Failure Factors & Prediction Model of Indonesian Medical Doctor Proficiency & Competency Test (UKMPPD) within COVID-19 Pandemic

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Abstract

Background: Coronavirus Disease 2019 drastically modulate the healthcare world. The pandemic's immense transmission and lethality rate enforce the Indonesian Medical Doctor Proficiency & Competency Test to discard practical measures and rely only on a written exam. These with pandemic social and physical restrictions impede prospective doctors' learning opportunities leading to easier failure. Henceforth, the present study has high urgency to identify and manage failurefactors, especially in the pandemic.

Methods: The cross-sectional study examines 75 clinical medical students through purposive analysis with an online questionnaire in August 2021. Data are analyzed with Chi-Square, Mann-Whitney, and binary logistics.

Result: Respondents have an average age of 24.15 (1.322) years old, majorly female (82.7%), and pass as first takers (86.7%) with 1.27 (0.949) off-campustutelage. The significant factors for the test failure are depression and economic status. The study developed a failure prediction model with the area under the curve 0.845, cut-off 366.5, 80.0% sensitivity, and 84.6% specificity.

Conclusion: Intrinsic, extrinsic, and academic factors have significant roles in the failure outcome. For this reason, preparation is crucial not only among individuals but also institutions. The study also provides feedback about the importance of mental health and economic status for Indonesian medical students.

Introduction

The global community has declared and agreed to the right to equitable health among all individuals. World Health Organization (WHO) 1946 constitution depicts that the most fundamental human right is unrestricted access toward the highest healthcare standards among all individuals.[1] Health is defined as a state of complete physical, mental, and social well-being along with the absence of disease or disability. Moreover, the 1948 Universal Declaration of Human Rights explains that the healthcare right also includes primary living supports, namely: food, clothing, shelter, health, social services, and security in the event of employment termination, illness, disability, divorce, old age or other events beyond the individual's control.[2] Indonesia, as the 4th most populated country, has a firm stance in the equity and healthcare of its citizens. The Republic of Indonesia 1945 Constitution states thateveryone has the right to live in physical and spiritual prosperity, have a residence, have a good and healthy living environment, and have the right to obtain healthcare services.[3] Every individual has a fundamental right to healthcare, including healthcare workers. Medical doctors reported having several barriers in accessing health facilities: embarrassment, peer pressure, feeling of self-care failure, over/under/misdiagnosis anxiety, time and

financial limitation, social and occupational stresses, etc.[4] Fortunately, it is observed that medical doctors have lower mortality rates compared to other professions. Medical professionals have an average age of death at 78.9 (14.1) years, which is higher than the global community (73.5 years) and Indonesian citizens (men: 70 years & women: 74 years). [5–7] Yet, among the professionals, depression presents within 27% of medical students, 29% of health administrative personnel, and 60% of clinical practice doctors.[8] The alarming rate of mental issues signifies that greater emphasis should be sown on the health of medical professionals.

Indonesia has 190075 registered doctors with the Indonesian Doctors Association (IDI), forming a doctor-to-population ratio of 0.4:1000.[9,10] The rate is still very distinct from the WHO recommendation of 1:1000, and the 2018 global annual rate of 1.566:1000.[11] Thereafter, the spread ofmedical doctors in Indonesia is also not equal. 57.2% of medical personnel, for instance, are located within Java.[11] These pose a massive gap in healthcare that threatens equitable health. The imbalance of doctors to the population triggers an overwhelming burden within the healthcare personnel and system. Consequently, burnout is on the rise, and medical performance is depleting. These, with the drastic escalation of patients due to the Coronavirus Disease 2019 (COVID-19) pandemic, conceive an atrocious situationof national pre-healthcare collapse (i.e., the circumstances where healthcare within the country cannot proceed as expected due to crisis in its implementation, system, workforce, or logistic).

