Introduction

As traditional higher education funding from government sources decreases, universities assume a proactive business model to ensure long-term survival and continued growth. Increases in tuition and student fees do not meet the operational expenses of many institutions. Administrative leadership urges faculty to enlarge student numbers, but instructors cannot compromise academic rigor. With increasing pressure to recruit and retain talented students, medical dosimetry higher education programs attempt to admit only those applicants best suited to complete the rigorous academic and clinical curriculum.

Allied health programs view the influx of student applications as an opportunity to increase enrollment, bolster sagging revenues, contribute to institutional prestige, and supplement the international supply of qualified health care workers. A problem arises when the allied health programs increase student admissions and observe an accompanying spike in learner attrition. Admissions committees receive more applications than available student slots, and allied health leadership scrutinizes applicant profiles to select the most promising individuals. Even with careful interview procedures, some admitted learners cannot complete the health sciences curriculum and withdraw because of personal, financial, or academic difficulties. A medical dosimetry program, which is a division of radiation oncology at a specialized allied health university, experienced higher than desired attrition. This observation prompted medical dosimetry faculty to investigate the relationship between applicant characteristics and academic success, with an intention of revising student selection criteria.
Leadership at the medical dosimetry school desired to ascertain the applicant characteristics and background that correlated with student success, as measured by graduation from the medical dosimetry program. The quantitative research method was used for an ex post facto correlational study focused on student selection criteria and potential academic success in the allied health sciences. The independent variables included medical dosimetry applicant cumulative undergraduate grade point average (GPA), science grade point average (SGPA), previous work as a radiation therapist, and prior degrees earned. The dependent variable consisted of the demonstration of successful graduation from a medical dosimetry educational program.

The research questions included the following: What is the relationship between cumulative undergraduate GPA, SGPA, a background in radiation therapy, and possessing a previous degree and medical dosimetry program success, as measured by graduation from a medical dosimetry program? The student selection criteria, or independent variables, were examined individually to ascertain the presence or absence of a statistically significant relationship with the dependent variable of program graduation using the alternative hypotheses H1a through H4a. The null hypotheses of H1 through H4 allowed for the absence of statistically significant relationships among the study variables.

Methods and Materials

Population

The population included students admitted to the medical dosimetry program at a specialized allied health university accredited by the Southern Association of Colleges and Schools and the Joint Review Committee on Education in Radiologic Technology.

Sampling frame

The study population comprised de-identified archival medical dosimetry student data from the academic years of 2003 through 2011 from enrolled learners in an undergraduate allied health medical dosimetry program at a Southern University. The de-identified historic data included information pertaining to cumulative undergraduate GPA, SGPA, prior work as a radiation therapist, prior degrees earned, the attainment of graduation from the medical dosimetry program, and demographic information. The demographic data gathered from the medical dosimetry student records consisted of information about sex, age, ethnicity, year of admission to the medical dosimetry program, and year of graduation from the educational program.

The Southern University supports one of the largest accredited medical dosimetry educational programs in the world. A 1-sample proportion for the graduation rates of the 150 medical dosimetry student records was conducted to estimate the power of the statistical analysis. The sample size of approximately 150 archived de-identified medical dosimetry student records was sufficient for the quantitative correlational analysis.

Informed consent

The student selection criteria study involved no more than minimal risk to the research participants, because data collection included only archival, nonidentifiable student records from the Southern University medical dosimetry program. None of the academic records, including undergraduate GPA, SGPA, prior experience as a radiation therapist, or graduation from the program, were linked to an individual. Ensuring that the students’ names were not included in the data collection process contributed to participant anonymity and minimized potential risks to the study population. A waiver of informed consent was approved by the Institutional Review Board (IRB) of the involved institutions.

Data collection

After receiving approval from the appropriate IRB organizations, de-identified archival student information was collected from existing databases at the Southern University. Access to the institutional network was protected with specific active directory passwords.

The data collection and analysis took place on Southern University’s encrypted computer network. The archival student information was de-identified during data collection. During the collection of student data, the learners’ names were replaced with a participant number. The participant number served as the identifier during the data collection, analysis, and reporting stages of the study.

A statistician from the Southern University served as a consultant during the quantitative correlational analysis of the study. The researcher shared de-identified archival medical dosimetry student records with the statistician over the encrypted institutional network for statistical analysis. The statistician signed a letter of collaboration among institutions and a confidentiality statement.

Data analysis

The 2 main components of descriptive statistics included in the study were distributions of frequency and calculations involving the variables of cumulative undergraduate GPA, SGPA, previous degrees earned, prior work as a radiation therapist, and successful graduation from a medical dosimetry educational program. Logistic regression provided evidence supporting or refuting the presence of significant relationships between the independent variables of undergraduate GPA, SGPA, previous degrees, and prior radiation therapy experience and the dependent variable of academic success, as measured by graduation from the medical dosimetry program.

