Original Article

Effect of age, premedical academic performance, and entry bias on students' performance in final preclinical examination at the University of Nigeria Medical School

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Abstract:

BACKGROUND OF THE STUDY: There is a strong correlation between admission requirements and students' academic performance. The aim of this study is to evaluate the effect of age, premedical academic performance, and entry bias on students' performance in final preclinical examination at the University of Nigeria Medical School.

METHODS: Data were obtained from files of students admitted into the medical school in the 2010/2011, 2011/2012, and 2012/2013 academic sessions. SPSS (version 20.0, IBM computer USA) was used to analyze the data, and statistical tests such as ANOVA, Pearson's correlation, and regression analysis were used to analyze the observations.

RESULTS: The younger students performed significantly better than their older counterparts in the final preclinical examination, determined by one-way ANOVA ($P < 0.05$). Students with high 100 level CGPA performed significantly ($P < 0.05$, ANOVA) better than those low CGPA. Only 100 level CGPA can predict students' academic performance in the final preclinical examination ($R^2 = 83.1\%$, $P < 0.05$).

CONCLUSION: Age is an important criterion in the admission process. O-level grades, Unified Tertiary Matriculation Examination (UTME), and University of Nigeria Nsukka (UNN) post-UTME are reliable criteria for admission; however, of these, only 100-level CGPA can be used to predict students' performance final preclinical examination.

Keywords:

Entry bias, medical education, preclinical examination, second MBBS, students' performance

Introduction

Several studies have documented that there is a strong correlation between admission requirements and students' performance and the number of graduates produced (Hansel *et al.,* 2010; Urlings-Strop *et al.,* 2009; Al Nasir and Robertson, 2009). Literature on students' performance in preclinical examination in Nigeria has often reported poor academic performance and increasing rates of attrition (Egwu and Anyanwu, 2010; Salahdeen and Murtala, 2005; Adegoke and Noronha, 2002; Bamgboye *et al.*, 2001; Olaleye and Salami, 1997).

Admission requirement into a Nigerian University includes a preadmission

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academic attainment and an admission test. University of Nigeria Medical College is one of Nigeria's premier college of medicine. Admission into the college can be through the Unified Tertiiary Matriculation Examination (UTME) or by Direct Entry (DE).

Secondary school certificate examination (SSCE) or O-level is the preadmission academic qualification. Candidates should possess at least credit in five subjects. Admission test includes the UTME conducted by JAMB and the post-UME conducted by the University. Admission through DE, a higher school certificate, or its equivalent is considered as a preadmission academic requirement.

Progression to the preclinical stage, for those admitted via UTME, requires that the students go through a 100 level or a part 1 (science) program, where they are tutored and then examined in biology, botany, chemistry, mathematics, and zoology. Candidates who pass all 100-level courses advance to the preclinical section (the basic medical sciences). DE students are admitted into 200 level. They are then taught anatomy, biochemistry, and physiology and then examined in the final preclinical examination.

Age, mode of entry, admission test (UTME and post-UTME), preadmission academic qualification (O-level result), and 100-level CGPA (premedical academic performance) may affect the performance of students in final preclinical examination (Bamgboye *et al*., 2001). Previous studies in Nigeria showed that younger students performed better than their older counterparts in medical school examination (Olaleye and Salami, 1997; Salahdeen and Murtala, 2005; Egwuatu and Umeora, 2007). Afolabi *et al*. (2007) in a study on the effect of the mode of entry into medical school on academic performance showed that predegree scores correlated better than the UTME scores.

Research done by Bamgboye *et al*. (2001) showed that candidates with high UTME scores often do not do well in University examination; the probability of such occurrence has prompted Nigerian universities to conduct their own additional admission screening. Lievens *et al*, (2009) also elucidated that cumulative grade point average is the most common predictor of academic performance.

In view of the roles of age, premedical academic performance and entry bias could have on academic performance the aim of this study is to evaluate the effect of age, premedical academic performance and entry bias on students' performance in final preclinical examination at the University of Nigeria Medical School.