Multidisciplinary efforts to increase the number of medical doctors in Indonesia are made through establishing educational programs at new universities. Although having sixty-seven faculty of medicine within universities across the nation, geographicfactors and distinct local tradition sometimes inflect differences in the exertion of the medical curriculum. Subsequently, the national standardization of competence among the prospective doctors is carried out through the Indonesian Medical Doctor Proficiency & Competency Test (UKMPPD) to mitigate the after-mentioned problem. All materials tested in the UKMPPD are factored in the 2019 Indonesian National Standard for Medical Profession Education (SNPPDI) compiled by the Indonesian Medical Council (KKI). The exam consists of two stages: a computer-based test (CBT) that tests theoretical measures and an Objective Structured Clinical Examination (OSCE) that tests clinical skills. Since the 2020 and the COVID-19 pandemic, UKMPPD is only carried out with the CBT stage.

Dwiyanti et al. affirmed the relationship between UKMPPD results with the cumulative grade point average (GPA) and pre-UKMPPD selection test scores.[12] While a study by Khadafianto in Yogyakarta found that aspects in medical assessments (i.e., written exams, Objective Structured Long Examination Record (OSLER), and the Mini-Clinical Evaluation Exercise (mini c- ex)) were associated with UKMPPD CBT outcome.[13] Similarly, score from Clinical Integration Assessment (CIA), Benchmark (BM), and *Asosiasi Institusi Pendidikan Kedokteran Indonesia* tryout can be taken as valid predictors for UKMPPD CBT score.[14]

UKMPPD results are influenced by various factors, including demographics, mental health, and academic performance of examinees. Meanwhile, changes in medical education due to physical and social restrictions during the pandemic

indirectly play a significant role in the outcome of UKMPPD. From August 2020–May 2021, the UKMPPD failure rate showed a polarizing trend from 17.63% to 32.48%.[15] As far as the author's knowledge, no previous studies have observed the UKMPPD failure factors and prediction models. The current study aims to analyze UKMPPD failure factors during the COVID- 19 pandemic.

Methods

Study Design

The present study utilizes a cross-sectional design in September 2021. The current study followed the International Review Board (IRB) and Helsinki Declaration ethical protocols by obtaining clinical ethical approval from Pelita Harapan University Ethics Committee with certification 163/K- LKJ/ETIK/IX/2021. The respondents have agreed, understood, and signed the informed consent before continuing the study. The sample size is computed through 5% alpha and 80% power.

Subject Collection & Enrollment

Using an online questionnaire on Google Form, the data are gathered through purposive sampling of the medical profession students from all medical faculty universities around Indonesia. All Indonesian respondents over 18 years old and who have taken the UKMPPD at least once can fill the online questionnaire distributed through Line, WhatsApp, Telegram, Kaskus, and other social media or forums.

Data Measurement

The online questionnaire is divided into four sections: demographic, UKMPPD, depression, and sleep quality. The level of depression is measured through part of the Depression Anxiety and Stress Scale (DASS-21), whereas the sleep quality uses Pittsburgh Sleep Quality Index (PSQI). Both instruments have decent validity and reliability for their capabilities.

Statistical Analysis

The study analyzes respondents' data through descriptive statistics, while the UKMPPD failure factors through Chi-Square, Mann-Whitney, and binary logistics. Significance describes as present in p-value < 0.05.

Result

The data collection in September 2021 generates 75 qualified respondents with a 100% participation rate which are medical university students with an average age of 24.15 (1.322) years old, predominantly female (82.7%), and pass the UKMPPD (86.7%) as the first takers (86.7%). The respondents claim to adopt studying at 1.27 (0.949) off-university academy in preparation for the exam. Likewise, it was observed that they have disproportionate mental health and sleep quality, where 22.6% have depression, and 70.7% have poor sleep quality. Other features are portrayed in **table 1**.

