The Odds of Success: Predicting Registered Health Information Administrator Exam Success

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Abstract

The purpose of this study was to craft a predictive model to examine the relationship between grades in specific academic courses, overall grade point average (GPA), on-campus versus online course delivery, and success in passing the Registered Health Information Administrator (RHIA) exam on the first attempt. Because student success in passing the exam on the first attempt is assessed as part of the accreditation process, this study is important to health information management (HIM) programs. Furthermore, passing the exam greatly expands the graduate's job possibilities because the demand for credentialed graduates far exceeds the supply of credentialed graduates. Binary logistic regression was utilized to explore the relationships between the predictor variables and success in passing the RHIA exam on the first attempt. Results indicate that the student's cumulative GPA, specific HIM course grades, and course delivery method were predictive of success.

Keywords: higher education; predictors; success; health information management; RHIA exam, undergraduate

Introduction

Health information management (HIM) programs provide the academic foundation for students desiring to take the American Health Information Management Association (AHIMA) Registered Health Information Administrator (RHIA) certification exam. An AHIMA-sponsored workforce study indicated that 94 percent of employers surveyed preferred hiring employees with the RHIA credential.[1] Currently, the demand for graduates of HIM programs who have also passed this credentialing examination far exceeds the supply of credentialed graduates.[2] This is one of the most pressing problems in the HIM profession because there are no easy and efficient ways to reduce the shortage.[3] Enrolling more students in existing HIM programs is not a realistic solution because currently only 59 accredited HIM programs are offering bachelor's degrees, and class sizes are constrained by available facilities, resources, and budgetary issues.[4, 5] A further constraint to accepting more students is the difficulty of placing these students in their mandatory professional internship due to the increasing number of sites that cannot accept students because site staff members lack time and resources.[6] One potential realistic solution is to increase the numbers of existing graduates who pass the RHIA exam on the first attempt. Exploring ways for programs to predict the number of students who successfully pass the credentialing exam on the first attempt is the first step of one pathway to increase the number of credentialed graduates.

The shortage of graduates of bachelor of HIM programs who have passed the national RHIA credentialing examination on the first attempt represents the research problem. A US Department of

Labor (2015) report noted that the projected growth rate for the HIM profession for 2014 to 2024 is 15 percent, which means that more than 29,000 new HIM jobs will open during that period.[7] A workforce study indicated that associate and bachelor of HIM programs together produce only 2,500 graduates annually, which is far short of the number of graduates needed to fill the projected new HIM jobs.[8] The scarcity of bachelor of HIM programs, lack of qualified faculty to staff new programs, and the increasing difficulty of securing the mandatory internship placements further exacerbate this shortage.[9–11] Furthermore, graduates who attempted the RHIA exam had moderate first-time exam pass rates of 71 to 76 percent in the years 2011 to 2013.[12] To increase the number of credentialed HIM professionals, more students must enroll in accredited programs and apply for and pass the RHIA exam. Unfortunately, there is a paucity of information on predictors of first-time success on the RHIA exam.

Literature Review

A few studies have attempted to determine predictors of success on the RHIA credentialing exam. Notably, Condon and Barefield[13] determined in a program evaluation study at one university that baccalaureate program and postbaccalaureate certificate program graduates' RHIA exam pass rates did not differ significantly, and they recommended future exploration of curriculum models, course delivery models, demographics, and other academic variables as indicators of RHIA exam success. In a larger program-level study by McNeill and Brockmeier,[14] data from more than 30 HIM programs for the academic years 2000 and 2001 were analyzed, but the researchers were unable to develop a model to predict their HIM graduates' RHIA exam success. McNeill theorized a relationship between schools that administer practice exams before graduation and RHIA exam scores, but no significant correlation was established.[15] Condon[16] gathered student data from 2001 to 2010 and hypothesized that core curriculum GPA and final grades in Introduction to HIM and medical coding classes were significantly positively related to RHIA passing exam scores, and the hypothesis was supported. He recommended that further studies examine other factors for correlation with RHIA exam success. Another related study evaluated distance learning in health informatics education by comparing certification results of on-campus students with those of online students. Russell et al[17] found an association of overall GPA as well as specific program admission GPA with RHIA success. They found no difference in performance between on-campus and online students; however, they evaluated only one year of student data, testing the difference in means without crafting a predictive model.

