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# Impact on Medical Education and the Medical Student's Attitude, Practice, Mental Health, After One Year of the Covid-19 Pandemic in Indonesia

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**Introduction:** The COVID-19 pandemic has caused disruptions in educational institutions across the country, prompting medical schools to adopt online learning systems. This study aims to determine impact on medical education and the medical student's attitude, practice, mental health after 1 year of the Covid-19 pandemic in Indonesia.

**Methods:** This study utilized a cross-sectional design. An online questionnaire was distributed digitally to 49 medical schools in Indonesia from February–May 2021. A total of 7,949 medical students participated in this study. Sampling was carried out based on a purposive technique whose inclusion criteria were active college students. This research used questionnaires distributed in online version among 49 medical faculties that belong to The Association of Indonesian Private Medical Faculty. Instruments included demographic database, medical education status, experience with medical tele-education, ownership types of electronic devices, availability of technologies, programs of education methods, career plans, attitudes toward pandemic, and the mental health of respondents. Univariate and bivariate statistical analysis was conducted to determine the association of variables. All statistical analyses using (IBM) SPSS version 22.0.

**Results:** Most of the respondents were female (69.4%), the mean age was  $20.9 \pm 2.1$  years. More than half of the respondents (58.7%) reported that they have adequate skills in using digital devices. Most of them (74%) agreed that e-learning can be implemented in Indonesia. The infrastructure aspects that require attention are Internet access and the type of supporting devices. The pandemic also has an impact on the sustainability of the education program. It was found that 28.1% were experiencing financial problems, 2.1% postponed their education due to this problems. The delay of the education process was 32.6% and 47.5% delays in the clinical education phase. Around 4% student being sick, self-isolation and taking care sick family. the pandemic was found to affect students' interests and future career plans (34%). The majority of students (52.2%) are concerned that the pandemic will limit their opportunities to become specialists. Nearly 40% of respondents expressed anxiety symptoms about a variety of issues for several days. About a third of respondents feel sad, depressed, and hopeless for a few days.

**Conclusion:** The infrastructure and competency of its users are required for E-learning to be successful. The majority of medical students believe that e-learning can be adopted in Indonesia and that their capacity to use electronic devices is good. However, access to the internet remains a problem. On the other side, the pandemic has disrupted the education process and mental health, with fears of being infected with SARS-CoV-2, the loss of opportunities to apply for specialty training, and the potential for increased financial difficulties among medical students. Our findings can be used to assess the current educational process in medical schools and maximize e-learning as an alternative means of preparing doctors for the future.

**Keywords:** COVID-19, e-learning, Indonesia, medical education, students

## INTRODUCTION

The COVID-19 pandemic has significantly impacted all aspects of life, including education at the medical faculty (Alsoufi et al., 2020; Kelly et al., 2020; Kim et al., 2020). Before the Covid-19 pandemic, the learning system in Indonesia almost entirely used the physical meeting method, students and lecturers met face-to-face. This pandemic demands that all levels of education are expected to adopt a different education model than usual.

The emergence of integrated technology in education has forced us to adapt to the changing learning environment, the demands for flexibility in methodology, and the need to enhance creativity and innovation in learning (Onyema, 2019). One method to achieve those demands is through e-learning. To have an effective learning model, all parties must be prepared, including network internet connection providers, educational institutions as education providers, and students as service recipients.

Because Indonesia is an archipelagic country with a big population [Badan Pusat Statistik (BPS), 2019; Ministry of Health of Republic Indonesia, 2019], the pandemic's impact on medical education has been different in Indonesia than in other countries, resulting in unique conditions. This is due to the enormous number of medical faculties in various provinces and islands significant differences in infrastructure, internet connections, and human resources.

At the beginning of the pandemic, there have been many international publications on the impact of the pandemic on e-learning, attitude, practice, and mental health (Alsoufi et al., 2020; Duraku and Hoxha, 2020; Kecojevic et al., 2020; Kelly et al., 2020; Kim et al., 2020; Onyema et al., 2020; Maulana, 2021; Nishimura et al., 2021). Onyema et al. (2020) found various obstacles in implementing e-learning education, such as infrastructure problems (network access, electricity) and poor digital skills. Besides those factors, the pandemic has also impacted the mental and financial health of medical students. The study showed that students who have concerns about a shift toward online education have a higher chance of experiencing general anxiety and depression (Maulana, 2021; Nishimura et al., 2021). This is linked to academic difficulties such as a lack of attention and focus in lessons and learning during the pandemic, as well as students' ability to understand, and expertise in completing tasks that are typically shortened (Duraku and Hoxha, 2020; Kecojevic et al., 2020).

After a year, however, numerous quick changes occur, resulting in a new mindset and practice in the "new normal" situation. Because there has been no large-scale research involving multiple medical faculties in Indonesia on the impact of a pandemic, the findings of this study can help to enrich data used to describe situations 1 year following a pandemic. It is known that mental health problems are an issue for medical students (Alsoufi et al., 2020; Maulana, 2021; Nishimura et al., 2021), but it is also known that mental health conditions are influenced by pandemic triggers and previous social, economic, ethnic, and health conditions (Browning et al., 2021). So this research will provide an additional picture of the severity of the impact of mental health on students in Indonesia compared to other countries or cultures. This study can also indicate the state of the pandemic's impact on medical education in low- and middle-income countries, as well as provide feedback for the improvement of various stakeholders involved in medical education.

There are currently few studies in Indonesia that discuss the impact of the COVID-19 pandemic on the medical education program and medical student (Daroedono et al., 2020; Agiananda and Lukman, 2021). Study by Daroedono et al. (2020) shows that the inhibiting factor of online learning for medical students is the problem of unstable internet signal. Research conducted by Agiananda and Lukman (2021) shows that medical students and health workers are a vulnerable group to physical and psychological disorders during a pandemic. These studies, on the other hand, used a small number of subjects, had a limited number of research variables, and only included subjects from one medical faculty. With cross-institutional and province data, we hope to determine the severity of the pandemic's impact

on some of these factors, such as medical students' attitudes, practices, and mental health.