Tabel 1. Demographic Characteristics

Characteristics	Frequency	
	n (%)	X (SD)
Age		24.15 (1.322)
Gender		
Female	13 (17.3)	
Male	62 (82.7)	

Marriage status		
Never	64 (85.3)	
Married/Divorced	11 (14.7)	
Blood Group		
A	15 (20.0)	
B	18 (24.0)	
AB	15 (20.0)	
O	27 (36.0)	
Economic Status		
≥ average	52 (69.3)	
≤ average	23 (30.7)	
Occupation		
No	19 (25.3)	
Working	56 (74.7)	
Family of Doctor		
Yes	23 (30.7)	
No	52 (69.3)	
Grade Point Average		3.50 (0.415)
Study Duration		
Normal	61 (81.3)	
Longer	14 (18.7)	
Exam Status		
First-Taker	65 (86.7)	
Re-Taker	10 (13.3)	
Off-Campus Tutelage		1.27 (0.949)
Exam Location		
Own University	59 (78.7)	
Other University	16 (21.3)	
Depression Level		6.77 (5.298)
Normal	58 (77.3)	
Mild	6 (8.0)	
Moderate	10 (13.3)	
Severe	1 (1.3)	
Extremely Severe	0 (0.0)	
Sleep Quality		9.20 (3.956)
Good	22 (29.3)	
Poor	53 (70.7)	
Exam Result		
Pass	65 (86.7)	
Fail	10 (13.3)	

Abbreviation: SD: standard deviation

Numerous factors have a significant effect on the potential failure of UKMPPD (**table 2**). On intrinsic factors, students who failed were 2.02 years older (p: 0.009), and the majority had AB blood type (80.0%). On the other hand, UKMPPD failure is also based on extrinsic factors where it is more commonly found in students who are married or divorced (70.0%), have lower middle economic status (80.0%), working (80.0%), and come from a family of doctors.(70.0%).

Table 2. Failure Factors of UKMPPD

Factor	Pass UKMPPD		OR CI95	P Value
	Yes	No		
Age	23.88 (0.801)	25.90 (2.424)		0.009
Gender			1.227 (0.229-6.583)	0.552
Female	54 (83.1)	8 (80.0)		
Male	11 (16.9)	2 (20.0)		
Marriage status			35.583 (6.573-192.644)	< 0.001
Never	61 (93.8)	3 (30.0)		
Married/Divorced	4 (6.2)	7 (70.0)		
Blood Group				< 0.001
A	14 (21.5)	1 (10.0)		
B	17 (26.2)	1 (10.0)		
AB	7 (10.8)	8 (80.0)		
O	27 (41.5)	0 (0.0)		
Economic Status			13.333 (2.552-69.665)	0.001
≥ average	50 (76.9)	2 (20.0)		
≤ average	15 (23.1)	8 (80.0)		
Occupation			19.636 (3.661-105.325)	< 0.001
No	54 (83.1)	2 (20.0)		
Working	11 (16.9)	8 (80.0)		
Family of Doctor			0.140 (0.032-0.606)	0.007
Yes	16 (24.6)	7 (70.0)		
No	49 (75.4)	3 (30.0)		
Grade Point Average	3.54 (0.412)	3.29 (0.385)		0.051
Study Duration			19.333 (4.049-92.319)	< 0.001
Normal	58 (89.2)	3 (30.0)		
Longer	7 (10.8)	7 (70.0)		
Exam Status			576.000 (33.044-10040.563)	< 0.001
First-Taker	64 (98.5)	1 (10.0)		
Re-Taker	1 (1.5)	9 (90.0)		
Off-Campus Tutelage	1.37 (0.894)	0.60 (1.075)		0.006
Exam Location			14.519 (3.161-66.694)	< 0.001
Own University	56 (86.2)	3 (30.0)		
Other University	9 (13.8)	7 (70.0)		
Depression Level	5.75 (4.187)	13.40 (7.058)		0.001
Normal	55 (84.6)	3 (30.0)		< 0.001
Mild	5 (7.7)	1 (10.0)		
Moderate	5 (7.7)	5 (50.0)		
Severe	0 (0.0)	1 (10.0)		
Extremely Severe	0 (0.0)	0 (0.0)		
Sleep Quality	8.45 (3.540)	14.10 (2.961)		
Good	22 (33.8)	0 (0.0)		< 0.001
Poor	43 (66.2)	10 (100.0)		0.024

Meanwhile, the academic component has an essential relation to UKMPPD. Students with more prolonged professions, re-takers status, little to no off-university tutoring, and those taking exams at other universities are at higher risk of not passing the UKMPPD ($p< 0.05$). Additionally, the level of depression and sleep quality also contributed to the failure of UKMPPD ($p < 0.001$ and 0.024). All students who did not pass had poor sleep quality, and 70.0% of failed students had depression.

