

## Students Predictors of Performance in Nursing and Midwifery Technician (NMT) Licensure Examination in Southern Malawi: An Ex Post Facto Study

Mc Geoffrey Mvula<sup>†</sup>, Annie Msosa

Department of Health Sciences, Kamuzu University of Health Sciences, Lilongwe, Malawi

### ABSTRACT

**Objectives:** Success in the nursing and midwifery licensure examination is the only legal prerequisite to practice as a nurse and midwife in Malawi. However, the past decade has registered poor performance of students in NMT licensure examinations for candidates who sit fail for the first time. The study sought to unravel whether students' socio-demographic and academic characteristics could predict NMT licensure examination performance.

**Methods:** A quantitative ex post facto study design. The study population consisted of 2,668 with a stratified random sampling method we reviewed 280 former NMT licensure exams candidate records from 2013 to 2017. Chi-square/Fisher's exact statistics and logistic regression determined the significance of associations and predictors respectively.

**Results:** The study revealed that NMT licensure examination could be predicted by students' academic characteristics especially entry Malawi School Certificate of Education (MSCE) point scores { $p < 0.001$ , OR 0.830, 95% CI (0.771-0.892)}, and exit college final scores { $p < 0.001$ , OR 1.214, 95% CI (1.131-1.303)}. This study established that students' socio-demographic characteristics like age { $\chi^2$  (2, N=280) = 13.143,  $p < 0.001$ }, and marital status { $\chi^2$  (1, N=280) = 5.645,  $p = 0.018$ } were significantly associated with NMT licensure examination performance but were not predictors of NMT licensure examination outcome. Furthermore, this study did not find any association between NMT licensure examination performance and the sex of the students { $\chi^2$  (1, N=280) = 0.523,  $p = 0.470$ }.

**Conclusion:** The study results confirmed that predictors of NMT licensure examinations performance are academic variables like entry MSCE scores and exit college final scores. Therefore, nursing and midwifery teaching institutions should frame relevant admission criteria, and recognize and timely intervene on students at risk of failure in licensure exams.

**Keywords:** Academic characteristics; Students' socio-demographic; Performance; Licensure examination; Nursing; Midwifery technician

### INTRODUCTION

Nurses and midwives form the largest workforce in the healthcare system in Malawi [1]. They are directly involved in providing patient care and they make critical decisions that strongly influence patients' outcomes [2]. Qualified nurses and midwives have knowledge and skills, which are essential in ensuring patients' safety and provision of high-quality care [3]. Thus, Malawi must have adequate well-qualified nurses and midwives. Nurses and Midwives Council of Malawi regulations stipulate that nurses and midwives sit for licensure examinations after college before practicing in various clinical settings. This aims to confirm that they are competent and safe to practice nursing and midwifery. Success in the nursing and midwifery licensure

examination is the only legal prerequisite to practice as a nurse and midwife in Malawi [4]. However, an effort to ensure quality training of nurses and midwives appears to be threatened in the past decade by significant failure rates in Malawian nursing and midwifery training institutions [5-8]. The past decade has registered poor performance of students in NMT licensure examinations. Despite the government and other stakeholders instituting strategies to ensure high-quality training for nurses and midwives [5-8].

To address these challenges, researchers have attempted to identify predictors of student performance on the licensure examinations [9]. Some of the predictors relate to academic and non-academic characteristics such as pre-requisite GPA qualifications, exit program cumulative GPA, and socio-demographics [10]. Because of the value

**Correspondence to:** Mc Geoffrey Mvula, Department of Health Sciences, Kamuzu University of Health Sciences, Lilongwe, Malawi, Email: mvula2017macgeofrey@kcn.unima.mw

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placed on success in NMT licensure examinations for both students and the program nurse educators must determine predictors of success in the licensure examinations [11,12]. Therefore, this study aimed at determining whether students' socio-demographic and academic characteristics could predict NMT licensure examination performance in Malawi.