## MATERIALS AND METHODS

The study using a cross-sectional design; was conducted in February-May 2021. The goal of this study was to determine impact on medical education and the medical student's attitude, practice, mental health after 1 year of the Covid-19 pandemic in Indonesia. The total number of medical students in Indonesia is estimated at 62,500 (Medico-19 Research Group Fakultas Kedokteran Universitas Indonesia, 2021). Sampling was carried out using a purposive technique with a target respondent of 10,000 students.

This research used questionnaires distributed in online version using Google form among 49 medical faculties that belong to The Association of Indonesian Private Medical Faculty. The Google form questionnaire was distributed through the coordinators of each medical school. Subsequently, the coordinators disseminated information to students through short messages, WhatsApp, or private emails. The author created the questionnaire without asking for respondents' identities to ensure data confidentiality. All participants who filled out the questionnaire were considered to have agreed to participate in the study, as stated in the research informed consent section of the Google Form. Ethical approval was obtained from the Ethics Committee at Atma Jaya Catholic University of Indonesia (No. 14/06/KEP-FKIKUJ/2021). Informed consent was obtained from all respondents.

This study uses questions utilized in the study of Alsoufi et al. (2020) with modifications, translation and adapted to the situation in Indonesia. Independent translators translated the questionnaire in Bahasa and discuss with three authors to ensure the same intended meaning. The questionnaire had an internal consistency, as evidenced by Cronbach's alpha values of 0.821 for the Bahasa version.

Instruments included demographic database, medical education status, experience with medical tele-education, ownership types of electronic devices, availability of technologies, programs of education methods, career plans, attitudes toward pandemic, and the mental health of respondents. Several questions about mental health disorders, especially anxiety and depression, were taken from GAD-7 and PHQ-2 (Kroenke et al., 2003; Spitzer et al., 2006).

Univariate statistical analysis was conducted to investigate respondents' characteristics and responses using frequency and percentage descriptively. In addition, we used the chi-square test to determine the association of variables by group of years of education. We performed all statistical analyses using (IBM) SPSS version 22.0.

## RESULTS

There were 7,949 students from 49 medical faculties in Indonesia who complete the questionnaire (response rate: 79%). Based

on demographic characteristics, most of the respondents were female ( $n = 5513$ , 69.4%) with an average age of  $20.9 \pm 2.1$  years. Most of the respondents were in their 1st to 4th year of education (71.7%) (Table 1).

## Impact on Medical Education

In the readiness assessment of infrastructure section of the questionnaire (i.e., the availability and skills of technology usage), it was discovered that 15.8% of respondents stated that they have less/sufficient skills in using electronic devices, while the majority of respondents stated that their ability to use electronic devices is good/very good (58.7%/25.5%). The majority of respondents reported having access to a 4G internet connection (93.7%). However, less than half of the respondents (48.7%) and only a few (6.7%) reported having a good and very good internet connection. Most participants own smartphones and personal computers, but only 30.4% support Augmented Reality and 49.3% support high-resolution camera phones. Less than a third of the respondents (27.5%) independently sought various external educational sources. Most of them (71.6%) depended solely on the lectures prepared by their faculty. Data on social media usage is crucial during a pandemic. Instagram is used by about 60% of the people in this study. Only 2% of the population uses Facebook. About 16% of the students said they don't use social media at all (Table 2).

The pandemic also has an impact on the sustainability of the education program. It was found that 13.2% delayed the education program for socio-economic reasons and other reasons (Table 3). Although One-third of the respondents (28.1%) were experiencing financial problems, but only 168 (2.1%) respondents postponed their education due to economic problems.

Another impact of the pandemic is the delay of the education process in the faculty where they studied (32.6%) and Almost half of the respondents (47.5%) stated that they experienced delays in the clinical education process (Table 3). Around 4% student being sick, self-isolation and taking care family who is sick.

In addition, the pandemic was found to affect students' interests and future career plans (34%), the analysis results revealed that the year of education did not significantly affect the change in interest in public health and infection control. Nevertheless, students in their 2nd to 4th years of study had a higher tendency to change their interests than students in their 1st year and students with study periods of more than 5 years (Table 3).

TABLE 1 | Student characteristics.

Variables ( $n = 7,949$ )	$n$ (%)
Age [Mean (SD)]	20.9 (2.1)
<b>Gender</b>	
Male	2,436 (30.6)
Female	5,513 (69.4)
<b>Year Level (n%)</b>	
1–4	5,698 (71.7)
5–7	2,251 (28.3)

The majority of students (80%) continued their online learning, and only a small percentage (39.5%) engaged in self-learning through a program that the faculty did not provide. Regarding student activities during the pandemic outside of learning, most respondents (86%) spent time with their families. Only a few participated in volunteering (6%) and research (7.8%) activities (Table 3). However, most respondents became a source of information to provide advice or guidance for their friends (97%) and family (56.9%).

## The Medical Student's Attitude and Practice

Table 4 shows that, while students agreed/strongly agreed that it would be better to help out in the hospital during the pandemic (69.1%). More than 70% of the respondents were concerned about being infected with COVID-19 during clinical practice or in the community. More than half of the students (55.7%) said the pandemic situation would impact their progress and careers as medical students. The majority of students (52.2%) are concerned that the pandemic will limit their opportunities to become specialists. Meanwhile, most respondents agree or strongly agreed (81.4%) that medical faculty efforts to guide career development are admirable. Worried about losing chances to apply for specialty training due to COVID-19 (80.6%).

Table 5 shows the respondents' understanding of e-learning. More than 90% of respondents stated that e-learning is a comprehensive digital electronic environment displaying curriculum, interactive, provides digital multimedia content (91.2%). However, less than 80% stated that One of the benefits of e-learning with live content is that the scholar receives instant

TABLE 2 | E-learning tools, technology and provider during pandemic.

