

## Factors Associated with Licensure Examination Performance of Radiologic Technology Graduates

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### ABSTRACT

The purpose of this study is to investigate the factors influencing the licensure examination performance of Radiologic Technology (RT) graduates in a private higher education institution (HEI) in Northern Mindanao, Philippines. A retrospective study was conducted in which the academic records of 181 RT graduates in HEI under study who took the licensure examination during the 2015-2019 period, were analyzed. Nine academic and non-academic factors were examined, and their impact on the licensure examination performance was tested using simple and multiple linear regression analyses. Results revealed that Student Internship Grade (SIG), College Admission Test (CAT), and Terminal Competency Assessment (TCA) scores were the significant factors affecting the licensure examination performance of the RT graduates. This study concludes the need for the administrators and educators of HEI under study to be aware of the role that SIG, CAT, and TCA play in the licensure examination. These factors should be included in the college admission and retention policies, as well as in the formulation of education intervention programs, in order to improve RT graduates' performance in the licensure examination.

**KEYWORDS:** examination; internship; licensure; Radiologic Technology

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### 1. Introduction

In the Philippines, the licensure examination performance of a Higher Education Institution (HEI) is a robust indicator of quality education it offers to the students [1,2]. This performance is measured by the percentage of examinees who passed the stringent examination administered by the Professional Regulatory Commission (PRC). One of the professions that is regulated by the PRC is Radiologic Technology (RT). RT is a highly specialized allied health profession that uses radiation to diagnose and treat diseases [3]. Therefore, it is imperative for RT graduates to pass the licensure examination not only to become licensed as a registered Radiologic Technologist, but also to practice. Failure to pass may have various consequences, including depression, isolation, financial strain, and loss of employment [4,5].

For the past five years, the national passing rate of RT licensure examination ranges from 42.76% to 51.90% [6-10]. The numbers suggest that at most half of the RT graduates who took the examination failed to pass and hence, were not qualified to practice the profession. This daunting trend warrants investigation of the factors associated with licensure examination performance of RT graduates. To date, there are no readily available data as to the definitive factors that affect RT graduates' performance in the licensure examination. However, a growing body of literature suggests that the licensure examination performance of graduates in allied health courses such as nursing and physical therapy depends on multiple academic and non-academic factors [1,11-13]. For instance, academic factors such as undergraduate cumulative Grade Point Average (ucGPA), Student Internship Grade (SIG), high school cumulative Grade Average (hscGA), College Admission Test (CAT), Terminal Competency Assessment (TCA), and Student Aptitude Test (SAT) scores were found to affect licensure examination performance [11-13]. Numerous studies have demonstrated that non-academic factors such as age, sex, and chronic absenteeism, may all influence how graduates perform in the licensure examination [14,15]. The identification of academic and non-academic factors could be invaluable to HEIs offering RT education as it attempts to explain and understand the performance of graduates, identify at risk students who are currently enrolled in the course, and design strategies to assist graduates to succeed in the licensure examination.

This study aims to explore how the academic and non-academic factors influence the licensure examination performance of RT graduates in a private college of RT in Northern Mindanao, Philippines.

## **2. Methodology**

### *2.1 Study Design, Setting, and Sampling Procedure*

This was a retrospective study that analyzed the academic records of RT graduates in a private college of RT in Northern Mindanao, Philippines who took the licensure examination during the 2015-2019 period. During this period, there were 181 first-time takers of the RT licensure examination from the private college under study. All of their academic records were included in the study.

### *2.2 Study Variables*

The main outcome variable of this study is the individual licensure examination performance of RT graduates. This is calculated as the average percentage of correctly answered items in the following five clusters of the RT licensure examination: Physics of Diagnostic Radiation and Protection, Image Production and Evaluation, Radiographic Procedures and Techniques, Patient Care Management and Human Anatomy and Physiology, and Radiological Sciences. These clusters cover the scope of the RT licensure examination as described in the Republic Act No. 7431 of the Philippines [16]. The performance of RT graduates in the first take of licensure examination was considered for the analysis.