## METHODOLOGY

### Study design and setting

The research employed a quantitative ex post facto design using the researcher's adapted and modified records analysis protocol. The study analysed students' records from six Christian Health Association of Malawi (CHAM) colleges in southern Malawi. These were; St Luke's College of Nursing, Holy Family College of Nursing, St Joseph College of nursing, Mulanje College of Nursing, Malamulo College of Health Sciences, and Trinity College of Nursing. These colleges were eligible due to their low students' performance in NMT licensure examinations over the past decade. Additionally, all these colleges offer an NMT diploma program using a prescribed core curriculum by the Nurses and Midwives Council of Malawi.

### Sample size and sampling methods

The target population was all NMT students who wrote licensure examinations between 2013 and 2017 from these colleges in southern Malawi (N=2,668). Using the Cochran formula,  $n = Z^2pq/e^2$ , we sampled 280 records and extracted 56 records per stratum from 2013 to 2017. By simple random sampling, we selected records per stratum. The inclusion criteria included records for NMT students who wrote licensure examinations between 2013 and 2017 from six CHAM nursing colleges in southern Malawi. The exclusion criteria included records for NMT students who wrote licensure examinations before 2013 and after 2017.

### Ethical review and approval

Data protection Act protects individuals regarding the processing of personal data, notably by requiring personal data to be processed lawfully and fairly [13,14]. The researcher got ethical approval from the College of Medicine Research and Ethics Committee (COMREC, P.03/19/2616), which is a review board for Kamuzu University of Health Sciences (KUHES). Furthermore, permission from the CHAM secretariat and the respective CHAM colleges was obtained. The students' identities and their data were anonymized using codes and kept confidential using a computer with password protection.

### Data collection

Data were extracted from the former student's college records using a records analysis protocol. The protocol was adapted and modified to record socio-demographic data, entry MSCE scores, program outcome performance in college, and NMT licensure examinations. The protocol was previously used in a similar study in the United States of America [15]. To ascertain the validity of the records analysis protocol, the items included were derived from relevant literature and guided by the research objectives. Furthermore, content validity was ensured through experts in nursing education who adequately reviewed confirming it met the minimum recommended standard [16]. Face validity was achieved by pre-testing at Malawi College of Health Sciences, Zomba campus, to ensure that records analysis protocol reliability captured the required information. To ensure privacy, each

candidate's records were assigned a code. Stratified sampling was used to determine 280 records from the selected CHAM colleges, with 56 records reviewed per stratum from 2013 to 2017. A proportional allocation was used to determine records from each year group per college. Further, students' records were apportioned into two categories comprising failure and successful records. A simple random sampling was used to select records per strata from each year group so that a recommended representative sample was obtained for each year group.

### Data analysis

Statistical Package for the Social Sciences (SPSS) version 26 was used to process and analyze the data. Descriptive statistics such as frequencies, percentages, modal class, mean and standard deviation were employed to define the background characteristics of the sample population [17]. The analysis also used bivariate descriptive statistics of cross-tabulation, then chi-square/fisher's exact statistical tests at a 95% confidence interval, with a p-value of  $<0.05$ , which were considered statistically significant. The chi-square/fisher's exact tests determined if the observed frequencies of events in specific categories fall within the frequencies expected to fall in these categories [15]. Fisher's exact statistic tests determined the statistical significance of relationships between academic predictors and the outcome of the NMT licensure examination. Logistic regression analysis determined predictors for NMT licensure examination performance. Variables, namely sex, age, marital status, entry MSCE scores, and exit college final scores, were subjected to bivariate logistic regression to determine those considered for multiple logistic regressions. The variables whose p-value from the bivariate analysis was equal to, or less than 0.05 were candidates for multiple logistic regression. Finally, a multiple logistic regression model with the following variables; age, marital status, entry MSCE scores, and exit college final scores, was constructed to identify predictor variables of NMT licensure examinations.

## RESULTS

### Demographic characteristics of the study participants

Table 1 presents the socio-demographic characteristics of the participants. A total of 280 students' records from six CHAM colleges in the southern region of Malawi were reviewed in the study. The results indicated that 58.9% (n=165) of the records belonged to female students. The age of students ranged from 16 to 39 years (mean  $22.0 \pm 4.327$ ). About 50.7% (n=142) of the students were in a modal class of 21 to 30 years at the start of NMT coursework. On marital status, 82.9% (n=232) were single at the start of NMT coursework. The entry MSCE point scores of the students ranged from 16 to 39 (mean  $28.1 \pm 4.381$ ). About 66.1% (n=185) were in the 21 to 30 points modal class. Only 3.2% (n=9) of students scored 20 points and below. The students' exit college final scores ranged from 48% to 85% (mean  $64.6 \pm 5.479$ ). However, 73.6% (n=206) of the students were in the 61% to 75% as a modal class compared to only 2.1% (n=6) who scored above 75%.