E-Learning Tools, Technology and Provider		$n$	%
Technology proficiency	Beginner	38	0.5
	Basic	1,215	15.3
	Intermediate	4,670	58.7
Internet connection	Advance	2,026	25.5
	Poor	440	5.5
	Standard	3,109	39.1
Digital e-learning tools	Good	3,871	48.7
	Very good	529	6.7
	Personal Computer	7,287	91.7
E-learning technology	Table or iPad	1,525	19.2
	Smartphone	5,770	72.6
	Augmented Reality	2,414	30.4
E-learning provider	High Definition Phone Camera	3,915	49.3
	Fourth Generation (4G) internet service	7,445	93.7
	University	5,688	71.6
Social media usage	Private education centers/course	75	0.9
	Various educational sources	2,186	27.5
Social media usage	Facebook	140	1.8
	Twitter	297	3.7
	Instagram	5,128	65.2
	Other social media	991	12.5
	Not	1,339	16.8

**TABLE 3** | Pandemic impact on education program.

Variables		Total (%) %	
<b>Impact on Education Program</b>			
Suspending education program on my own volition	Have not suspended educational program	6,901 86.8	
	Suspended educational program due to financial problems	168 2.1	
	Suspended educational program due to my social status and personal responsibilities	587 7.4	
	Suspended educational program due to other reasons	293 3.7	
Education program being suspended/postponed by Faculty	Yes	2,589 32.6	
	No	5,360 67.4	
Clinical training program being suspended	Yes	3,773 47.5	
	No	4,176 52.5	
Currently working/volunteering in a Hospital	Yes as a student in the clinical education/as volunteer	4,353 54.8	
	No, I do not currently work at the hospital	1,735 21.8	
Activities During Pandemic (more than one answer)	Student at the preclinical education stage,	1,861 23.4	
	Feel unwell and have implemented self-isolation	187 2.4	
	Looking after ill patient/family member	124 1.6	
	Preparing for medical license exams/Post-graduate exams	314 4.0	
	Volunteering activities	475 6.0	
	Medical research activities	623 7.8	
	Medical education through online platform	6,360 80.0	
	My medical education program at the university was not disrupted	3,136 39.5	
	Spending more time with family	6,840 86.0	
	Exercise and improving physical fitness	3,129 39.4	
Self-learning through a program not provided by faculty	Play video games	1,886 23.7	
	Watch TV	3,841 48.3	
	Read non-medical books	2,168 27.3	
	Rest and relax	2,626 33.0	
	<b>Impact on career plan and future interest</b>		
	COVID-19 pandemic affected your career plan and future interest (more than one answer)	Affected my career plan and future interest	2,704 34.0
		Interested in public health	1,629 20.5
Interested in infectious disease		1,249 15.7	
Becoming source of Covid-19 pandemic information (more than one answer)	No affected career plan or future interest	4,283 53.9	
	Family	4,524 56.9	
	Friend	7,711 97.0	
	<b>Overview of the COVID-19 Pandemic Affecting Career Plans and Future Interests</b>		
1st year	This has affected future career plans or interests	484 32.4	
	I became interested in Public Health	346 23.2	
	I became interested in Infection Treatment	259 17.4	
Year 2–4	Does not affect my future career plans or interests	810 54.3	
	This has affected future career plans or interests	1,453 34.5	
	I became interested in Public Health	870 20.7	
5th year or more	I became interested in Infection Treatment	699 16.6	
	Does not affect my future career plans or interests	2,227 52.9	
	This has affected future career plans or interests	767 34.1	
	I became interested in Public Health	413 18.3	
	I became interested in Infection Treatment	291 12.9	
	Does not affect my future career plans or interests	1,246 55.4	

feedback from the instructor (77.8%). Most respondents (88.2%) consider e-learning as part of tele-education.

The majority of respondents (74.0%) agreed that e-learning can be implemented easily in Indonesia. Nevertheless, only half (49.5%) agreed that the quality of internet services

can support e-learning. Most students agreed/strongly agreed (83.9%) that e-learning can cover the practical aspects of medical education curriculum. However, less than 60% agreed/strongly agreed that e-learning is more convenient and flexible than conventional learning (58.2%). In 71.6% of respondents consider

the e-testing can replace the current traditional testing methods in medical faculty, while 77.3% agreed/strongly agreed that interaction between students and lecturers is possible through e-learning (Table 6).

Table 7 shows that the majority of respondents (94.6%) use the internet regularly in their learning process and the majority (84.7%) use it to download the material related to the learning medical study. In large number of the respondents (90.5%) share learning materials that they get to other students. Most of the respondents (93.4%) also use

the internet to study with friends or in groups. More than 90% of students participated in online Health Education programs and used the internet to attend medical-related trainings during the pandemic. Most students also use online learning to grasp a medical concept, which may include attending Problem Based Learning training (80.7%). However, less than 60% of students use applications or medical education programs to obtain medical training certifications. In terms of gadget usage, as many as 95.8% of students use their computers.

**TABLE 4** | Medical students' attitudes toward effects the COVID-19 pandemic.

Attitudes toward Covid-19 pandemic	Strongly disagree	Disagree	agree	Strongly agree
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Better helping hospitals during COVID-19 pandemic	193 (2.4)	1,849 (23.3)	4,515 (56.8)	977 (12.3)
Wasting potential learning capability during pandemic	200 (2.5)	1,451 (18.3)	4,381 (55.1)	1,830 (23.0)
Negatively affecting my personal well-being	601 (7.6)	3,363 (42.3)	3,157 (39.7)	580 (7.3)
Afraid of being exposed to COVID-19 during clinical practice/training	290 (3.6)	1,351 (17.0)	4,345 (54.7)	1,336 (16.8)
Afraid of being exposed to COVID-19 in the community	228 (2.9)	1,293 (16.3)	4,825 (60.7)	1,422 (17.9)
COVID-19 has no effect on my educational progress and career	631 (7.9)	3,802 (47.8)	2,920 (36.7)	412 (5.2)
COVID-19 has no effect on enrolling in specialties requiring safe care	580 (7.3)	3,568 (44.9)	2,955 (37.2)	410 (5.2)
Admire the way medical faculty efforts to provide guidance for career development	199 (2.5)	1,076 (13.5)	5,302 (66.7)	1,167 (14.7)
Worried about losing chances to apply for specialty training due to COVID-19	125 (1.6)	1,097 (13.8)	4,879 (61.4)	1,530 (19.2)