The independent variables of the study were as follows: ucGPA, SIG, hscGA, results of CAT, TCA, and SAT, age, sex, and chronic absenteeism. The ucGPA is calculated as the average of all semestral GPAs taken by the student in the entire course of RT. The SIG is computed as the average of Junior and Senior Internship grades. Using the grading scheme of the private college, both ucGPA and SIG ranged from 5.00 (lowest) to 1.00 (highest). The hscGA is the average of all yearly GPAs in the entire four-year period in high school. High school grades are presented in the Department of Education (DepEd) Form 137. The hscGA ranged from 65.00 (lowest) and 100.00 (highest). CAT and SAT are evaluation conducted by the College Guidance Office to first-year students and transferees during admission to the College of Radiologic Technology (CRT). TCA is a 100-item summative evaluation of all theoretical and practical skills acquired by the students. This test is administered by the CRT to fourth-year students at the end of the 264-day hospital internship duty. Results of CAT, TCA, and SAT ranged from 0% (lowest rating) to 100% (highest rating).

The age in years of RT graduates during the first take of licensure examination was used. Chronic absenteeism is described as missing at least ten percent of the academic year for any reason, including excused and unexcused absences. Absenteeism during the 264-day hospital internship period was considered. An RT graduate who missed at least ten percent of school days or 26 hospital duty days was considered to be chronically absent. Absences incurred during the hospital internship period were stored in the extension of duties logbook of the CRT Clinical Coordinator.

### *2.3 Source of Data*

Retrospective data collection was performed at the archives of CRT in the study setting. The following data were collected: licensure examination performance, ucGPA, SIG, hscGA, CAT, TCA, SAT, age during the first licensure examination take, sex, and extension of duties summary.

### *2.4 Analysis*

Descriptive and inferential statistics were used for the analysis. In descriptive analysis, frequency (N) and percentage (%) were used for the categorical variables (sex and chronic absenteeism) while mean (M) and standard deviation (SD) were used for continuous variables (age during the first licensure examination take, ucGPA, SIG, hscGA, CAT, TCA, SAT, and licensure examination performance). In inferential analysis, the test of relationship between independent variables and licensure examination performance was carried out using Pearson correlation. Simple and multiple linear regression analyses were conducted. All independent variables explored in the simple linear regression analysis were taken forward into the multiple linear regression analysis. Simple linear regression estimated unadjusted coefficients that were used to determine the strength of influence of each independent variable to licensure examination performance. Adjusted coefficients were estimated from multiple linear regression analysis. These coefficients described the strength of association between each independent variable and licensure examination

performance after adding all independent variables to the multiple linear regression model. A p-value less than 0.05 was considered significant. All statistical analyses were carried out using SPSS Version 21.

### *2.5 Ethical Considerations*

To ensure confidentiality of private records, all data collected from the archives of CRT were de-identified by an independent CRT Records Officer. Alphanumeric codes were then assigned to individual records. Ethics approval was granted by the local Institutional Ethics Review Committee of Iligan Medical Center College (Reference: 2020-1100-0012).

## **3. Results**

During the 2015-2019 period, there were 181 RT graduates in a private college of RT in Northern Mindanao, Philippines who took the licensure examination (Table 1). Of the 181 RT graduates, 97 (53.6%) were male while 84 (46.4%) were female. The majority of the RT graduates (114, 63.0%) were chronically absent during their 264-day hospital internship. The mean age of the RT graduates was  $24.2 \pm 3.3$  years. The mean scores and standard deviations of the continuous variables are displayed in Table 2.

Pearson correlation of independent variables and licensure examination performance of the RT graduates revealed that chronic absenteeism, ucGPA, SIG, hscGA, CAT, TCA, and SAT scores were significantly related with licensure examination performance ( $p < 0.001$ ) (Table 3). Among these significant variables, chronic absenteeism, hscGA, CAT, TCA, and SAT scores were positively correlated with licensure examination performance. On the other hand, ucGPA and SIG were negatively correlated with licensure examination performance. Both sex and age demonstrated no significant relationship to licensure examination performance ( $p > 0.05$ ).

In the unadjusted linear regression analysis for licensure examination performance as an outcome, chronic absenteeism, ucGPA, SIG, hscGA, CAT, TCA, and SAT were the significant factors (Table 4). The RT graduates who were not chronically absent during their hospital internship have on average 2.494 higher score compared to RT graduates who were chronically absent. This association is not significant after adjustment of all other factors. For every unit increase in ucGPA, licensure examination performance decreases by 10.026; however, this association is not significant after adjustment for other variables. A unit increase in hscGA and SAT is associated with the an increase of 0.738 and 0.776, respectively in licensure examination performance but this association is not significant after adjustment for other variables. For each unit increase in SIG, licensure examination performance decreases by 9.241. This association is significant when adjusted for other factors. Finally, for each unit increase in CAT and TCA, there is a corresponding increase of 0.680 and 0.647 in the licensure examination performance of the RT graduates.

