Pre-Clinical Grades Predict Clinical Performance in the MBBS Stage II Examination at the University of the West Indies, Mona Campus

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Summary: In the preclinical sciences, statistically significant predictive values have been reported between the performances in one discipline and the others, supporting the hypothesis that students who perform well in one discipline were likely to perform well in the other disciplines. We therefore decided to conduct a retrospective study to investigate the predictive effects of preclinical subjects on clinical subjects from 87 students of The University of the West Indies (UWI), Mona Campus who took the MBBS Stage II examination at various times between May 2000 and May 2002. The grade in Pathology was significantly predicted by scores in Anatomy and Pharmacology; Medicine by Physiology and Pharmacology scores; Surgery by Anatomy and Social and Preventive Medicine scores; while, the Obstetrics and Gynecology grade was predicted by the Anatomy score. The results support the hypothesis that the scores in some preclinical subjects can predict the performance in specific clinical subjects, which could be interpreted to suggest that poor performance in specific preclinical disciplines could be a warning sign of future poor performance in the related clinical disciplines.

Keywords*:* Medical education, preclinical grades, clinical grades, predictors of performance

INTRODUCTION

We had previously reported the content and format of the preclinical MBBS Stage I examination consisting of Anatomy, Biochemistry, Pharmacology, Physiology and Social and Preventive Medicine at The University of the West Indies (UWI), Mona Campus between December 1997 and May 1999 (Pepple et al, 2012). The MBBS Stage II examination was the final examination of clinical training by the same cohort of students at UWI and was staggered over a five semester period. It consisted of Pathology, Medicine, Surgery, and Obstetrics and Gynecology. Pathology was the first examination to be taken in May 2000 followed by the examinations in Medicine, Surgery, and Obstetrics and Gynecology at the end of the clinical training in May 2002.

In the preclinical or basic medical sciences disciplines, significant correlation and predictive values have been reported for Anatomy, Biochemistry, Pharmacology, Physiology and Social and Preventive Medicine (Pepple et al, 2012*)* as well as for scores in Biochemistry, Pharmacology and Anatomy (Hamdi et al, 2000), Biochemistry and

Pharmacology (Kwanashie and Abdu-Aguye, 1990) and Anatomy, Physiology and Biochemistry (Salahdeen and Murtala, 2005), respectively. Lavine and Watkins (1999) reported that the performance of students in the basic medical sciences can be used as a predictor of clinical science performance. They can also be used as predictors of performance in licensure examinations (Donnelly et al, 1986; Hyde et al, 1987; Swanson et al, 1996; Wilkinson and Frampton, 2004).

Kozar et al (2007) previously reported that the score in the Pathology examination was the strongest predictor of performance in the National Board of Medical Examiner's Surgery Subject examination (NBME-SS); while the score in Medical Gross Anatomy was the strongest predictor of performance in the United States Medical Licensing Examination (USMLE) Step 1 examination (Peterson and Tucker, 2005). Similarly, the score in an Introduction to Clinical Medicine examination was also reported to be significantly predicted by scores in first year microanatomy, physiology and microbiology grades (Lavine and Watkins, 1999). Additionally, the overall

preclinical grade point average (GPA) was reported to be positively correlated with the final Doctor of Medicine (MD) grade, such that students with GPA scores of less than 2.0 were found to have spent a longer than expected time in the medical program (Al-Wardy et al, 2009). However, a weak predictive value has been reported for preclinical basic sciences and clinical sciences in dental education (Potter et al, 1982), as well as, between organ system courses and clinical science courses (Shaban and McLean, 2011). There was no correlation reported between the total clinical grade and the NBME examination grade in Psychiatry (Ramchandani, 2011).

From the foregoing reports, there seems to be no consensus on the predictive values of preclinical subjects on clinical subjects. This comprehensive study, involving all the preclinical and clinical subjects undertaken at UWI, Mona Campus, during the period December 1997 to May 2002 by the same cohort of students was therefore designed to investigate the predictive value of Anatomy, Biochemistry, Pharmacology, Physiology, and Social and Preventive Medicine on the clinical subjects of Medicine, Pathology, Obstetrics and Gynecology and Surgery. We hypothesize that the predictive values of the preclinical subjects on clinical subjects could be a useful tool, particularly in medical schools that use the discipline-based mode of teaching/learning in order to identify students who are weak and may require early intervention.