**TABLE 5** | Knowledge of medical students toward e-learning.

Variables	True	False	I don't know
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
E-Learning depends on a comprehensive digital electronic environment displaying educational curriculum through electronic networks	7,253 (91.2)	212 (2.7)	484 (6.1)
E-Learning is an interactive system that provides an opportunity for learning through Information and Telecommunication Technology	7,455 (93.8)	243 (3.1)	251 (3.2)
E-learning provides a digital multimedia content (written text, audio, video and images)	7,517 (94.6)	201 (2.5)	231 (2.9)
One of the benefits of E-learning with live content is that the scholar receives instant feedback from the instructor	6,184 (77.8)	1,022 (12.9)	743 (9.3)
E-learning is considered a type of tele-education	7,012 (88.2)	269 (3.4)	668 (8.4)

**TABLE 6** | Attitudes of medical students toward e-learning.

Variables	Strongly disagree	Disagree	agree	Strongly agree
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
E-learning is applicable in Indonesia	291 (3.7)	1,265 (15.9)	5,881 (74.0)	512 (0.4)
E-Learning is a possible substitute for standard medical education	1,543 (19.4)	3,458 (43.5)	2,714 (34.1)	234 (2.9)
An interactive electronic content with discussions can be achieved through e-learning	467 (5.9)	1,544 (19.4)	5,405 (68.0)	533 (6.7)
Most medical students can use live online learning content	294 (3.7)	679 (8.5)	6,058 (76.2)	918 (11.5)
E-learning can be used for Clinical aspects of Medical Sciences	810 (10.2)	2,275 (28.6)	4,521 (56.9)	343 (4.3)
E-learning can cover the practical aspect of medical education curriculum	339 (4.3)	939 (11.8)	6,053 (76.1)	618 (7.8)
E-testing can replace the current traditional testing methods in medical faculties	687 (8.6)	1,577 (19.8)	4,861 (61.2)	824 (10.4)
E-Learning is more convenient and flexible than conventional learning	759 (9.5)	2,562 (32.2)	4,119 (51.8)	509 (6.4)
The quality of internet services in Indonesia can support E-learning	1,137 (14.3)	2,562 (32.2)	3,938 (49.5)	312 (3.9)
It is possible to obtain medical educational material through the internet	361 (4.5)	759 (9.5)	6,076 (76.4)	753 (9.5)
Interaction between students and lecturers is possible through E-learning	462 (5.8)	1,341 (16.9)	5,651 (71.1)	495 (6.2)
Medical students have financial difficulty in gaining access to E-learning	368 (4.6)	1,203 (15.1)	5,197 (65.4)	1,181 (14.9)
Universities/Faculty shall succeed in establishing E-learning programs for medical students	424 (5.3)	1,294 (16.3)	5,753 (72.4)	478 (6.0)

Around 50–60% percent of respondents in each region of Indonesia said the internet service was good, with only about 10% saying it was very good. Fewer than half of respondents in some provinces, such as East Nusa Tenggara (NTT), Papua, and South Sumatra, said they had good internet service (Figures 1A,B).

## Medical Student's Mental Health

The relationship between years of education, clinical phase, and financial status and mental health was investigated in this study. Although not statistically significant, there was an increasing trend in anxiety symptoms ( $p = 0.12$ ). Meanwhile, depression symptoms differed between first-year students and those in their final year ( $p = 0.003$ ) (Table 8).

Medical students frequently experience mental health issues. Nearly 40% of respondents expressed anxiety symptoms about a variety of issues for several days. About a third of respondents feel sad, depressed, and hopeless for a few days, but some respondents state that this condition occurs almost every day (4–5.6%). The tendency to worry increases with the length of the study year (Table 8). Nearly a third of respondents said they were having financial difficulties (28.1%). Further investigation reveals that there is no significant relationship between financial situation and anxiety or depression symptoms (Table 9).

## DISCUSSION

The emergence of the pandemic has had a significant impact on the educational patterns at the faculty of medicine, particularly in terms of virtual learning methods and activities. The COVID-19 pandemic can be seen as a catalyst for the transformation of medical education. Today, the role of e-learning is becoming increasingly important. Many factors influence the success of e-learning, particularly from the perspective of its users and, of course, the supporting facilities. E-learning can provide students with greater educational opportunities while also improving faculty effectiveness and efficiency. However, e-learning requires a certain level of human resource and infrastructure readiness, which is unavailable in developing countries like Indonesia. Institutional readiness to adopt e-learning is contingent on aligning new tools that consider the educational and economic context (Frehywot et al., 2013).

## Impact on Medical Education

Our research shows that the availability of facilities in Indonesia, such as devices, skills, and accessibility to support e-learning, is satisfactory. These findings support the feasibility of e-learning implementation for medical students. The primary factors for executing distance learning are technical resources and infrastructure. Subsequently, understanding technology, financial, institutional, educator, and student barriers are critical for successfully implementing distance learning in medical education (Al-Balas et al., 2020).

The majority of students use their smartphones to supplement their learning. The study of Kapasia et al. (2020) reported that most students used android phones to access e-learning. These results support the need for smartphone applications that provide

access to online learning and medical education lectures. It also drives the need to provide interactive sessions *via* optimized smartphones (Alsoufi et al., 2020). Because the screen on a mobile phone is smaller, it must be supported by easy-to-read writing fonts and a variety of applications that support this function.

