Assessing the impact of cognitive competencies on the success in physician licensure examination: a case-control study*

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Abstract

Introduction In the realm of education and professional licensure, the assessment of individuals' competencies is pivotal in determining eligibility for entry into various fields of practice. Medical school assessments encompass cognitive and non-cognitive measures. The Philippines' Physician Licensure Examination (PLE) relies solely on cognitive assessment. This study explored the predictive power of cognitive assessment in the passing the Physician Licensure Examinations.

Methods A case-control study design was done. Cognitive examination grade was defined as the average cumulative grade of written examinations in specific subjects, while the dependent variable was PLE scores.

Results The study revealed a positive association between failing written examinations and failing the Physician Licensure Examination. In all subjects, there is an observed association, but only Pharmacology reached statistical significance (OR: 2.30 CI:1.01,5.24). For the remaining subjects, although there is an association, it did not reach statistical significance (Biochemistry OR:1.42, CI: 0.43, 4.72; Medicine 3 OR:1.56, CI: 0.81, 3.0; Surgery 3 OR:1.28 CI: 0.63, 2.58). There was no association seen between failing the written examination and failing the PLE in Obstetrics (OR:0.98 CI: 0.47, 2.03). Furthermore, there was a weak positive correlation (0.18-0.31) between written examination grades and corresponding board exam subject grades for all subjects, highlighting the importance of cognitive assessments in predicting success. The research also found a statistically significant difference in PLE grades between those who failed the written examinations and those who passed.

Conclusion These findings emphasized the crucial role of cognitive assessments in predicting success in the PLE and its associated board subjects. The study underscored the need for medical institutions to focus on strengthening cognitive competencies and to align the content and rigor of written examinations with the PLE. Addressing these issues would better prepare students for the licensure examination and enhance the quality of healthcare professionals entering the workforce. The results may contribute to the ongoing discussion on the effectiveness of assessment methods in medical education and licensure examinations.

Key words: Cognitive assessment, physician licensure examination, correlation, association, case-control

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In the realm of education and professional licensure, the assessment of individuals' competencies is pivotal in determining eligibility for entry into various fields of practice. National licensure examinations, which serve as gatekeepers to professions ranging from medicine and law to teaching and engineering, are designed to evaluate a candidate's readiness

and competence. The successful prediction of an individual's performance on these examinations is of immense importance, not only to the candidates themselves but also to the institutions responsible for conducting the assessments and the professions they serve.[1,2,3]

Medical school assessments can be classified into cognitive and non-cognitive measures. Cognitive measures include Grade Point Average (GPA), Medical College Admission Test (MCAT) scores, and other traditional academic indicators of knowledge and intellectual abilities. Non-cognitive measures, on the other hand, focus on attributes such as communication skills, problem-solving abilities, professionalism, and interpersonal skills.[4] The relationship between these assessment types and success on national licensure examinations has been examined. Research has indicated that both cognitive and non-cognitive assessments are important predictors of success on national licensure examinations in medical school.[5,6,7,8]

The PLE in the Philippines, however, is solely based on cognitive assessment as in other parts of the world (US, UK and Australia).[9,10,11] The academic competence of medical students, however, is assessed based on both cognitive and non-cognitive assessments.[12] With the addition of the non-cognitive domain, the cognitive adequacy of the students may be overestimated leading to their passing of the academic curriculum but, subsequently, failing the board examination. This study aimed to investigate whether cognitive assessment, represented by written examination grades, could predict success in the PLE. This emphasized the need for the medical school to fortify the cognitive preparations of the students and take full responsibility for assessing the non-cognitive domain of education.

Methods

After receiving approval from the UERMMMC Ethics Review Committee, a case-control study design was done to explore the relationship between cognitive assessment and success in the PLE. Cognitive examination grade was defined as the average cumulative grade of written examinations in specific subjects. The dependent variable was the scores in selected PLE subjects, while the independent variable was the cumulative grade in written examinations during the academic years. Data from students who took the PLE from March 2021 to October 2022 were collected, including their long examination grades. Cases were identified as those who passed the PLE and controls were those who failed the physician licensure examination.

Using convenience sampling, the authors identified 75 students who failed and 75 students who passed the PLE from March 2021 to October 2022. The minimum required sample size is 77 based on the computation of sample size for a correlational study with a 0.05 type 1 error rate and 0.80 type 2 error rate and a correlation of 0.3150 based on a preliminary study conducted to determine sample size.[13] The data on the academic grades were obtained from the different departments. The names of the students were given to the chair and the average grades for the written examinations were asked.

Odds ratio with 95% confidence interval was determined for the following: association of failing the written examinations with passing the PLE; association of failing the written examinations with failing the corresponding board exam subjects. The chi-square test or Fisher exact test was used as appropriate to determine statistical significance. A p-value of <0.05 was deemed statistically significant. Pearson's correlation was used to determine the magnitude of the correlation between the written examination grades and the corresponding grades in the board exam subjects. Independent T-test was used to determine statistically significant difference in the PLE scores of those who passed versus those who failed the written examinations.