**Table 1:** Background characteristics of the subjects (n=280).

Parameters	Frequency (%)
Student sex	
Female	165(58.9)
Male	115(41.1)

Age categories	
20 years and below	123(43.9)
21 to 30 years	142(50.7)
Above 30 years	15(5.4)
Marital status	
Married	48(17.1)
Single	232(82.9)
MSCE point scores categories	
20 points and below	9(3.2)
21 to 30 points	185(66.1)
Above 30 points	86(30.7)
College final scores categories	
60 percent and below	68(24.3)
61 to 75 percent	206(73.6)
Above 75 percent	6(2.1)

### Students' age and NMT licensure examination performance

The study results illustrated that 43.9% (n=123) were younger students aged 20 years or below, and a larger percentage of the 74.0% (n=91), passed the NMT licensure examination on the first attempt. For the middle-aged students from 21 to 30 years, almost two-thirds of the 64.8% (n=92) passed the NMT licensure examination on their first attempt. However, it was observed that 73.3% (n=11) of older students above 30 years failed the NMT licensure examination on their first attempt. Fisher's exact statistical test showed that there was a significant association between age categories and NMT licensure examination performance  $\{\chi^2 (2, N=280) = 13.143, p < 0.001\}$  as shown in Table 2.

**Table 2:** Students' age and NMT licensure examination outcome.

Parameter	Pass (%)	Fail (%)	Total (%)	Fisher's exact test	
				$\chi^2$	P-value
Age in categories				13.143	0.001*
20 years and below	91(74.0)	32(26.0)	123(43.9)		
21 to 30 years	92(64.8)	50(35.2)	142(50.7)		
Above 30 years	4(26.7)	11(73.3)	15(5.4)		
Total	187(66.8)	93(33.2)	280(100.0)		

Note: \* indicates P<0.001

### Students' sex and NMT licensure examination performance

The results shown below (see Table 3) indicate that 58.9% (n=165) were female students. In terms of NMT licensure performance, 35.7% (n=41) male students failed compared to 31.5% (n=52) female students. Chi-square test indicated there was no significant association  $\{\chi^2 (1, N=280) = 0.523, p\text{-value} = 0.470\}$ .

**Table 3:** Students' sex and NMT licensure examination outcome.

Parameter	Pass (%)	Fail (%)	Total (%)	Chi-square Test	
				$\chi^2$	P-value
Students sex				0.523	0.470
Female	113(68.5)	52(31.5)	165(58.9)		
Male	74(64.3)	41(35.7)	115(41.1)		
Total	187(66.8)	93(33.2)	280(100.0)		

### Marital status and NMT licensure examination performance

The results Table 4 indicated that 69.8% (n=162) single students passed on first attempt compared to 52.1% (n=25) married students. The chi-square tests illustrated a statistically significant association between marital status and NMT licensure examination performance  $\{\chi^2 (1, N=280) = 5.645, p = 0.018\}$ . In general, a bivariate analysis demonstrated that marital status was significantly associated with NMT licensure examination performance.

**Table 4:** Student's marital status and NMT licensure examination outcome.

Parameter	Pass (%)	Fail (%)	Total (%)	Chi-square Test	
				$\chi^2$	P-value
Marital Status					
Married	25(52.1)	23(47.9)	48(17.1)	5.645	0.018*
Single	162(69.8)	70(30.2)	232(82.9)		
Total	187(66.8)	93(33.2)	280(100.0)		

Note: \* indicates P<0.018

### Entry MSCE point-scores and NMT licensure examination performance

The study results displayed below Table 5 indicated that 3.2% (n=9) of the students scored 20 points and below, and they registered a 100.0% pass rate on the first attempt. It was further observed that 76.2% (n=142) of the students with entry points between 21 and 30 passed the NMT licensure examination on their first sitting, whilst 58.1% (n=50) of the students with entry points above 30 failed the NMT licensure examination on their first sitting. The p-value was significant between entry MSCE point scores and NMT licensure examination performance  $\{\chi^2 (2, N=280) = 35.729, p < 0.001\}$ .