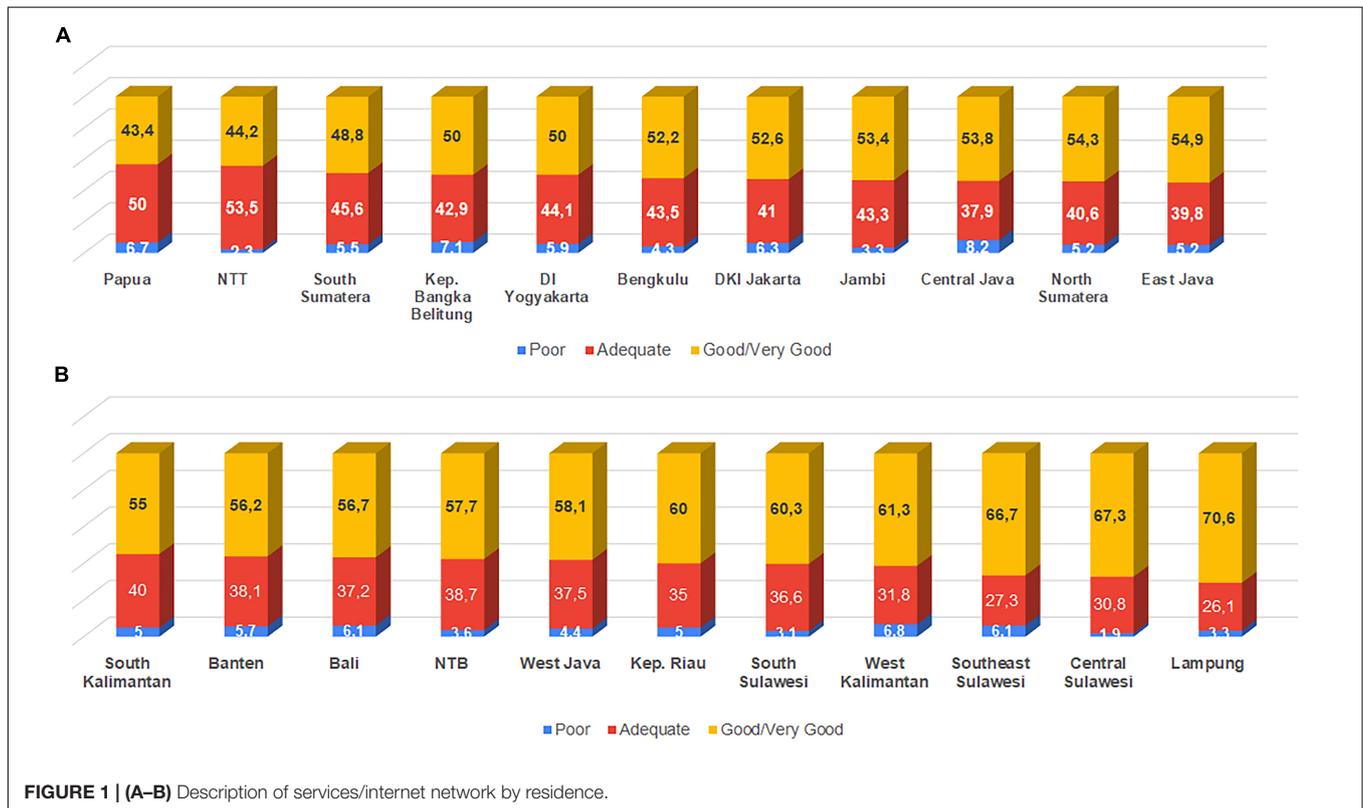
According to a study by Daroedono et al. (2020) students rely more on mobile data without a backup (such as WiFi). According to a survey conducted by the Indonesian Internet Service Providers Association in 2019–2020, 97% of respondents used data packages (quota) from cellular operators [Indonesia Survey Center (ISC), 2020], implying that they rely heavily on the consistency and reliability of cellular phone signals, as well as additional expenses for internet data package fees. Other studies show that most students use android phones to access e-learning during the lockdown; the students experienced various issues, including anxiety, depression, poor internet connectivity, and a poor learning environment at home. Students from remote areas face greater challenges (Kapasia et al., 2020). This emphasizes the importance of interventions to create positive learning environments for students from socially vulnerable groups.

In our study, the majority of students used 4G technology and were proficient with their devices. Furthermore, during the pandemic, the Republic of Indonesia's Ministry of Education and Culture provided university students with a 15 GB/month internet data quota (Ministry of Education and Culture Republic of Indonesia, 2021). However, almost half of the students stated that they had less and poor internet/network connections. The geographical constraint of Indonesia, which is very large and consists of islands, is one of the causes of access problems in some areas (CNN Indonesia, 2020). This condition becomes a challenge because of building networks and data facilities in certain areas. Our study found that less than 50% of students from three regions, namely East Nusa Tenggara (NTT), Papua, and South Sumatra, had good/excellent access to the internet. This is something that needs to be considered when it comes to improving the region's communication infrastructure. The success of e-learning implementation is dependent on cross-sectoral collaboration, which includes telecommunications service providers. It is hoped that good quality internet connection will be evenly distributed in all regions in Indonesia. Telecommunication companies should provide high-quality internet coverage to students. Building a unified educational platform for all medical schools may be the optimal solution to address the disparity between student satisfaction and instructor performance in distance learning (Al-Balas et al., 2020).

The pandemic impacted the medical education process in Indonesia, as much as 32.6 and 47.5% of the education program and Clinical training program being suspended. Half of the students stated that they were afraid of being exposed to COVID-19 during clinical practice/training, 54.7%. Harries et al. (2021), in their study, reported that the pandemic had a moderate effect on their stress and anxiety levels, with 84.1% of respondents feeling at least somewhat anxious. Meanwhile, delays in academic activities were positively associated with anxiety symptoms in college students in China (Wenjun et al., 2020). Another impact of the pandemic on medical students, they felt the pandemic had

**TABLE 7 |** Medical students' practice evaluation of e-learning.

Variables (Yes answer)	n (%)
Were you awarded certificates through online training courses related to the medical field?	4,175 (52.5)
Did you participate in any online medical education program during this period?	7,285 (91.6)
Do you download content related to your medical education in a periodic manner?	6,734 (84.7)
Do you share educational material with your fellow medical students at your faculty?	7,193 (90.5)
Did you use the internet to study with a friend or a group of friends through online meetings?	7,423 (93.4)
Did you use the internet to attend a course in Problem-based learning format?	6,416 (80.7)
Do you utilize your personal computer in online studying?	7,616 (95.8)
Do you use the internet regularly in your studies?	7,520 (94.6)