Results

The study identified a statistically significant positive correlation between failing written examinations and failing the PLE. While an association was observed across all subjects, only Pharmacology demonstrated statistical significance (OR: 2.30, 95% CI: 1.01-5.24). For other subjects, although an association was noted, it did not reach statistical significance (Biochemistry OR: 1.42, 95% CI: 0.43-4.72; Medicine OR: 1.56, 95% CI: 0.81-3.0; Surgery OR: 1.28, 95% CI: 0.63-2.58). No association was found between failing the written examination and failing the games in Obstetrics (OR: 0.98, 95% CI: 0.47-2.03) (Table 1).

In Table 2, there is a statistically significant positive association between those who failed the written examination and those who failed the corresponding board subjects for Biochemistry (OR 5.5 ,CI: 1.10, Pharmacology OR: 2.44 CI: 1.07,5.54 and OB OR: 2.58, CI: 1.22, 5.47)); . For the remaining

Table 1. Association of written exams to failing PLE.

	Failed PLE	Passed PLE	OR (95% CI)	p value
Biochemistry			1.42	0.56
Failed Written Exam	27	19	0.43 to 4.72	
Passed Written Exam	7	7		
Total	34	26		
Pharmacology				
Failed Written Exam	40	32	2.31	0.04
Passed Written Exam	13	24	1.02 to 5.24	
Total	53	55		
Medicine Year 3				
Failed Written Exam	39	30	1.56	0.18
Passed Written Exam	35	42	0.81 to 3.00	
Total	74	72		
Surgery Year 3				
Failed Written Exam	29	26	1.28	0.49
Passed Written Exam	34	39	0.63 to 2.58	
Total	63	65		
Obstetrics Year 2				
Failed Written Exam	20	20	0.98	0.96
Passed Written Exam	53	52	0.47 to 2.03	
	73	72		

Table 2. Association of failing written exam to failing corresponding board exam subjects.

	Failed corresponding board subjects	Passed corresponding board subjects	OR (95% CI)	p value
Biochemistry				0.03
Failed	22	24	5.50	
Passed	2	12	(1.10 to 27.37)	
Pharmacology				0.03
Failed	41	31	2.44	
Passed	13	24	(1.07 to 5.54)	
Medicine				
Failed	33	36	1.70	0.12
Passed	27	50	(0.87 to 3.30)	
Surgery				0.05
Failed	29	26	2.02	
Passed	27	49	(0.99 to 4.10)	
Obstetrics				0.01
Failed	21	18	2.58	
Passed	33	73	(1.22 to 5.47)	

subjects, although there is an association, it did not reach statistical significance (Medicine 3 OR: 1.70, CI:0.87, 3.30 and Surgery 3 OR: 2.02, CI: 0.99, 4.11)

There is a statistically significant weak positive correlation between the written examination grades and the corresponding board exam subject grades for all subjects (Table 3).

There is a statistically significant difference in the PLE grades of those who failed the written examinations versus those who passed the written examinations. The mean difference ranges from 2.5 to as high as 6 points. On the average, those who failed their written examinations also failed their PLE and those who passed their written examinations also passed their PLE (Table 4).

In Table 5, the optimal cut off scores to ensure passing the PLE were: a general weighted average of 2.96, an NMAT score of 87 and a passing grade for each subject. To ensure passing the specific subjects, the optimal cut off score was at least 75 (Table 6).

Table 3. Correlation of written grade per subject to corresponding board exam subjects results.

Subject	Pearson's r	95% CI	p value
Biochemistry Year 1	0.3150	0.07 to 0.52	0.01
Pharmacology Year 2	0.3025	0.12 to 0.46	0.001
Medicine Year 3	0.2627	0.10 to 0.40	0.001
Surgery Year 3	0.2155	0.04 to 0.37	0.01
Obstetrics Year 3	0.1863	0.02 to 0.33	0.02

Table 4. Comparison of the mean score in the corresponding subjects in the Board exams of those who failed and passed their subjects.

	PLE grade of those who failed the written exams	PLE grade of those who passed the written Exams	Difference	p value
Biochemistry Year 1	72.15 ± 8.44	78.21 ± 5.686	6.06 ± 2.41	0.01
Pharmacology Year 2	71.15 ± 7.88	75.68 ± 6.66	4.52 ± 1.51	0.003
Medicine Year 3	71.97 ± 7.63	74.51 ± 5.64	2.54 ± 1.10	0.02
Surgery Year 3	71.44 ± 7.83	74.43 ± 6.14	2.99 ± 1.22	0.01
Obstetrics Year 3	72.30 ± 7.26	75.41 ± 5.14	3.110 ± 1.08	0.004
Overall	71.73 ± 7.78	75.10 ± 5.76	3.370 ± 0.56	<0.0001

Table 5. ROC curve analysis of optimal cut off for passing board exams.