**Table 5:** Entry MSCE point-scores and NMT licensure examination outcome.

Parameter	Pass (%)	Fail (%)	Total (%)	Fisher's Exact Test	
				$\chi^2$	P-value
Entry MSCE score				35.729	<0.001*
20 points and below	9(100.0)	0(0.0)	9(3.2)		
21 to 30 points	142(76.2)	43(23.2)	185(66.1)		

Above 30 points	36(41.9)	50(58.1)	86(30.7)
Total	187(66.8)	93(33.2)	280(100.0)

Note: \*indicates P<0.001

### Exit college and NMT licensure examination performance

The results presented Table 6 indicate that students 100% (n=6), with exit college final examination scores above 75% passed the NMT licensure examination on the first attempt. Furthermore, the study results illustrate that a large proportion, 60.3% (n=41) of the students who scored below 60% failed the NMT licensure examination on the first attempt. The p-value was statistically significant ( $\chi^2$  (2, N=280) =29.645, p<0.001).

**Table 6:** Exit college final exam scores and NMT licensure examination outcome.

Parameter	Pass (%)	Fail (%)	Total (%)	Fisher's Exact Test	
				$\chi^2$	P-value
College final score					
60 percent and below	27(39.7)	41(60.3)	68(24.3)		
61 to 75 percent	154(74.8)	52(25.2)	206(73.6)	29.645	<0.001*
Above 75 percent	6(100.0)	0(0.0)	6(2.1)		
Total	187(66.8)	93(33.2)	280(100.0)		

Note: \*indicates P<0.001

### Logistic regression analysis of NMT licensure performance and other variables

Table 7 shows multiple logistic regression analyses run to determine predictors for NMT licensure examinations performance. Based on the multiple logistic regression analysis results, entry MSCE point scores {p-value <0.001, OR 0.830, 95% CI (0.771-0.892)}, and exit college final scores {p-value<0.001, OR 1.214, 95% CI (1.131-1.303)} were significant predictors of NMT licensure examinations performance. The logistic regression results indicated that entry MSCE point scores were a strong predictor variable of NMT licensure examinations performance {p-value<0.001, OR 0.830, 95% CI (0.771-0.892)} in the presence of other variables. The results showed that as entry MSCE points increased by one unit (one point), the chances of passing the NMT licensure examinations decreased by 17.0%. This was coherent with the bivariate analysis results, which showed an inverse association pattern, such that as MSCE points increased, the percentage pass rate in NMT licensure examinations alternatively decreased (100.0% to 41.9%). Another significant academic predictor variable of NMT licensure performance was Exit College final scores {p-value<0.001, OR 1.214, 95% CI (1.131-1.303)}. The odds ratio showed that as student-exit college final scores increased by one unit (one mark), a student had 1.214 times the chances of passing NMT licensure examinations on the first attempt. The results were consistent with the bivariate analysis, which showed a direct association pattern between exit college final scores, and NMT licensure pass rate such that as the exit college final scores increased, the percentage pass rate in NMT licensure examinations increased respectively (39.7% to 100.0%).

**Table 7:** Multiple logistic regression of demographic and academic variables on NMT licensure examination performance.

Parameter	NMTLE Performance		OR (95% CI)	P-Value	Adjusted	
	Pass (%)	Fail (%)			OR (95% CI)	P-Value
Sex						
Female	113(68.5)	52(31.5)	0.831(0.502-1.374)	0.47	-	-
Male	74(64.3)	41(35.7)	1			
Age in years	-	-	0.904(0.853-0.959)	0.001*	0.958(0.883-1.038)	0.292
Marital status						
Married	25(52.1)	23(47.9)	2.129(1.132-4.005)	0.019*	1.705(0.665-4.373)	0.267