**FIGURE 1 | (A-B)** Description of services/internet network by residence.

**TABLE 8 |** Overview of Mental Health during a pandemic by year of education.

Worrying too much about different things?	Total n (%)	Year 1 n (%)	Year 2–4 n (%)	5th year or more n (%)	p-value
Not at all	3,725 (46.9)	732 (49.1)	1,986 (47.2)	1,007 (44.7)	0.120*
A few days	3,040 (38.2)	553 (37.1)	1,613 (38.3)	874 (38.8)	
More than half	768 (9.7)	133 (8.9)	391 (9.3)	244 (10.8)	
Almost every day	416 (5.2)	74 (5.0)	216 (5.1)	126 (5.6)	
<b>Feeling sad, depressed or hopeless</b>		<b>Year 1</b>	<b>Year 2–4</b>	<b>5th year or more</b>	<b>p-value</b>
Not at all	4,719 (46.9)	918 (61.5)	2,526 (60.1)	1,275 (56.6)	0.003*
A few days	2,223 (28)	405 (27.1)	1,159 (27.6)	659 (29.3)	
More than half	642 (8.1)	110 (7.4)	339 (8.1)	193 (8.6)	
Almost every day	365 (4.6)	59 (4.0)	182 (4.3)	124 (5.5)	

\*Chi-square test.

interfered with their ability to develop the skills needed to prepare for residency (61.4%) (Harries et al., 2021).

One of the challenges in medical school is the high cost during the education process. The impact of the pandemic will undoubtedly be affected by the student's financial support system. Our study found that one-third of the respondents (28.1%) were experiencing financial problems, and 2.1% of students suspended educational programs due to financial problems. In line with other studies, in Pakistan, nearly half of the medical students (50.6%) have been affected regarding the financial aspects (Seetan et al., 2021). While the study of Al-Husban et al. (2021) showed that financial influence was a significant aspect in around 53% of students and 34% of students could not pay the university fees due to the pandemic in Jordanian.

Another impact of the pandemic is the delay of the education process, especially in the clinical phase. Almost half of the respondents stated that they experienced delays in the clinical education process. In their study, Sani et al. (2020) showed that the pandemic's immense impact on clinical phase students, the competence of students' clinical skills could decrease because they no longer have access to patients and simulation models under supervision. Therefore, students will require costly and time-consuming training after returning to the clinical environment to regain the expected level of competence and opportunities lost due to the pandemic can cause anxiety over career advancement (Sani et al., 2020).

This study also found that around 4% of students are sick, self-isolation and taking care of sick families. Bani Hani et al. (2021), in their study, reported that among 1,830 participants, 237 students (13%) tested positive for COVID-19. These include 15.2% of clinical students and 11.2% of pre-clinical students. These results support the hypothesis of higher COVID-19 incidence in clinical students than pre-clinical students (Bani Hani et al., 2021).

Some students said the pandemic had influenced their interests and future career plans, such as their interest in public

health and infection. The severity of anxiety symptoms is linked to a decrease in the desire to work in the medical specialty of respiratory and infectious diseases, according to a study by Deng et al. (2021). Psychological issues and job satisfaction appear to be separate factors that influence medical careers and specialties. According to a study by Byrnes et al. (2020), about one-fifth of medical students surveyed, believe that the COVID-19 pandemic will impact their choice of specialization. Many of them expressed concern about not being able to explore the specialty or obtain letters of recommendation (Byrnes et al., 2020). Meanwhile, a study of 10,433 medical students from 257 medical schools in Brazil found that more than half of the respondents were concerned about being infected with COVID-19 (Tempeski et al., 2021).

Furthermore, the pandemic situation has had a significant impact on the future competencies required of the medical workforce in the 21st century. In addition to professional competence, care for patients, and sustainable personal accountability, new competencies better suited to address current health challenges must be embraced (Rose, 2020). Medical schools should begin to restructure their curricula to better prepare doctors as an essential element for the future workforce.

## The Medical Student's Attitude

Our study reported that only 37% of the students agree/strongly agree that e-learning is a possible substitute for standard medical education, which means that more than half of respondents think studying medicine is quite tricky if e-learning were to replace traditional methods. In line with Ibrahim et al.'s study, most medical students agree that some disciplines or materials (as clinical teaching) are not suitable for e-learning and clinical skills are the most challenging learning process (Ibrahim et al., 2021). However, there is no doubt that e-learning is becoming one of the teaching methods that most likely used by providers of education with all its limitations, for that reason the clinical educators are expected to redesign the curricula core through a strategy of distance learning that guided by the faculty involving didactic teaching, case studies, and, in some cases, participation of inpatient and outpatient video conferences. Pedagogical principles of education based on competency should be quickly operationalized to enable schools to shorten secretariat blocks in terms of traditional time-bound without lowering the performance standards (Lucey et al., 2018). The data of this study also shows that more than half of the students (61%) agree and strongly agree that e-learning can be used for clinical aspects of medical sciences. It is necessary to emphasize the importance of psychomotor skills in clinical education. In the midst of a pandemic, several things can be done, for example, to use an online platform to present a review of the patient's history, findings from the physical examination, results of investigations, and proposed management plans. This visual interface will simulate bedside teaching (Sam et al., 2020).

Telemedicine is a form of patient care during a pandemic. It would be beneficial if clinicians had the opportunity to treat to people with severe and chronic conditions and if the workload of physicians could be reduced, especially during an outbreak

**TABLE 9** | Overview of mental health during a pandemic based on financial conditions.

Variable	Financial distress		
	Yes (2,232)	No (5,717)	p-value
	n (%)	n (%)	
Feeling sad, depressed or hopeless			0.927*
Not at all	1,315 (58.9)	3,404 (59.5)	
A few days	630 (28.2)	1,593 (27.9)	
More than half	186 (8.3)	456 (8.0)	
Almost every day	101 (4.5)	264 (4.6)	
Worrying too much about different things?			0.876*
Not at all	1,043 (46.7)	2,682 (46.9)	
A few days	846 (37.9)	2,194 (38.4)	
More than half	225 (10.1)	543 (9.5)	
Almost every day	118 (5.3)	298 (5.2)	

\*Chi-square test.