The dependent variable of graduation from the medical dosimetry program possessed a binary response (yes/no) and fit the requirements of logistic regression analysis. Correlational analysis suited the needs of the research study, because administrative leadership wanted to know the characteristics of applicants that correlated with future academic success. Logistic regression and correlational analysis could establish a relationship between the study variables, but the chosen quantitative design of correlation did not imply causation.

Results

Descriptive statistics

During the academic years of 2003 through 2011 in the medical dosimetry program at the Southern University, in the 156 archival student records that were collected, 78 (50%) medical dosimetry students were women and 78 (50%) were men.

The ages of students admitted to the medical dosimetry educational program at the Southern University during the academic years of 2003 through 2011 displayed a mean value of 29.45 years (standard deviation [SD] = 7.326).

Graduation rates from admitted learners to the medical dosimetry program during the academic years of 2003 through 2011 were calculated: 156 medical dosimetry students entered the allied health program, and 17 (10.9%) of the admitted students did not successfully graduate from the Southern University. The overall graduation rate for the medical dosimetry program was 89.1%. Table 1 shows the number of admitted students each year and the corresponding graduation rate, as well as the overall graduation rate of the medical dosimetry program.

The data show a general trend in increase in the number of admitted medical dosimetry students at the Southern University over time, with a peak of 32 admitted learners in 2010 (20.5% of the research population). The academic year 2010 coincides with a transition of the medical dosimetry curriculum from a 1-year to a 2-year degree program. In 2010, 32 students were admitted to the medical dosimetry program, but half (n = 16) of them were distributed in the last 1-year tract, whereas the other half (n = 16) began the new 2-year curriculum. The reformulation of the medical dosimetry program in 2010 and the acceptance of 2 distinct tracts (32 cumulative students) were reflected in the graduation frequency for 2011 (14 1-year tract graduates from an original admitted population of 16 1-year tract students).

Undergraduate cumulative GPA and program success

Students admitted to the medical dosimetry program during the academic years of 2003 through 2011 demonstrated a
cumulative undergraduate GPA mean value of 3.26 on a 4-point scale (SD = 0.39).

To investigate the relationship between undergraduate cumulative GPA and graduation from the medical dosimetry program, a univariate logistic regression analysis was performed. The significance of the logistic regression concerning cumulative undergraduate GPA and successful graduation was greater than 0.05 (p = 0.673); therefore, a statistically significant relationship did not exist between the 2 variables. The lack of a significant correlation between the variables of cumulative undergraduate GPA and medical dosimetry student graduation led to the failure to reject the first null hypothesis (H1).}

SGPA and program success

The calculation of the SGPA included courses that the Southern University registrar identified as science prerequisites for the medical dosimetry program. Admitted students could enroll in a variety of science undergraduate coursework at accredited colleges and submit official transcripts to the Southern University registrar for consideration of transfer credit. There were 7 students (4.5% of the study population) who were admitted to the medical dosimetry program during the academic years of 2003 through 2011 and had not completed any recognized science prerequisite courses, and these students’ records were excluded from the data analysis for hypothesis 2.

Students with completed science prerequisites admitted to the medical dosimetry program during the specified period demonstrated a SGPA mean value of 3.43 on a 4 scale (SD = 0.55).

The analysis of hypothesis 2 necessitated the completion of an additional univariate logistic regression to determine the possibility of a statistically significant relationship between SGPA and successful medical dosimetry program graduation. Because of the high p value (p = 0.588), a statistically significant relationship did not exist between SGPA and medical dosimetry graduation. The lack of significance in the data analysis led to the failure to reject the second null hypothesis (H2) comparing SGPA and program graduation.

Previous background in radiation therapy and program success

Hypothesis 3 investigated the presence of a statistically significant correlation between an applicant’s prior education or work experience as a radiation therapist and his or her successful completion of the medical dosimetry program. Most students admitted to the medical dosimetry program between the academic years of 2003 and 2011 did not possess a background in radiation therapy. Of the admitted learners, 113 students (72.4%) did not have experience as a radiation therapist, and 43 accepted students (27.6%) brought prior education or work as a radiation therapist to the medical dosimetry program.

Of the 17 students who did not graduate from the medical dosimetry program during the academic years of 2003 through 2011, 13 (76.5%) did not have previous knowledge as a radiation therapist. Of the 17 students, 4 (23.5%) who did not successfully complete the medical dosimetry program had backgrounds in radiation therapy. Of the admitted students, 39 individuals (28.1%) had documented work or educational experience as a radiation therapist and successfully graduated from the medical dosimetry program.