MATERIALS AND METHODS

This retrospective study analyzed the grades of a cohort of 87 students who sat the MBBS Stage II examination between May 2000 and May 2002 as well as 97 medical students from the same cohort who had previously sat the MBBS Stage I examination between December 1997 and May 1999. We were unable to make any useful comparisons with data after 2002 as there was a transformation of the medical program in the Faculty of Medical Sciences at UWI, Mona Campus, from a discipline-based to a system-based curriculum in 2001.

Data were collected from records in the Department of Basic Medical Sciences and from the Office of the MBBS Program Director. The study was approved by the Ethics Committee of the Faculty of Medical Sciences, UWI at the Mona Campus. Confidentiality was maintained as there was no disclosure of the names of the students whose data were used.

The examinations consisted of both multiple choice questions (MCQ), short essay questions and objective structure clinical examination with a *viva voce* examination for the students who were on the pass/fail borderline (i.e. achieving a score of between 45% - 49%) and those on the borderline for honors

(achieving a score of between 60% - 64%) and distinction (achieving a score of between 70% - 74%). The Pathology examination consisted of a MCQ paper consisting of 100 questions with duration of 3 hours, 5 short essay questions made up of Anatomical Pathology, Microbiology, Chemical Pathology and Hematology with duration of 80 minutes, and an objective structured clinical examination consisting of 30 questions with duration of 90 minutes. The examination in Medicine, Obstetrics and Gynecology and Surgery are made up of a MCQ paper consisting of 100 questions with duration of 3 hours, short answer questions with duration of 2 hours, and a clinical component made up of objective-structured clinical examination (OSCE) with duration of 30 minutes for each student.

Statistical Analysis:

The data were analyzed using the SPSS Statistical package for means, standard deviation, Pearson's correlation, Chi-squared test, ANOVA and stepwise multivariate regression analyses with the level of statistical significance taken at the level of $p < 0.05$.

RESULTS

A total of 87 students sat the examination in Pathology. This is because 10 students failed one or more of the preclinical subjects and were therefore not eligible to continue with this cohort. A total of 77 students sat the Medicine, Obstetrics and Gynecology and Surgery examinations. This is because ten students who sat the Pathology examination were not eligible to proceed with their cohort. The mean scores, ranges and number of students who obtained a pass grade (i.e. obtained a grade of 50% - 64%), received honors (65% -74%) and distinctions (75% - 100%) and those who failed (scored less than 50%), are shown in Table 1. There was no statistically significant difference between the grades, with Surgery having the lowest average grade (52%) and Medicine having the highest average grade (57%). Pathology had the highest number of failures (7) with Medicine (1) and Surgery (2) having the lowest numbers of failures. There was no failure in Obstetrics and Gynecology. Table 2 shows the correlation matrix of scores in all the subjects. They were all significantly correlated with one another. The predictive values of the preclinical subjects using a stepwise multivariate analysis are shown in Table 3. Grade in Pathology was significantly predicted by the grades in Pharmacology and Anatomy. Grade in Medicine was significantly predicted by the grades in Physiology and Pharmacology. Grade in Surgery was significantly predicted by the grades in Anatomy and Social and Preventive Medicine. The grade in Obstetrics and Gynecology was significantly predicted by the grades in Anatomy.

Pre-clinical grades predict clinical performances

Table 1: Grades Achieved in the MBBS Stage II Examination in Pathology, Medicine, Surgery and Obstetrics and Gynecology.

	Mean ± SD (Range) %	Pass (50% – 64%)	Honors (65% – 74%)	Distinction (75% – 100%)	Fail (0% – 49%)
Pathology (N = 87)	55.10±6.61	73	6	1	7
Medicine (N = 77)	57.82±3.48	74	2	-	1
Surgery (N = 77)	52.94±3.28	74	1	-	2
Obs & Gyn (N = 77)	54.74±3.75	72	4	1	-

Table 2: Correlation Matrix of Scores Obtained in Pathology, Medicine, Surgery and Obstetrics and Gynecology.