Table 3. UKMPPD Failure Factors Regression

Factor	Estimate	Odds Ratio		CI_{95}	p-value
		Crude	Adjusted		
Age	0.584		1.794	0.491-6.558	0.377
Marriage Status	-0.897	35.583	0.408	0.007-23.464	0.664
Economic Status	4.231	13.333	68.761	1.103-4287.859	0.045
Family of Doctor	-2.767	0.140	0.063	0.002-1.911	0.112
Off-Campus Tutelage	0.404		1.498	0.303-7.398	0.620
Exam Location	3.204	14.519	24.622	0.735-824.872	0.074
Depression Score	0.435		1.546	1.068-2.236	0.021

Abbreviation: CI: confidence interval

T**able 3** shows that through binary regression controlling for factors, significance is only observed in economic status (odds ratio (OR): 68,761, 95% confidence interval (CI_{95}): 1.103-4287,859, p: 0.045) and depression score (OR: 1.546, CI_{95}: 1.068-2.236, p: 0.021), while other factors are just confounders. The UKMPPD failure prediction was also developed into the following probability equation:

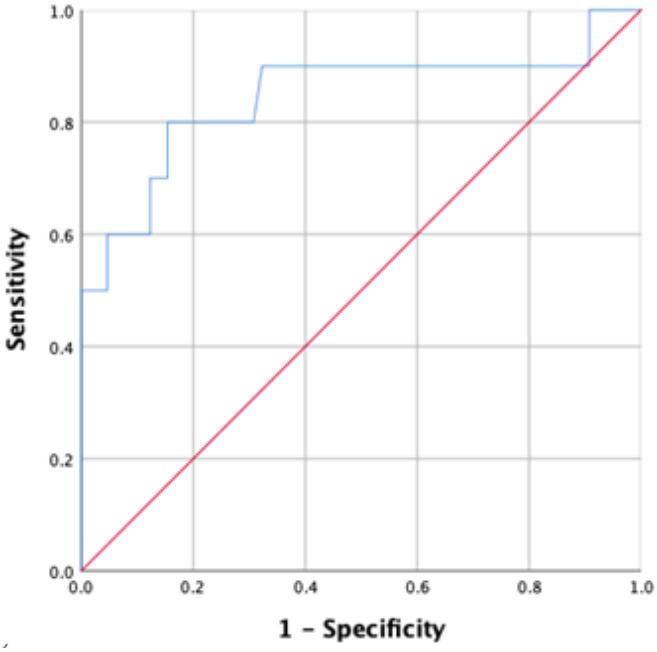
UKMPPD Failure Probability =

$$1/(1+e^{-(-22.055+0.584*\text{age}-0.897*\text{marriage}+4.231*\text{economy}-2.767*\text{family of doctor}+0.404*\text{tutor}+3.204*\text{exam location}+0.435*\text{depression score})})$$

Nevertheless, the after-mentioned equation is entirely unsuitable for daily application. Thus, the UKMPPD failure prediction model was made based on a regression score with an area under the curve 0.845, cut-off 366.5, sensitivity 80.0%, dan specificity 84.6%. (**table 4**). The probability of contrasting different diagnostic rates of UKMPPD failure can be seen in **figure 1**.