(Hollander and Carr, 2020). So, in a pandemic, psychomotor skills training will include using telemedicine to communicate and perform examinations. In contrast to an in-person clinical visit, telemedicine involves a virtual visit. It can play a significant role in teaching medical students and helping them acquire clinical experience by interacting with actual patients under the supervision of attending physicians. Virtual clinical experiences may offer patients advantages, as they are provided with ease and allow for connectivity without the risk of infection transmission (Woollicroft, 2020). Approaches like these need to be evaluated further, and more support for their implementation in medical schools is needed.

In contrast to responses toward e-learning, our study found that more than half (71.4%) of respondents agree/strongly agree that e-testing can replace traditional testing methods in medical schools. As with e-learning, internet connection affects e-testing success; according to Ibrahim's research, low internet quality affects students' exams (Ibrahim et al., 2021). According to research conducted in the United Kingdom, the COVID-19 pandemic has a significant impact on OSCE, written examinations, and student mentoring. The majority of students believe that action is required to change the curriculum during the pandemic (Choi et al., 2020). In these circumstances, institutions must be aware of the uncertainty of timing and new test methods, which can put students under stress. The testing agency's clear and consistent communication can help to alleviate anxiety.

In this study, it was found that most students (69.1%) agreed/strongly agreed that they could help in hospitals during the pandemic. However, the risk of being infected with COVID-19 has caused many medical schools to postpone clinical education rotations, though some do continue conducting clinical rotations but restrict students to non-red zone areas of the hospital. A study in Brazil reported that most students were concerned about contracting COVID-19 (Tempski et al., 2021). The Association of American Medical Colleges and the Liaison Committee on Medical Education recommend suspending medical school rotations, as continued involvement of medical students may pose a risk of transmission of infection, which may have a major impact on patient care, especially considering the lack of personal protective equipment (Menon et al., 2020). In Indonesia itself, the Ministry of Education of Culture issued a circular letter of online learning and *work from home* to prevent the spread of Covid-19 (Ministry of Education and Culture Republic of Indonesia, 2020b).

## The Medical Student's Practice The Educational Process During the COVID-19 Pandemic

Our research shows that most students continued their education through online learning. Although the learning method was switched to e-learning, one-third of respondents stated they had postponed preclinical learning activities, and almost half had postponed clinical activities. The delay was caused, in part, by a lack of treatment, vaccines, and several management procedures for infected students at the start of the pandemic. Preclinical

students, whose learning activities are dominated by classroom learning (lecturer-based), experienced fewer delays than students in the clinical stage (Rose, 2020; Papapanou et al., 2021).

According to other studies, the pandemic heavily limited the clinical learning experience for medical students (Kaul et al., 2021). Several factors contributed to the decrease in teaching materials, including the transition from traditional health services to telemedicine, the policy of limiting surgeries to emergency cases, and the limitation of clinical supervisors' practice hours (Rose, 2020). Students' participation in direct patient care is limited by a number of other essential factors. Some institutions have to limit the number of team members who enter patient rooms to reduce the possibility of transmission to health workers and save on Personal Protective Equipment (PPE) usage.

Because of the virus's ease of spread, medical schools have become wary of involving students in the care of patients with or who are suspected of having COVID-19. The decline in the number of patients seeking treatment for conditions other than COVID-19 further complicates matters (Catherine and Lucey, 2020). Naturally, policies regarding student activities in hospitals will differ from one medical faculty to the next. Different policies are evident in different countries; for example, Italy, Ireland, and the United Kingdom engaged their students as health care workers earlier, whereas students in Canada were withdrawn from clinical assignments (Cole, 2020; CTV News, 2020; O'Brien, 2020). In the United States, some medical schools graduate students earlier. Clinical students' differing reactions to the condition are, of course, dependent on various factors, including parental permission. According to research conducted in the United Kingdom, students agreed that assisting in hospitals during an outbreak would be a valuable learning opportunity (Choi et al., 2020).

During the pandemic, each faculty will prepare graduates on time and according to standards every year. Hence, each medical faculty needs to enhance classrooms to support virtual online learning- which is being explored as a critical thinking and communication skills exercise in a simulated clinical experience. According to other studies, nearly 60% of people believe that online learning can adapt to limited time better than classroom learning (Ibrahim et al., 2021).

In this pandemic, students play a critical role, particularly in disseminating COVID-related information. Students could be a source of information for friends and family. According to Kaul's research, students could contribute to the service in meaningful ways in non-clinical roles (Kaul et al., 2021). In Indonesia, medical student activities related to COVID-19 include student volunteer activities. Students are assigned to handle preventive and promotional programs through communication, information dissemination, and education to the general public. Student volunteers can assist the government in contact tracing, call center services at the central and regional levels, and in COVID-19 service centers (Ministry of Education and Culture Republic of Indonesia, 2020a).

This pandemic situation can motivate medical students to volunteer, help with patient education, contact tracing, mental health assessments, and support their communities during this

trying time (Wayne et al., 2020). Moreover, these activities may improve their collaboration and leadership skills to better prepare them for successful patient care, interprofessional multidisciplinary practice, and advance their analytical abilities (Alsoufi et al., 2020).

Nevertheless, students must maintain their focus on completing their education in accordance with the study period. Mentors play a crucial role in providing guidance and support during these unprecedented times (O'Byrne et al., 2020). Students can also be encouraged to participate in non-clinical activities such as research and community service, examples of indirect (Kaul et al., 2021).

### Medical Students as a Source of Information and the Role of Social Media

Medical students was found to be a source of information and advice for 97% of friends and 56.9% of family in this study. It can be said that medical students play an important role in distributing cutting-edge resources for public health, particularly in the midst of this pandemic, which is characterized by misinformation and extremely high rates of health hoaxes (Nasir et al., 2020).

Instagram is more widely used than other social media platforms, such as Facebook. Hence moving forward, all medical faculties can communicate with students on this same platform and learn how students communicate and participate in public education. Social media platforms like Facebook, Twitter, Instagram, YouTube, WhatsApp, and Podcasts have distinct communication capabilities that can be used for a variety of educational purposes in both formal and informal educational settings. Doctors and institutions must adapt to incorporate social media platforms into medical education (Katz and Nandi, 2021).

