An imbalance in the sample size of racial minorities may have influenced the statistical significance of rehabilitation facility utilization. Another limitation of this study was the lack of information on community resources and caregiver availability, limiting the interpretation of PAC location decisions. Therefore, our analysis is preliminary until additional, more representative data are analyzed to confirm our findings.

## 5 Conclusion

Among the individuals with ADRD and extremity fractures in this study, the rate of underutilization of rehabilitation facilities was higher among Hispanics than among people of other races. The COVID-19 pandemic limited the utilization of rehabilitation facilities by more than 20%. Caregiving for Hispanics, presence of CVD, and use of Medicaid services were associated with the risk of disability and caregiver burden, due to shifting trends from rehabilitation facilities to homes with services. Geriatric healthcare workforce education should be prioritized to enhance the competencies of healthcare providers serving these individuals, to relieve caregiver burdens in provider shortage areas.

## 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.

## Ethics statement

The studies involving humans were approved by the Ethics Committee of the University of Nevada, Las Vegas. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and institutional requirements.

## Author contributions

SO: Writing – original draft. JY: Conceptualization, Writing – review & editing. SC: Investigation, Writing – review & editing. CJ: Investigation, Writing – review & editing. DB: Investigation, Writing – review & editing. SM: Investigation, Writing – review & editing. LF: Investigation, Writing – review & editing. YK: Investigation, Supervision, Writing – review & editing. JS: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Supervision, Writing – review & editing.

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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.

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fpubh.2024.1322830/full#supplementary-material>

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