Materials and Methods

Files of students admitted into the medical school in the 2010/2011, 2011/2012, and 2012/2013 academic sessions were obtained from the Faculty of Medical Sciences. Data evaluated included students' biodata (age and sex), mode of entry, UTME and post-UTME scores, O-level grades in English, Mathematics, Biology, Chemistry, and Physics, and 100-level CGPA. The performance indices used were the anatomy, medical biochemistry, and physiology scores in the final preclinical examination.

Statistical analysis

Data were analyzed using Statistical package for social sciences (SPSS) version 20 (IBM computers USA). ANOVA was used to examine if there was any relevant difference in student performance in the final preclinical examination compared to age range, mode of entry, UTME and UNN post-UTME scores, 100 level CGPA, and O-level results. $P = 0.05$ or less was considered as statistically significant. Pearson's correlation was conducted between the quantitative variables of interest to test for linear relationship between student performance in the final preclinical examination and some of the mentioned entry bias. Stepwise regression was used to find out what factor can predict student performance in the final preclinical examination.

Results

A total of 386 student data were analyzed, which consist of 291 (75.4%) males and 95 (24.6%) females. The mean age, UTME score, UNN post-UTME score, and 100-level CGPA are 19.4 ± 3.3 years, 264.3 ± 24.0, 287.6 ± 34.5, and 3.8 ± 0.7, respectively. The mean score in anatomy, medical biochemistry, and physiology are 50.2 ± 11.1, 53.0 ± 12.3, and 50.8 ± 9.3, respectively.

The result on Table 1 showed that younger students performed significantly better than their older counterparts in the final preclinical examination, determined by one-way ANOVA ($P < 0.05$).

DE students had higher scores in final preclinical anatomy, medical biochemistry, and physiology than UTME students, and UTME students had higher scores than change of degree students. This was however, not statistically significant, one-way ANOVA ($P > 0.05$).

Students with higher UTME and UNN post-UTME scores had significantly higher mean scores in final preclinical anatomy, medical biochemistry, and physiology, one-way ANOVA ($P < 0.05$).

Students with higher 100-level CGPA had significantly higher mean scores in final preclinical anatomy, medical biochemistry, and physiology, one-way ANOVA ($P < 0.05$).

Table 1: Final preclinical mean examination scores by age, premedical academic performance and entry bias

Age range (years)

	16-18	19-21	22-24	≥25	Total	P
n	213	98	44	31	386	
Anatomy Score (mean±SD)	52.6±10.2	49.2±10.4	45.8±12.6	43.9±11.8	50.2±11.1	0.00
Medical biochemistry Score (mean±SD)	54.9±11.9	52.5±12.1	48.5±13.1	47.8±10.7	53.0±12.3	0.00
Physiology Score (mean±SD)	52.8±8.9	49.6±9.6	47.3±8.7	45.5±9.0	50.8±9.3	0.00

Mode of entry

	UTME	COD	Direct entry	Total	P
n	359	16	11	386	
Anatomy Score (mean±SD)	50.3±11.0	47.8±14.2	53.8±8.1	50.2±11.1	0.37
Medical biochemistry Score (mean±SD)	53.0±12.1	49.1±16.0	58.3±6.2	53.0±12.3	0.16
Physiology Score (mean±SD)	50.8±9.4	48.7±9.9	54.3±5.9	50.8±9.3	0.31

UTME score

	200-219	220-239	240-259	260-279	≥280	Total	P
n	9	50	118	94	104		
Anatomy Score (mean±SD)	42.7±14.7	47.1±12.2	49.8±10.8	50.0±10.2	52.8±11.1		0.01
Medical biochemistry Score (mean±SD)	40.2±17.9	49.3±13.0	52.6±12.2	53.1±11.1	55.7±11.9		0.00
Physiology Score (mean±SD)	43.3±11.1	46.7±10.3	49.2±9.3	51.6±8.0	54.0±9.2		0.00