Because of the very small number of studies of RHIA exam success, we sought predictors from other healthcare areas and prior studies. Specifically, we examined predictive studies related to national credentialing exam success in other healthcare areas, such as nursing, pharmacy, clinical lab, physical therapy, and other allied health fields, to inform this study. In these fields, numerous studies have examined the predictors of certification success.[18–20] Therefore, we analyzed more than 50 prior studies published between 2000 and 2014. These studies incorporated a variety of predictors of certification success in different health education and professional programs. Table 1 lists the author, year, and discipline of the relevant studies. Table 2 shows the number of times a variable was examined and a count of the number of times that it was significant in these studies.

The most commonly studied variable was course/professional GPA, which was included in nine studies. Examples include the studies by Condon,[21] Dockter,[22] and Ericsson.[23] Results of including course/professional GPA were substantial, with eight of these studies finding significance and one finding a nonsignificant relationship. These findings suggest that course/professional GPA is an important predictor.

Another commonly studied variable was the scores on standardized entry exams, such as the SAT or ACT, included in nine studies. Examples include the studies of Austin,[24] Grossbach and Kuncel,[25] and Houglum et al.[26] Results were mixed, with seven of these studies finding that standardized exams scores were significant predictors and two not finding exams' scores were significant. While these findings are not totally consistent, they do lean toward standardized testing being an important predictor.

An additional way that course performance was incorporated into prior research was via cumulative GPA. Overall cumulative GPA was examined in seven studies, and in all but one this variable was significant, suggesting that cumulative GPA should be included in a predictive model. Siu and Reiter,[27] Erickson,[28] and McCall et al[29] provide examples of using cumulative GPA in studies of prediction.

Other predictors considered in the studies included ethnicity, practice exams, native language, mentoring, student demographic data, repetition of supporting courses, parental education, high school rank, Health Education Systems Incorporated nursing exam scores, family income, admission scores, clinical experience, writing sample scores, institutional status, institutional Carnegie classification, long-range goals, accredited program, rural pathway admittance, and more.

Table 2 displays the significant variables from these prior works ordered from highest to lowest in terms of the number of significant results. Because 44 studies indicated significant variables, we chose the top 10 percent of the variables for inclusion in our study. SAT, ACT, and TEAS exam scores were in the top 10 percent but were not included because researchers did not have access to those data.

Research Model

To develop our research model, we considered the significant variables discovered in our review of prior works and sought to construct empirically testable relationships. Condon's[30] predictive study of RHIA success guided this study's conceptual framework; however, Condon examined only two cumulative GPA categories and final grades in only four courses. Our conceptual model included the hypothesized relationships between grades in required HIM program courses, cumulative GPA, and student success in passing the RHIA exam on the first attempt. Figure 1 shows our conceptual model of RHIA success. Given the importance of passing the RHIA exam on the first attempt, the following research questions were chosen for this study:

1. What are the relationships between first-time pass rate on the RHIA exam and the required HIM course grades and cumulative GPA?
2. What is the relationship between first-time pass rate on the RHIA exam and the cumulative GPA?
3. What is the relationship between first-time pass rates on the RHIA exam for on-campus students versus online students?

Methodology

The retrospective study was conducted to develop a model for prediction of first-time success on the RHIA exam. The study site was the HIM department of a large state university in the southern United States. Data were collected by ex post facto examination of academic records and RHIA exam scores. SPSS was used to generate predictive and descriptive statistics.

The sample consisted of the on-campus and online students (n = 74) who graduated with a bachelor's degree in HIM between 2011 and 2013. Participants were selected utilizing a convenience sampling of bachelor of HIM students who graduated during those years and who took the RHIA exam between January 1, 2011, and December 31, 2013, and for whom RHIA exams scores were available. These years were chosen because data for those years constituted the most current score data set available at the time of the study. The demographic variables of gender, age range at program admission in years, ethnicity, educational format, and on-campus versus online course delivery were collected to describe the population.