In the adjusted linear regression analysis, only SIG, CAT, and TCA scores were significantly associated with licensure examination performance. The independent

**Table 1.** Descriptive analysis of categorical variables.

<b>Variables</b>	<b>N</b>	<b>%</b>
<b>Sex</b>		
Male	97	53.6
Female	84	46.4
<b>Chronic Absenteeism</b>		
Yes	114	63.0
No	67	37.0
<b>Overall</b>	<b>181</b>	<b>100.0</b>

**Table 2.** Descriptive analysis of continuous variables.

<b>Variables</b>	<b>M</b>	<b>SD</b>
Age, in years	24.2	3.3
ucGPA	2.6	0.2
SIG	2.6	0.3
hscGA	78.1	4.1
CAT	76.1	4.0
TCA	76.4	4.1
SAT	74.4	3.9
Licensure Examination Performance	75.1	3.9

**Table 3.** Correlation of independent variables and licensure examination performance.

<b>Independent Variables</b>	<b>Licensure Examination Performance</b>	
	<b>R</b>	<b>p-value</b>
Sex	0.109	0.143
Chronic Absenteeism	0.308	0.000
Age	-0.011	0.888
ucGPA	-0.630	0.000
SIG	-0.691	0.000
hscGA	0.766	0.000
CAT	0.690	0.000
TCA	0.676	0.000
SAT	0.766	0.000

**Table 4.** Unadjusted and adjusted linear regression models predicting licensure examination performance of RT graduates (n = 181).

Independent Variables	Unadjusted		Adjusted	
	$\beta$	p-value	$\beta$	p-value
Sex <sup>a</sup>	0.858	0.143	0.271	0.456
Chronic Absenteeism <sup>b</sup>	2.494	0.000	0.332	0.407
Age	-0.012	0.888	0.006	0.916
ucGPA	-10.026	0.000	1.311	0.298
SIG	-9.241	0.000	-2.737	0.007
hscGA	0.738	0.000	2.270	0.449
CAT	0.680	0.000	0.217	0.003
TCA	0.647	0.000	0.140	0.048
SAT	0.776	0.000	-1.995	0.527

<sup>a</sup> Reference: Male. <sup>b</sup> Reference: Yes. Dependent variable: Licensure Examination Performance, Multiple Linear Regression Model Summary: R: 0.809, R-square: 0.654, Adjusted R square: 0.636. The model is significant at p<0.001.

variables used in the analysis explained 65.4% of the variability in the licensure examination performance of the RT graduates (R-square=0.654).

#### 4. Discussion

To the best of the authors’ knowledge, there is no published research discussing the academic and non-academic factors associated with the licensure examination performance of RT graduates. However, attempts were made to compare the results of the present study with those concerning allied health programmes.

In this study, seven academic factors (ucGPA, SIG, hscGA, CAT, TCA, and SAT) and one non-academic factor (chronic absenteeism) were significantly related to licensure examination performance. Of the seven academic factors, hscGA, CAT, TCA, and SAT were positively related to licensure examination performance. On the other hand, ucGPA and SIG were negatively related to licensure examination performance. A previous study shows a positive correlation of SIG and ucGPA to licensure examination performance [17]. Theoretically, this result is similar to the findings of the present study. The HEI under study follows a five-point grading scale where ‘5.0’ is the lowest while ‘1.0’ is the highest. Using the grading system of the HEI under study, smaller grade values correspond to high SIG and high ucGPA. Therefore, the negative correlation of SIG and ucGPA to licensure examination performance means that RT graduates who obtained smaller grade values (high SIG and high ucGPA) most likely performed well in the licensure examination.

When all of the academic variables were taken into consideration in the multiple linear regression analysis, only SIG, CAT, and TCA scores were significantly associated with licensure examination performance. This result implies that among the academic variables used, SIG, CAT, and TCA scores exerted the greatest impact on the licensure examination performance. SIG was negatively associated with licensure examination performance, while CAT and TCA scores were positively associated with licensure