UNN post-UTME score

	200-219	220-239	240-259	260-279	≥280	Total	P
n	17	17	35	58	58	259	
Anatomy Score (mean±SD)	42.0±10.8	47.6±9.8	47.1±12.4	50.7±10.1	60.4±6.0	51.2±11.0	0.01
Medical biochemistry Score (mean±SD)	40.7±13.8	46.7±9.9	48.3±14.0	53.0±12.3		54.8±11.4	0.00
Physiology Score (mean±SD)	43.3±10.6	47.8±8.8	46.9±10.0	51.0±8.5		51.9±9.1	0.00

100 L GPA

	1.50-2.39	2.40-3.49	3.50-4.49	≥4.50	Total	P
n	25	84	193	73	375	
Anatomy Score (mean±SD)	34.5±10.8	40.7±9.5	52.7±7.8	60.4±6.0	50.4±11.1	0.00
Medical biochemistry Score (mean±SD)	33.9±10.3	42.2±9.0	55.9±9.0	64.8±6.5	53.2±12.3	0.00
Physiology Score (mean±SD)	38.8±9.8	43.53±7.8	52.4±7.1	58.7±6.5	50.8±9.3	0.00

COD - Change of degree, GPA - Grade point average, UTME - Unified Tertiary Matriculation Examination, SD - Standard deviation, UNN - University of Nigeria Nsukka

The result in Table 2 shows that the students with better grades in O-level English, Mathematics, Biology, Chemistry, and Physics had significantly higher scores in final preclinical anatomy, medical biochemistry, and physiology, one-way ANOVA ($P < 0.05$).

Table 3 reveals that the correlation between scores of final preclinical anatomy, medical biochemistry, and physiology with the mentioned entry bias is as follows:
• A significant negative correlation (r= −0.254, −0.229 and −0.279; $P < 0.01$) with age
• A weak correlation ($r = 0.17$, −0.16 and −0.003; $P > 0.05$) with mode of entry
• A significant correlation ($r = 0.147, 0.161$ and 0.304; $P < 0.01$) with UTME score
• A significant correlation ($r = 0.187, 0.306$ and 0.232; $P < 0.01$) with UNN post-UTME
• Year one (100 level) CGPA correlated strongly ($r = 0.620, 0.694$ and 0.552; $P < 0.01$).

The regression analysis shows that only 100-level CGPA can predict students' academic performance in the final preclinical examination ($R^2 = 83.1\%$).

The regression equation for predicting scores in final preclinical scores from our model ($P < 0.05$) is as follows:
• Anatomy = 11.58+ (10.1 × 100 L CGPA)
• Medical Biochemistry = 4.03+ (12.84 × 100 L CGPA)
• Physiology = 24.23+ (7.06 × 100 L CGPA).

Discussion

The finding of this study reveals that younger students performed significantly better than the older students in the final preclinical examination. This finding is in agreement with previous Nigerian studies which documented that younger students performed better than older students (Olaleye and Salami 1997; Salahdeen and Murtala, 2004; Egwuatu and Umeora, 2007). There are a number of factors that could be responsible for this trend: Older students encounter more obstacles learning and adapting to school life (Dyrbye et al, 2005; Moffat et al, 2004; Park and Adler, 2003; Mosley et al, 1994; Bramnes et al; 1991). A student with such an experience will possibly have a reduced self-esteem and usually may not appear competent. Other workers have also suggested financial problems and family responsibilities as factors that could be responsible for poor academic performance and high fail out rate of older students (Egwuatu and Umeora, 2007; Egwu and Anyanwu, 2010).

There was a significant negative correlation between age and performance (Table 3). An indication that younger students are better motivated to succeed than their older counterparts. Age is a reliable admission criterion. However, the regression analysis shows that age may not be used to predict performance in final preclinical examination.