Lugito's research shows that respondents in the range of age 17–56 years. The three most frequent social media platforms used by participants were Instagram, WhatsApp, and YouTube. Social media exposure was associated with less likelihood to suffer from severe-extremely severe depression, mild-moderate, and severe-extremely severe anxiety, mild-moderate stress. Thus, medical professionals and government officials can use social media to disseminate information about COVID-19 to generate positive psychological effects (Lugito et al., 2021).

### Evaluation of Medical Students' Use of E-Learning

Our study shows that the implementation of e-learning is quite good. Most students use the internet in the learning process, including downloading materials, sharing learning materials, studying with friends or groups, and utilizing internet facilities to attend medical-related training. The Nambiar study conveys essential points that must be considered for teacher and student satisfaction in the implementation of e-learning, such as quality and punctual interactions between students and lecturers, availability of technical support, structured online class modules, and modifications to accommodate practical classroom implementation (Nambiar, 2020).

### Mental Health

This study found the prevalence of mental health disorders that can lead to anxiety and depression. Many students (54.7%) reported anxiety symptoms about being exposed to SARS-CoV-2 during their clinical training, while 60.7% were worried about viral transmission in the community. Data on the prevalence of mental health disorders vary widely.

Several studies reported an increase in depressive symptoms among students. Depression symptoms were prevalent in 66.7% of pre-pandemic students (95% CI = 65.3–68.1) and 81% of students during the pandemic (Campos et al., 2021). A Study by Agiananda and Lukman (2021) showed that 30% of medical students were psychologically distressed (21.2% affected by depression and 24.9% by anxiety). Studies in Indonesia showed that depression, anxiety, and stress are commonly found in Indonesia during the COVID-19 pandemic (Argo et al., 2021). Research in Libya showed that high levels of anxiety and depression were found among medical students, of whom 31.3% indicated a high likelihood of experiencing depressive symptoms, and 10.5% likely experienced anxiety (Alsoufi et al., 2020). Another study among Chinese college students, 0.9% suffered from severe anxiety and 2.7% experienced moderate anxiety symptoms during the COVID-19 outbreak (Cao et al., 2020) while a study in Jordan reported that COVID-19 affected students' physical health, study and social relationships. In fact, almost half of respondents reported experiencing mental health disorders (Seetan et al., 2021).

Many factors cause mental disorders during the pandemic. There are high morbidity and mortality rates, increased work commitments with a significant reduction in recovery time, impact of illness on coworkers and family, economic stress, social isolation, and social stress, among other reasons (Kaul et al., 2021). Moreover, anxiety, fear, and depression have been reported among medical students due to ineffective learning as a result of the abrupt switch to online learning (Nishimura et al., 2021). Another study by telephone interview found that students were bored with online learning after the first 2 weeks of studying from home, that research subjects with low incomes had to buy quotas to be able to participate in online learning, and that mood changes occur when there were too many assignments which were considered ineffective (Irawan et al., 2020).

Worries and sadness/depression increased with the length of the study period in our study. This can be caused by students who have a longer study period being concerned that they will not be able to complete their studies in the time allotted, or worse, they will be dropped from school. Final-year students face various concerns as they are required to interact with various people, including meeting peer groups, mentors, and patients during the education process and preparing for national exams and post-graduation job opportunities. These circumstances may increase their exposure to the SAR-COV-2 virus, increasing their concern of infection.

Although most preclinical students do not have complaints of anxiety and depression, there is a small proportion who are worried about the current condition. This is in line with the findings of Halperin et al.'s (2021) study, which reported that student anxiety at the beginning of pandemic for the

preclinical level was more significant due to the relocation of learning methods, uncertainty over the date of the exam, at-home distraction, and lack of experience in the medical faculty. Meanwhile, students at the profession (clinical) stage have a decreased level of concern due to the imposition of online learning methods that can reduce the frequency of exposure to the virus (Halperin et al., 2021). Other studies have shown that those concerned about the shift to online education are more likely to experience generalized anxiety and depression (Nishimura et al., 2021).

In this study, there was no relationship between financial problems and mental health. This shows that mental health problems are caused by many factors, not only because of financial issues. However, in general, the financial impact of the pandemic is an important issue that must be considered because the economic status at the country and the individual level was found to be significantly affected by the outbreak (Kernan, 2019). Although the cause of mental health problems is multifactorial, it is crucial to consider the pandemic's significant effect on the loss or reduction of income sources (Seetan et al., 2021).

## LIMITATION OF STUDY

Although the study involved participants from 49 medical faculties (from 90 faculties) in Indonesia, it has not been able to describe the overall situation of students at other medical faculties, especially those from state/government medical faculties or different provinces.

## CONCLUSION

The infrastructure and competency of its users are required for E-learning to be successful. The majority of medical students believe that e-learning can be adopted in Indonesia and that their capacity to use electronic devices is good. However, access to the internet remains a problem. Medical students are also important players in this epidemic, especially when it comes to sharing COVID-related information. On the other side, the pandemic has disrupted the education process and mental health, with fears of being infected with SARS-CoV-2, the loss of opportunities

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to apply for specialty training, and the potential for increased financial difficulties among medical students. Our findings can be used to assess the current educational process in medical schools and maximize e-learning as an alternative means of preparing doctors for the future.

## DATA AVAILABILITY STATEMENT

All relevant datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

## ETHICS STATEMENT

Ethical approval was obtained from the Ethics Committee at Atma Jaya Catholic University of Indonesia (No. 14/06/KEP-FKIKUAJ/2021). The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

YT, WSS, and MW designed and directed the project. YT and PAP were involved in planning and supervised the work. IS and FY performed the analysis and designed the Table. YT, PAP, ABSD, RW, DAd, PKS, EB, DAn, DQA, KS, IWD, YA, TP, AT, WP, AK, AW, MS, MM, SY, Rahayu, SS, BR, SMPL, AP, DALD, MD, TOP, FMR, ZPM, SWH, NH, WS, WD, DP, LC, SL, RT, GDTT, IAT, AWS, FA, SAL, NST, GP, RP, MA, RA, JI, Handayani, VP, MT, and FK drafted the manuscript. YT, IS, FY, PAP, and FK aided in interpreting the results and worked on the manuscript. All authors discussed the results and commented on the manuscript.

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