The statistical analysis for hypothesis 3 continued using univariate logistic regression. The logistic regression resulted in a p > 0.05 (p = 0.694); therefore, a statistically significant correlation was not inferred between an applicant’s previous experience as a radiation therapist and successful graduation from the medical dosimetry program. The lack of statistically significant results calculated during the logistic regression caused the failure to reject the third null hypothesis (H3) that related a background in radiation therapy and successful graduation from the medical dosimetry program.

Prior degrees and program success

Students admitted to the medical dosimetry program at the Southern University displayed a variety of backgrounds in higher education. Of the 156 students admitted to the medical dosimetry program between the academic years of 2003 and 2011, 130 students (83.3%) claimed a previous degree. Associate degrees were held by 21 admitted students (13.5%). Many of the admitted students (n = 96, 61.5%) possessed an accredited bachelor degree. Some admitted students earned a master degree (n = 11, 7.1%), and 2 individuals (1.3%) gained a professional degree before entering the medical dosimetry education program. Of the accepted allied health learners, 26 students (16.7%) had not previously earned a recognized degree.

The last hypothesis investigated the presence of statistically significant relationships between an applicant’s previous degrees and his or her success in the medical dosimetry program, as demonstrated by graduation. A univariate logistic regression calculated a significance of 0.007. The results of the logistic regression are demonstrated in Table 2. This significance value of 0.007 was less than the p value of 0.05; therefore, the correlation between previous degrees earned and an applicant’s success in the medical dosimetry program was statistically significant. As the p value was less than 0.05, the fourth null hypothesis (H4) was rejected. An applicant’s chance of successful graduation from the medical dosimetry program during the academic years of 2003 through 2001 was statistically correlated with his or her achievement of a previous degree.

Table 2 also illustrates the odds ratio for the fourth hypothesis. Hypothesis 4 related an applicant’s previous degrees with his or

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<th>df</th>
<th>Sig.</th>
<th>Exp (B)</th>
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S.E. = standard error; df = degrees of freedom; Sig = significance, p-value; Exp = odds ratios.
her chance of successful graduation from the allied health academic program. The odds ratio for hypothesis 4 was calculated as 0.226. The individuals who entered the medical dosimetry program without previous degrees were 77.4% less likely to graduate. A student with a prior degree had 22.6% greater odds of completing the medical dosimetry education program.

Discussion

Undergraduate cumulative GPA and program success

The univariate logistic regression analysis relating cumulative undergraduate GPA and program success for medical dosimetry students did not produce a statistically significant relationship. Allied health schools rely on cumulative undergraduate GPA as a strong indicator that a student can succeed in the academic program, but additional factors could display a positive correlation with student success. Questions remain about the sanctity of undergraduate GPA and the absolute predictive value of a single number. Grade inflation, variations in academic difficulty between competing colleges, and inconsistency in grading techniques lead to nonuniformity in student grade distributions.

SGPA and program success

Based on the results of this quantitative correlational analysis, a statistically significant relationship did not exist between SGPA and medical dosimetry student success. The calculation of a specialized GPA assists admission committees with ranking applicants into suitable hierarchies that meet the individualized needs of each discipline. Creating subsets of GPA rankings and associated contextual factors supplement the interpretation of admission committees and provide additional information to support selection decisions.

The findings of the research involving the specialized population of medical dosimetry learners from the Southern University did not mirror the customary positive correlation of a high SGPA and academic success. The coursework included by the Southern University registrar for the calculation of a science-specific GPA encompassed a broad range of undergraduate subjects including anatomy and physiology, general- and calculus-based physics, chemistry, geology, and a multitude of other natural science classes. The lack of uniformity of classes required by the natural science core curriculum added an additional complication in the calculation and significance determination associated with SGPA.

Previous background in radiation therapy and program success

Based on the statistical findings, a statistically significant correlation did not exist between a medical dosimetry applicant’s previous experience as a radiation therapist and eventual success in the profession of medical dosimetry. The similar allied health field of nurse anesthesia did investigate the significance of an applicant’s background in health care and future success in an academic program. Conflicting results are demonstrated concerning the predictive value of an allied health student’s previous exposure to health care professions and his or her potential success in a new academic program. Differences in opinion exist among program directors and admission committee members when choosing the specific attributes or experiences that allied health students benefit from because of their prior health care exposure.

Prior degrees and program success

A statistically significant correlation did exist between an allied health student’s possession of a previous degree and eventual success in the medical dosimetry program. An applicant who had completed a prior academic program and earned an associate, bachelor, master, or professional-level degree experienced greater odds of completing the medical dosimetry educational program.