examination performance. This indicates that RT graduates with lower SIG (indicating higher grade values in the HEI grading scale) have higher licensure examination performance. On the other hand, RT graduates with higher CAT and TCA scores have higher licensure examination performance. The mean licensure examination performance of the RT graduates in HEI under study seems to be marginal and very close to the passing mark of 75%. Low licensure examination performance is associated with higher SIG (indicating higher grade values in the HEI grading scale), lower CAT, and lower TCA scores. Therefore, effective interventions should be designed and implemented among RT graduates with higher SIG, lower CAT, and lower TCA scores to improve their licensure examination performance. The SIG of the RT graduates is based on their clinical performance and scores in the theoretical examinations [18]. RT graduates who performed poorly in the clinical hospital setting and scored low in the theoretical examinations, would get a low SIG. Hence, a strong academic policy that requires students to obtain at least passing SIG, should be formulated to increase the likelihood of obtaining higher licensure examination performance among the RT graduates. Meanwhile, the results of the CAT may be used to aid in the admissions decision-making and to identify those applicants that are likely to succeed in the RT licensure examination. Applicants with low CAT scores will be closely monitored and necessary tutoring interventions may be provided to increase their performance in the licensure examination.

Meanwhile, RT graduates who were chronically absent during their hospital internship period were associated with lower licensure examination performance. Existing literature shows that being chronically absent places students at risk for low academic examination performance [19-24]. In a cross-sectional study conducted among graduate and undergraduate nursing students at a private university in Amman, Jordan, higher absenteeism rates were associated with lower academic outcomes, such as low examination performance [19]. The negative link between chronic absenteeism and examination performance has been reported previously in a wide variety of courses such as Pharmacy, Psychology, and Medicine [20-24]. The same results were found in this study. Therefore, the HEI under study should develop policies to decrease the rate of chronic absenteeism among RT students during their hospital internship period as this factor has a considerable impact on licensure examination performance. Several studies found that allocating a certain percentage of grades for class attendance and imposing sanctions for unexcused absences during hospital internship, may decrease the rate of chronic absenteeism [19, 24].

When all covariates were included in the regression model, chronic absenteeism was no longer associated with licensure examination performance. This implies that this non-academic factor exerted a negligible impact on licensure examination performance when all academic and non-academic variables are considered in the analysis.

On the other hand, the investigated nine factors explained 65.4% of the variability in the licensure examination performance, leaving 34.6% unaccounted. Hence, other factors may be explored in the future to determine their impact on the licensure examination performance of the RT graduates. The retrospective nature of this study does not allow inferring causations but only associations. Confounding factors, such as intelligent quotient (IQ), may affect the impact of the key factors to the licensure examination performance. However, due to the design used in the study, the authors

were unable to determine the IQ of the RT graduates. Nevertheless, this factor may be investigated in the future.

This study reported an SIG of 2.6 among the RT graduates. In the grading system of the HEI under study, this grade is equivalent to 79%. In one study, among 2,160 students who graduated from a baccalaureate RT program from 2016 to 2018 in 24 HEIs in the Philippines, the mean SIG was 83.86%, that is slightly higher compared to the results of the study [17]. Meanwhile, the mean SIG of the 295 RT graduates of De La Salle – Health Sciences Campus from 1998 to 2004 was 86.02% [25]. During the 2015-2019 period, the mean licensure examination performance of the RT graduates under study is 75.1%, with a corresponding SD of 3.9. This high variability in the licensure examination performance implies that the performance scores of the RT graduates vary to a higher degree.

This study has important implications in the current RT educational practices. Educational management programs that target low-performing RT students and graduates should address factors related to licensure examination performance. The findings of this study can trigger strategic plans to understand the growing concern on the low passing rate in the RT licensure examination both on the national level and the HEI under study, to reduce the number of retakers, and to identify students at risk of succeeding in the RT licensure examination. It is important for undergraduate RT programs with diverse student populations to assess their students thoroughly and to intervene effectively to ensure that these students pass the RT licensure examination and that they are well prepared for entry-level professional RT practice. Academic and non-academic factors explored in this study must be included in the assessment so that students at risk of failure can be identified as early as possible and appropriate tutoring or other interventions started.

## **5. Conclusions**

This study shows that among the nine academic and non-academic factors, only SIG, CAT, and TCA scores contribute to the licensure examination performance of the RT graduates. Those who have low SIG, CAT, and TCA scores, were likely to obtain low performance in the licensure examination. This study highlights the need for the administrators and educators of HEI under study to be aware of the role that SIG, CAT, and TCA play in the licensure examination. These factors should be included in the college admission and retention policies, as well as in the formulation of education intervention programs, in order to improve RT graduates' performance in the licensure examination.

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## **Conflict of Interest Statement**

The authors declare no conflict of interest.



**Author Contributions:** All authors contributed equally. They approved the final version of this manuscript.

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