Table 2: Final preclinical mean examination scores by O-level grades

O-level	A1	Anatomy						
		B2	B3	C4	C5	C6	Total	P
English								
n	4	25	119	73	74	91	386	
Score (mean±SD)	61.0±7.3	52.8±9.7	53.1±10.0	51.2±10.1	47.1±11.6	47.0±11.6	50.2±11.1	0.00
Mathematics								
n	87	51	95	35	51	67	386	
Score (mean±SD)	55.2±8.6	53.9±9.3	50.6±11.1	49.3±9.1	47.0±11.6	43.4±11.5	50.2±11.1	0.00
Biology								
n	41	56	150	65	47	27	386	
Score (mean±SD)	57.6±8.2	54.2±10.0	51.3±9.8	46.6±11.1	45.1±12.5	43.1±10.7	50.2±11.1	0.00
Chemistry								
n	69	51	134	46	41	45	386	
Score (mean±SD)	56.2±9.5	51.7±9.7	52.0±8.9	46.2±11.3	44.1±12.1	43.9±12.6	50.2±11.1	0.00
Physics								
n	72	55	130	42	48	39	386	
Score (mean±SD)	55.1±9.7	54.5±9.4	49.1±10.6	48.1±9.7	46.5±12.3	46.2±12.1	50.2±11.1	0.00

O-level	Medical biochemistry							
	A1	B2	B3	C4	C5	C6	Total	P
English								
n	4	25	119	73	74	91	386	
Score (mean±SD)	57.5±7.0	56.3±9.7	56.4±11.5	53.5±11.8	50.3±13.2	49.2±12.3	53.0±12.3	0.00
Mathematics								
n	87	51	95	35	51	67	386	
Score (mean±SD)	58.7±10.1	56.4±11.3	54.4±10.9	50.7±10.7	49.8±12.6	44.7±12.8	53.0±12.3	0.00
Biology								
n	41	56	150	65	47	27	386	
Score (mean±SD)	61.1±10.0	58.3±10.7	53.7±10.1	48.1±13.5	49.0±13.9	45.1±11.8	53.0±12.3	0.00
Chemistry								
n	69	51	134	46	41	45	386	
Score (mean±SD)	60.8±9.1	53.7±11.9	54.8±10.0	47.8±12.5	47.3±12.3	45.4±13.9	53.0±12.3	0.00
Physics								
n	72	55	130	42	48	39	386	
Score (mean±SD)	57.7±11.9	57.8±10.7	52.5±11.6	51.6±10.5	48.0±12.9	47.4±13.8	53.0±12.3	0.00

| O-level	Physiology							
	A1	B2	B3	C4	C5	C6	Total	P
English								
n	4	25	119	73	74	91	386	
Score (mean±SD)	56.5±4.7	52.1±7.5	53.1±9.0	52.0±9.5	49.2±8.7	47.4±9.8	50.8±9.3	0.00
Mathematics								
n	87	51	95	35	51	67	386	
Score (mean±SD)	55.1±7.5	53.0±9.1	51.5±8.9	50.2±8.2	48.3±8.6	44.6±9.9	50.8±9.3	0.00
Biology								
n	41	56	150	65	47	27	386	
Score (mean±SD)	57.1±7.3	54.3±8.9	51.2±8.5	47.5±9.5	46.9±9.7	46.1±8.9	50.8±9.3	0.00
Chemistry								
n	69	51	134	46	41	45	386	
Score (mean±SD)	56.0±8.1	51.2±8.4	52.8±7.8	46.5±10.0	46.1±8.1	44.8±10.4	50.8±9.3	0.00
Physics								
n	72	55	130	42	48	39	386	
Score (mean±SD)	54.5±8.9	54.7±8.2	49.9±8.5	49.5±9.1	48.0±9.5	45.9±10.3	50.8±9.3	0.00

SD - Standard deviation

There have been controversies regarding the UTME conducted by JAMB; concerns of some authors have been on the organization of the examination and societal morality; this has brought the integrity of JAMB to question (Olaleye and Salami, 1997; Bamgboye *et al.*, 2001; Salahdeen and Murtala, 2004). This has

Table 3: Correlation of final preclinical examination scores with the mentioned factors