Table 4. UKMPPD Failure Prediction Model

Factor	Multiplier/Selection	Score
Age	Age *4	
Marriage status	Married/Divorced: 0	
	Never Narried: 1	
Economic Status	≥ average: 0	
	≤ average: 21	
Family of Doctor	Yes : 0	
	No: 13	
Off-Campus Tutelage	Tutelage number *1	
	Own University: 17	
Exam Location	Other University: 0	
Depression Score	Score *28	



Gambar 1. ROC Curve of UKMPPD Failure Model

Discussion

Reflecting upon the data collection on 75 Indonesian prospective medical doctors in August 2021, the UKMPPD passing rate is 86.7%. This is in line with the findings of Intan et al. with an 89.09% passing rate in February–May 2019.[16] The rate is satisfactory as it exceeds the national rate from August 2020 to May 2021 (67.52-82.37%).[15]

The intrinsic factor certainly has a profound role in this study. There was an age difference of 2.02 years old between those who failed and passed the UKMPPD. The failure minority also has mostly AB blood type. Mahat et al. corroborate the notion that medical students with AB blood had the lowest scores compared to others (60.3 (10.73)).[17]

ABO blood group was not directly related to the failure. However, it determines the personality in facing challenges or exams and learning methodologies. Blood typing has a significant correlation with his/her ability to be understood (p: 0.002), multiple personality ($p < 0.001$), optimism (p: 0.002), big-hearted ($p < 0.001$), and genius-look ($p< 0.001$).[18,19] Different personalities when learning materials and tackling exams contribute more to the passing rate than expected. For example, extroverted people can help teach their slow peers; further, optimism may become a “temporary” cure for people with mental issues (i.e., depression, anxiety, stress, and panic) agony. Subsequently, these relationships between ABO and UKMPPD indicate differences at the genetic level.

Nevertheless, significance was also found in extrinsic factors: sleep quality, marital status, occupation, and family doctor. Marriage comes with various responsibilities. With the increase in family members, married individuals must invest more time in their partners and households. This reduces the time and concentration of medical students to study and pass the UKMPPD. Beard et al., in their regression, found that marital status had a negative significance on individual academic performance (-0.36 and $p < 0.05$).[20]

For similar reasons, employment status renders someone to have lower academic performance. A recent study by Douglas et al. found that at least 62% of undergraduate students have a job.[21] This situation triggers a decrease in concentration and study time in each individual. Mardelina and Muhson described an essential difference between work, learning activities, and achievement (Δ: 0.16 and 0.10 at p: 0.01).[22]

Moreover, the failure in UKMPPD is also regulated by the quality of sleep. Although not directly related to sleep quality (p: 0.875), academic performance was correlated with components of sleep willingness, time to sleep, bedtime, and hypnotic state ($p < 0.05$).[23] Problems in sleep will interfere with individual academics due to the role of sleep in memory consolidation, concentration, awareness, and stress control. During the rapid eye movement (REM) cycle, slow 10-16 Hz brain waves bridge memory integration between the hippocampus and the long- term memory in the neocortex.[24] These waves occur only during sleep, where there are fluctuations in synchronization of membrane potential among the hyperpolarization and depolarization of cortical neurons.[25] Moreover, inadequate sleep will also rob the energy for individuals to enact their daily activities and studies.People with less than needed sleep (sleep deprivation) can solicit alertness-wakefulness concern (e.g.,

reduced concentration, slower thought process, and depression) while also simultaneously manifesting physical problems (e.g., hypertension, infection due to impaired immunity, obesity, decreased sex drive, andcardiovascular diseases).

Off-campus tutelage, exam locations, participant status, and length of study certainly play a substantial role in the UKMPPD. Individuals with adequate tutoring have more adequate opportunities and learning materials. Abulyatama University medical students had 54.3% passing students who took off-campus tutelage, while 22.9% failed students did not.[26] The tutelage has a high bearing because it enables the prospective medical doctors to learn more UKMPPD materials, especially hand-picked high yield materials with cutting-edge learning methods specific to each tutelage, for example, tacky mnemonics, distinct keywords, and high prevalent topics.

Further, the location of exams at other universities and re-taker status put pressure on individuals. The participants had to remember the UKMPPD material and the layout of the new exam room, and the burden from mental disorders and peers. The 90.0% rate of failure in re-takers is in line with the 2019 study, where it was similarly found that 77.78% of all those who failed UKMPPD were re-takers.27 Nonetheless, only economic status and depression scores were significant after multivariate regression control, while other factors are proven to be confounders.