## DISCUSSION

The study aimed to determine predictors of performance in NMT licensure examinations. The results suggest that student performance in NMT licensure examinations could be predicted by students' academic characteristics, especially entry MSCE point scores. The results showed that as entry MSCE points increased by one unit (one point), the chances of passing the NMT licensure examinations decreased by 17.0%. This was coherent with the bivariate analysis results, which showed an inverse association pattern, such that as MSCE points increased, the percentage of pass rate in NMT licensure examinations alternatively decreased (100.0% to 41.9%). Literature from several related study findings suggests that pre-entry qualification was an important benchmark for success in nursing schools [18,19]. In a related study, Truman discovered that students who passed the NCLEX-RN possessed statistically higher pre-admission GPAs (p=0.011) and SAT verbal scores (p=0.009), than those who failed [20]. Similarly, Doe et al. established an association between entry grades obtained in the West African Senior School Certificate Examination (WASSCE) and performance in the licensure examinations [21]. It was discovered that 45.5 % of students with entry aggregate between 20 and 24 failed licensure examinations, while the majority (76.9%) with entry aggregate of 11-14 passed the examinations on the first sitting. Chi-square statistics indicated that the higher the grade point a student attained the better performance he or she achieved in licensure examinations [21]. The results from this study suggest program entry qualification especially MSCE performance plays an important role in determining the students' success in the NMT licensure examinations.

Nursing programs often utilize a standardized exit exam score to assess students' readiness for the nursing licensure examinations and to plan for remediation steps to improve pass rates [22]. This study established that exit college final scores were another significant academic predictor of NMT licensure examinations performance. The odds ratio showed that as students exit college final scores increased by one unit (one mark), and a student had 1.214 times the chances of passing NMT licensure examinations on the first attempt. Further, these results were consistent with the bivariate analysis, which showed a direct association pattern between exit college final scores, and NMT licensure examination pass rate. As the exit college final scores increased, the percentage pass rate in NMT licensure examinations increased respectively (39.7% to 100.0%). In a related study in the United States of America, it was discovered that a combination

of nursing program academic outcomes predicted NCLEX-RN performance [23]. Similarly, in their study found that performance in the licensure examinations seemed to increase with an increase in Final Grade Point Average (FGPA) [21]. There was a positive relationship between the final grade point of students and licensure examinations outcome at a 0.05 confidence level. The study revealed that only 5 % of students with a Final Grade Point Average (FGPA) between 3.6 and 4.0 failed the licensure examinations whilst the majority of students (83%) with a Final GPA of 1.5 to 1.9 failed the examination on the first attempt [21]. Furthermore, it also established that college final Cumulative Grade-Point-Average (CGPA) had a strong positive relationship with performance in licensure examinations (AOR=15.27; 95% CI=6.28, 27.11) [11]. They concluded that students' college final CGPA could be a good predictor of performance in the licensure examinations. Consequently, results from this study demonstrate that exit college final scores could predict the outcome of NMT licensure examinations.

The above study results may have been affected by some methodological limitations. The study only examined data of students who graduated successfully from the program by taking the exit college final examination and then completing the NMT licensure examination. Students who were not successful in the exit college final examination were not included in this database, as they did not sit for licensure examinations, and this should be taken as a study limitation when considering these results.

## CONCLUSION

The study confirmed that predictors of NMT licensure examinations performance are academic variables like entry MSCE scores and exit college final scores. There is the revelation that students with lower entry MSCE points and higher exit college final scores tend to perform better in NMT licensure examinations and vice versa. Significantly, students should receive more support earlier in their academic careers right away from secondary school so that they are prepared not only for the nursing and midwifery profession but also for other professions. Furthermore, it is imperative for nursing and midwifery education institutions to analyze valid predictors of academic performance constantly. Furthermore, they should formulate relevant admission criteria, then timely recognize and intervene in students who are at risk of failure through the provision of needed support to increase their chances of success in NMT licensure examinations.

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## CONFLICT OF INTEREST

The authors declare that they have no competing interests.

## AUTHORS' CONTRIBUTION

MGM carried out the study starting from conception, analysis, and interpretation of data and reviewing the manuscript. AM participated in reviewing, data analysis, drafting, and commenting on the manuscript. All authors read and approved the final draft of the manuscript.

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