Factors/criteria	Anatomy	Medical biochemistry	Physiology	MBBS
Age	−0.254**	−0.229**	−0.279**	−0.265**
UTME score	0.147**	0.161**	0.304**	0.206**
UNN post-UTME	0.187**	0.306**	0.232**	0.256**
100 L CGPA	0.620**	0.694**	0.552**	0.664**
O-Level English	0.163**	0.118*	O.142*	0.147*
O-Level Mathematics	0.255**	0.264**	0.204**	0.257**
O-Level Biology	0.356**	0.369**	0.347**	0.379**
O-Level Chemistry	0.364**	0.344**	0.317**	0.361**
O-Level Physics	0.360**	0.402**	0.379**	0.401**

**Correlations significant at $P<0.01$ level. UTME - Unified Tertiary Matriculation Examination, CGPA - Cumulative Grade Point Average, UNN - University of Nigeria Nsukka
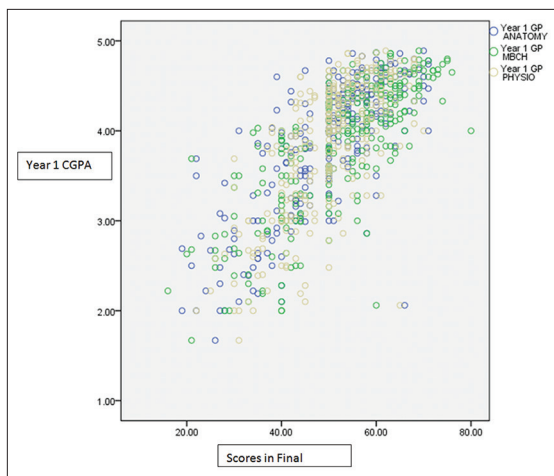
Figure 1: Scatterplot of 100 L CGPA against final preclinical examination scores in anatomy, medical biochemistry, and physiology

prompted Nigerian universities to conduct its own entrance/qualifying examination designed by the institution, the post-UTME. Usually students who applied to the institution and scored 180 and above in the UTME are eligible to write the entrance/qualifying examination. Our findings show that both UTME and the UNN post-UTME are reliable admission criteria but cannot be used to predict performance in the final preclinical examination.

Entrance or qualifying examination designed by an institution itself has been found to be a predictor of academic performance for graduates (Johnson *et al*., 1986; Mitchell 1990; Bastias *et al*., 2000; Baig 2001). On the contrary, our finding suggest that the UNN post-UTME cannot be used to predict performance in the final preclinical examination; possibly because the UNN post-UTME was designed to test for cognition just like the UTME; it is worthy of mention that measures of intelligence and intellectual aptitude alone are poor predictors of performance in the University (McManus

et al., 2008). Perhaps, a well-structured examination module encompassing all domains, unique to the college of medicine designed by the institution, may serve as a good predictor of academic performance in a Nigerian medical school. Low attrition rates in US medical schools is attributed to excellent admission procedure which ensures that the best candidates are selected from a pool of highly qualified candidates (Eva *et al*., 2004).

Grade point averge (GPA) has been the most common measure of academic achievement (Lievens *et al*, 2009; Reede 1999). Several studies have documented that GPA is the best predictor of academic performance (Dietrich and Crowley, 1982; Salvatori 2001, Eva *et al*., 2004). The result of this study [Table 3 and Figure 1] showed that 100-level CGPA is a reliable criteria that should be considered for progression into the preclincal section and for change of degree. The regression analysis conducted revealed that 100-level CGPA can be used to predict performance in the final preclinical examination. This is in agreement with previous findings.

Conclusion

Age is an important criterion in the admission process. O-level grades, UTME, and UNN post-UTME are reliable criteria for admission. However, of these, only 100-level CGPA can be used to predict performance in final preclinical examination.

Recommendation
We recommend that medical colleges should themselves develop unique entrance examination that encompasses more than one domain which should be able to accurately provide the candidates' true ability and may possibly serve as a single long-term predictor of student performance in the medical schools.

We recommend that 100-level CGPA be adopted as a criterion for change of degree and progression to preclinical medical studies medical schools and that cutoffs should be established.

Conflicts of interest
There are no conflicts of interest.

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