The relationship between depression and individual academic ability has been examined in numerous studies. Ikhsan et al. found a correlation between individuals' depression levels and passing the block exam (p: 0.004).[28] Meanwhile, Ekawati et al. found that 23.80% of students were depressed doing their thesis.[29]

Depression in prospective medical doctors can be triggered either by internal factors (genetic and experience) or external factors (peer pressure, academic pressure, illness, drugs, and hormones). The workload and academic burden within the medical profession certainly deepen the depression level in every individual. Riandini et al. found that excessive workload for medical students in the pediatrics department was significantly associated with academic stress (OR: 8.569, CI95: 1.914-38.350, p: 0.005).[30] Incidentally, depression within clinical students was different from that of pre-clinical medical students (p:0.018), in which there were 42.5% with mild depression and 5.0% with major depression.[31]

These hormonal instabilities will negatively modulate individuals' perceptions of themselves and their surroundings. They will feel isolated, difficult to enjoy life, and interfere in daily activities. Amotivation, anhedonia, and irritability due to this dopamine disorder concoct difficulties in learning, sleeping, eating, and activities leading to academic setbacks and UKMPPD failure. A study at the Malang Islamic University corroborates these findings by showing a solid and significant correlation between depression and the UKMPPD passing rate (r: 0.675 and $p < 0.001$).[27]

On the other hand, a prominent role for the UKMPPD comes from economic status. Thecost of continuing studies in the medical major is not negligible. Based on thegovernment regulations by the Minister of Research, Technology and Higher Education (Permenristekdikti) No. 18 of 2018 article 26, institutions may determine their educational costs but have to remain

affordable and within the range defined by the government.[32] If the particular institution adopts class c fees in selecting operational cost programs, then the education fee ranges from 150-300 million rupiah. Gadjah Mada University charges a single tuition fee (UKT) for medical majors ranging from 45-65 million rupiah for undergraduates and professionals based on the Gadjah Mada University Chancellor Decree of 515/UN1.P/KPT/HUKOR/2021.[33] The after- mentioned cost does not include fees of the semester, buildings, laboratories, internships, and many others.

Consequently, financial maturity is absolute for individuals who study medicine and their families. Individuals from lower-middle- income families may view these costs as a challenge that disrupt learning. A part-time job or working with parents to earn an income dreadfully reduces study time, interferes with concentration, and consumes energy. Economic incapacity additionally restricts a person from using technology or tutoring to achieve academic success. Razak et al. portray that students' financial conditions affect academic performance tremendously (B: 0.201 and $p < 0.001$).[34] Meanwhile, some medical students may opt to flunk the UKMPPD not to become a financial burden to themself and their families.

On the contrary, the present study bridges individuals and institutions with the curriculum of the medical profession and the need for doctors in Indonesia. Urgent and strict revisions on the medical curriculum amid the current COVID-19 pandemic are vital. Even actions such as identifying the influencing factors of UKMPPD may be the ray of light for Indonesia to see more competent doctors in the future, which can help fight the pandemic. The upsurge of decent medical doctors within the fourth most populated Southeast Asia archipelago hoped to restore the healthcare system, the equitable spread of healthcare personnel, and the medical trust of the citizens to the doctors.

However, the study has limitations on its design, the minimal number of samples, and the use of online questionnaires, leading to recall and selection bias. Yet, these things cannot be denied or salvaged because of the impact of the COVID-19 pandemic restrictions. Further studies on the topic may include greater sample size and prospective nature to open up a more accurate frontier in determining the malefactor failure factors and finally giving Indonesia the healthcare system it needs.

Conclusion

Various intrinsic, extrinsic, and academic factors have significant roles in the failure of UKMPPD. For this reason, UKMPPD preparation is crucial among individuals and institutions. The study also provides feedback to individuals and institutions about the importance of mental health and economic status for Indonesian medical students.

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