	Pathology	Medicine	Surgery	Obstetrics & Gynecology
Pathology	---------	r = 0.669 p = 0.01	r = 0.455 p = 0.01	r = 0.307 p = 0.007
Medicine	r = 0.669 p = 0.01	------------	r = 0.501 p = 0.01	r = 0.302 p = 0.008
Surgery	r = 0.455 p = 0.01	r = 0.455 p = 0.01	-----------	r = 0.355 p = 0.02
Obstetrics & Gynecology	r = 0.307 p = 0.007	r = 0.302 p = 0.008	r = 0.355 p = 0.02	-----------

Table 3: Predictors of Scores Obtained in Pathology, Medicine, Surgery and Obstetrics and Gynecology by the preclinical subjects using a stepwise multivariate regression analysis

Dependent variable	Predictors	Beta-coefficient	p-value
Pathology	Pharmacology	0.552	0.01
	Anatomy	0.322	0.01
Medicine	Physiology	0.422	0.01
	Pharmacology	0.304	0.02
Surgery	Anatomy	0.356	0.03
	Social and Preventive Medicine	0.269	0.02
Obstetrics & Gynecology	Anatomy	0.410	0.01

Table 4: Predictors of Scores Obtained in Pathology, Medicine, Surgery and Obstetrics and Gynecology using a stepwise multivariate regression analysis

Dependent variable	Predictors	Beta-coefficient	p-value
Pathology	Medicine	0.669	0.01
Medicine	Pathology	0.554	0.01
	Surgery	0.252	0.01
Surgery	Medicine	0.437	0.01
	Obstetrics & Gynecology	0.228	0.03
Obstetrics & Gynecology	Surgery	0.356	0.02

The predictive values of the clinical subjects are shown in Table 4. The Pathology grade was significantly predictive of the grade in Medicine. The grade in Medicine was significantly predicted by the grade in Surgery, while the grade in Surgery was significantly predicted by grades in Medicine and Obstetrics and Gynecology. Also, the grade in Obstetrics and Gynecology was significantly predicted by the grade in Surgery.

The grades for the performance of students in the MBBS Stage I examination were previously reported in Pepple et al, (2012).

DISCUSSION

The results of this study show that some of the preclinical subjects have positive predictive values on the performance of some clinical subjects. This is in agreement with previous studies (Lavine and Watkins, 1999; Peterson and Tucker, 2005; Kozar et al 2007) that reported strong predictive effects of preclinical subjects on clinical subjects. The Pathology score in the second year was found to be the strongest predictor of third year NBME surgery score, possibly because the integrative thinking and clinical application skills requisite for surgical decision-making are usually first required of preclinical students during their pathology course (Kozar et al., 2007). Similarly, the gross anatomy score was reported as a good predictor of passing the USMLE Step 1 examination because more than 90% of the questions are multiple-choice in format and are typically phrased as clinical scenerios that resemble the examination format and content of the USMLE Step 1 examination (Peterson and Tucker, 2005).

The analysis of the performance of students in preclinical sciences is a useful instrument to help identify "at risk" students for early intervention (Kozar et al 2007; Shaban and McLean 2011) as well

as determine other variables that affect performance in clinical subjects while selecting students for admission into medical schools (Ramos et al, 1986).

Other reports that showed weak (Shaban and McLean 2011) or no predictive effect (Ramos et al, 1986; Ramchandani, 2011) investigated the effects of other variables such as preschool grades, admission scores and interpersonal attributes.

Although Ramchandani (2011) did not report any predictive effect of preclinical psychiatry grade on the NBME examination, the report showed that students with stronger interpersonal attributes performed better on the NBME psychiatry examination.

The dental preclinical sciences had a weak predictive value on the clinical sciences because they differ in context. Communication skills, decision making and management are some of the issues encountered in the clinical sciences which are not common to the preclinical sciences (Curtis et al, 2007).

We were unable to confirm the statement by Kies et al (2010) that the clerkship order was significantly associated with the clerkship examination score but not on USMLE Step 2 score, as all the clinical clerkships in the present study began at the same time and the final examinations were also taken at the same time, except for Pathology that was taken earlier.

In conclusion, the result of this study has confirmed our earlier hypothesis (Pepple et al, 2012) that performance in some preclinical subjects can predict performance in related clinical subjects and that this predictive value could be used to identify students at risk for early intervention.

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