Subject	Optimal cut off score	Sensitivity	Specificity
GWA (medicine)	2.96	0.96 (0.89 to 0.99)	0.19 (0.10 to 0.29)
NMAT	87.00	0.51 (0.39 to 0.62)	0.73 (0.61 to 0.83)
Biochemistry	75.64	0.38 (0.20 to 0.59)	0.76 (0.59 to 0.89)
Pharmacology	75.16	0.625 (0.48 to 0.75)	0.60 (0.46 to 0.73)
Medicine	75.71	0.56 (0.43 to 0.67	0.64 (0.51 to 0.74
Surgery	75.53	0.71 (0.58 to 0.81)	0.43 (0.30 to 0.56)
Obstetrics	75.68	0.25 (0.16 to 0.37)	0.82 (0.71to 0.90)

Table 6. ROC Curve analysis of optimal cut off for passing corresponding board exam subjects.

Subject	Optimal cut off score	Sensitivity	Specificity
Biochemistry	75.06	0.75 (0.58 to 0.88)	0.58 (0.37 to 0.78)
Pharmacology	75.55	0.73 (0.39 to 0.86)	0.72 (0.58 to 0.83)
Medicine	75.7	0.76 (0.45 to 0.86)	0.67 (0.53 to 0.78)
Surgery	75.04	0.65 (0.53 to 0.76)	0.57 (0.43to 0.70)
Obstetrics	75.29	0.75 (0.64 to 0.83)	0.46 (0.32to 0.60)

Discussion

The results of this study provided valuable insights into the relationship between cognitive assessments, specifically written examination grades, and success in the PLE as well as its impact on corresponding board exam subjects. These findings may have significant implications for medical education and the predictive power of cognitive assessments.

The grading system of the medical school consisted of cognitive assessment composed mainly of written examinations and non-cognitive assessments composed of grades on clinical preceptor sessions, peer evaluations, manual submissions and others.[14] There were some students who did not pass any single written examination but were able to pass the subjects because of the non-cognitive assessments. This research determined if the students who passed the subjects because of the non-cognitive assessments despite failing the written examination would pass the PLE.

Association Between Failing Written Examinations and PLE Success

The research identified a statistically significant positive association between those who failed the written examination, and those who subsequently failed the PLE. This finding underscores the importance of cognitive assessments in predicting PLE outcomes and the need for a strong foundation in these subjects. Moreover, there was a significant positive moderate relationship between academic performance and licensure performance. Similar studies showed that students who have good academic grades passed and attained a higher rating in the PLE.[15,16]

Association of Failing Written Examinations with Corresponding Board Subjects

The study also revealed a significant positive association between failing the written examination and failing the corresponding board exam subjects like Biochemistry, Pharmacology, Surgery, and Obstetrics. For instance, graduates who failed the Biochemistry exam in the PLE were 5.5 times as likely to have failed the written examin Biochemistry during their medical course. These results highlighted the strong predictive power of cognitive assessments in determining performance in both written exams and board subjects.[16]

Correlation Between Written Examination Grades and Board Examination Subject Grades

The data showed a statistically significant weak positive correlation between written examination grades and the corresponding board examination subject grades for all subjects studied. The higher the examination grades, the higher the corresponding board examination subject grades. This correlation suggests that students who perform well in written examinations tend to excel in the corresponding board subjects, emphasizing the role of cognitive assessments as a predictor of success. A similar study for nursing students showed that all six subjects in the board examination were significantly correlated with academic performance in the individual subjects. The Academic Performance significantly predicted the Licensure Performance. This direct relationship implied that when academic performance was high, board rating also was high.[17,18]

Difference in PLE Grades

The research uncovered a statistically significant difference in PLE grades between those who failed the written examinations and those who passed. The mean differences ranged from 2.5 to as high as 6 points. Moreover, students who failed their written examinations also failed their PLE, while those who passed their written examinations also passed their PLE. This finding reinforces the strong link between performance in written assessments and overall success in the PLE.

These findings have important implications for medical education and assessment practices. It highlights the necessity of focusing on cognitive competencies, and the need for early intervention and targeted support for students who struggle in these areas. These results should prompt medical educators to consider assessing whether students who failed the written examination should be permitted to pass the subjects based on their non-cognitive assessments, which may have elevated their overall grades. Additionally, these results emphasize the importance of aligning the content and rigor of written examinations with the content of the PLE, thereby ensuring that students are adequately prepared for the licensure examination.

Conclusion

In conclusion, the study's results underscored the pivotal role of cognitive assessments in predicting success in the PLE and its associated board subjects. By recognizing the significance of cognitive competencies in medical education and licensure, educational institutions can develop strategies to enhance student performance and, ultimately, the quality of healthcare professionals entering the workforce. These findings may contribute to the ongoing discussion on the effectiveness of assessment methods in medical education and licensure examinations. They may also guide medical schools in enhancing their cognitive preparations for students and in comprehensively assessing non-cognitive domains to better prepare future medical professionals. The weighting of non-cognitive assessments in the overall grade should be carefully considered. While they provide valuable information, they should not overshadow the importance of cognitive assessments which play a significant role in passing the licensure examination as shown in this study.

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