The transition into second degrees in medicine and allied health happens for some students after a nonsuccessful or unsatisfying career in business or the technical fields. More mature age, prior exposure to professional expectations, experiences with conflict resolution, and enhanced communication obtained at the workplace could better position second-career students for academic success. Earning a previous degree could familiarize adult students with the expectations of higher education, the required effort needed for success, and the professional communications between professors and students.

Limitations

The quantitative ex post facto correlational study did possess limitations that constrained the generalizability of the research findings beyond the identified population of medical dosimetry students. Published research does not exist concerning medical dosimetry higher education in the specific area of student selection criteria and academic success. The related disciplines of radiation therapy, nurse anesthesia, dental hygiene, clinical laboratory science, medical school, and dental school were selected as comparison groups when formulating the design of the research study and the appropriate statistical method to use during analysis.

Because of the specialized nature of medical dosimetry higher education, data collection was limited to a relatively small group of student records. The 156 medical dosimetry student records created a research population that yielded statistically significant results concerning the correlation between previous degrees and chances for academic success, but the small sample size and lack of randomization precluded generalizability to a larger group of participants.

The medical dosimetry program at the Southern University underwent a major shift from a 1-year curriculum to a 2-year degree program in 2010. With the support of crucial stakeholders represented on a curriculum and advisory committee, university leadership at the medical dosimetry program increased the duration of the educational curriculum.

In the new 2-year program, faculty redistributed the didactic curriculum in a logical format, but the radiation treatment planning instruction expanded to fill the increased laboratory and clinical rotations. The effect of the change of the medical dosimetry curriculum on the graduation rate of enrolled students was not quantified. The unknown consequences of the change in duration of the medical dosimetry program implemented in 2010 existed as a limitation in the quantitative correlational study.

Future research

Future research could include the collection and study of archival student records from other accredited medical dosimetry programs in the United States. Contacting program directors at other medical dosimetry schools and asking for de-identified student records to quantify and compare with the findings at the Southern University could grant additional merit to the results and confirm or deny the current findings. If the research population grew large enough, randomization of the participants could occur. Randomization would allow the chance for increased
generalizability concerning the results by helping to ensure that the selected participants resemble the general characteristics of the larger allied health student population.

The absence of published research investigating medical dosimetry higher education illustrates a gap in established knowledge concerning this area. Medical dosimetry educators and leaders would value a science-based inquiry into student selection that would provide helpful information to admissions committees during the competitive admissions process.

Recommendations

Consider reducing the weight granted to an individual’s undergraduate cumulative GPA when ranking medical dosimetry applicants during the admissions process. A statistically significant correlation was not found in the logistic regression when comparing cumulative undergraduate GPA and medical dosimetry student success.

Standardize the science courses identified by the registrar to include in the calculation of SGPA. The lack of uniformity in the SGPA calculation adds a layer of complexity to the interpretation of statistical analysis.

Differentiate the type of radiation therapy experience that an applicant brings to the medical dosimetry program during the admissions process. Medical dosimetry leadership could obtain valuable information concerning the relative value of work experience as a radiation therapist as compared with didactic training in radiation therapy alone.

Increase the ranking of applicants who possess a prior degree when applying to the medical dosimetry program. A statistically significant correlation was found in the student selection study when relating previous degrees and successful graduation from the medical dosimetry program.

Conclusions

Allied health education programs work to supply competent graduates to fill the noted shortage of health care workers in a global workplace. Medical dosimetry educational programs address the shortage of radiation oncology workers and increase student enrollment. Higher education undergoes changes because of limited financial resources, reduced full-time faculty positions, increased accessibility mediated by technology, and an influx of nontraditional learners. The challenges associated with higher education growth and sustainability along with trends in student attrition urge allied health leadership to revise student admissions criteria to select the applicants best suited to the curriculum and future careers in patient care.

Medical dosimetry student selection represents an area in higher education with a lack of published studies. The quantitative ex post facto correlational study explored the relationship between student selection criteria and success in a medical dosimetry program. The independent variables selected for investigation in the quantitative study included cumulative undergraduate GPA, SGPA, previous work or education as a radiation therapist, and prior degrees earned. The measure of student success was defined as graduation from the medical dosimetry educational program. After acquiring IRB permission from the necessary organizations, archival de-identified student records were collected from the academic years of 2003 through 2011 at a large medical dosimetry program at a Southern University.

Univariate logistic regression produced a statistically significant positive correlation between an applicant’s previous degree and his or her successful graduation from the program. Statistically significant relationships were not found when relating cumulative undergraduate GPA, SGPA, prior work as a radiation therapist, and academic success in the medical dosimetry program. Further research could include a larger population that solicits input from multiple accredited medical dosimetry programs. A more inclusive research population could yield a representative sample, use randomization techniques, and provide statistically significant results to shape future medical dosimetry student admissions practices.

References