The dependent variable for all research questions was the pass rate on the RHIA exam. This variable is a dichotomous variable that was coded 1 for pass and 0 for fail for the purpose of binary logistic regression testing.[31] Only the first attempt on the exam was recorded; subsequent attempts were excluded. The specific academic predictors for research question 1 were the GPAs in the required HIM major courses: Departmental Management, Quality Improvement Regulations and Procedures for HIM, Management of HIM Systems, Legal Aspects of HIM, HIM Research and Data Analysis, Health Information Technology Throughout the Enterprise, and Contemporary Leadership Principles for HIM.

For research question 2, the predictors were cumulative GPAs for graduates in 2011 to 2013 for on-campus and online students. For research question 3, the student's educational format, operationalized as on-campus or online, served as the predictor.

RHIA certification exam data were utilized to collect the first-time pass information for graduates in the years 2011 to 2013. The RHIA exam development committee determines the relevance of exam questions by conducting a job analysis study every three to five years. De-identified data for students who successfully passed the exam on the first attempt during these years were obtained by the department chair from exam reports distributed by the AHIMA Commission on Certification for Health Informatics and Information Management (CCHIIM).[32] An Excel worksheet was developed by the researchers to collect the demographic, academic, and RHIA exam pass/fail data.

The researchers obtained Institutional Review Board (IRB) permission to conduct the study and university permission to access the college records. Data were collected by administrative staff from student academic records and the RHIA certification exam report. Exam score reports and academic records were cross-referenced by administrative staff. Twelve students were excluded from the study because they did not take the exam during the study years. Data for the remaining students were de-identified, compiled, and given to the researchers. Only the outcome of the candidate's first exam attempt was recorded.

Data Analysis

The aim of this study was to determine whether the independent (predictor) variables accurately predicted first-time success on the RHIA exam. The level of significance (α) was set to .05 for all research questions, the power to detect an effect if one exists was established as .80, and a medium effect size of .5 was chosen.[33] A power analysis showed that a sample of 65 students was adequate for this study. To prepare the data, missing course grades (n = 15) were replaced with dummy variables. Data were analyzed with descriptive statistics and binary logistic regression.

Predictive Model

To analyze the relationship between first-time pass rate on the RHIA exam, cumulative GPA, and grades in specific HIM courses, the researchers used binary logistic regression to predict the probability of the outcome of passing or failing on the first attempt. The basic regression model used to examine these relationships was as follows:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_{4+} \ldots,$$

where p = the probability that the outcome is a 1 or a 0, and Y = logit(p) = ln[p/(1 – p)] is the logarithmic transform of p, which is the probability of the outcome event occurring. Thus, Y equals 1 for passing and 0 for failing the RHIA exam on the first attempt. Also, X_i = independent predictor variables affecting Y, b_i = beta values that are the coefficients of the predictor's contribution to the outcome variable's variation from the estimate, and a is a constant.

Logistic Regression Method

Data were analyzed using stepwise backward likelihood ratio (LR) logistic regression. This method is recommended for exploratory studies in areas where little previous work is available.[34] SPSS starts with the full model containing all the independent variables. At each step, SPSS tests the model fit, in this case using the LR, and removes the predictor that has the least effect on the model fit. This process continues until no more predictors can be removed.[35]

Because the academic course grades are all categorical predictors with three levels (i.e., A, B, and C grades), SPSS automatically recodes two levels of these variables into dummy variables, and holds the third categorical level out of the results display because it is the control variable. Specifically, the researchers chose the highest grade (the A grade) as the control. Thus, regression results will present values for B and C course grades.

Results

The retrospective sample was composed of all 74 participants who graduated during the study years and who took the exam. The majority of the participants were female (83.8 percent). Fifty-seven percent were on-campus students, and 43 percent were online students. Age at program admission ranged from younger than 20 years to older than 50 years. Sixty-two percent of the candidates were 20 to 29 years old, and 18 percent were 30 to 39 years old. Sixty-eight percent were white, 16 percent were black, 11 percent were Hispanic, 3 percent were Asian, and 3 percent had unassigned ethnicity. Table 3 presents the demographics of the study group by study year.

Table 4 presents the national demographics for all RHIA examinees during 2011–2013. We compared these demographics, provided by AHIMA research contacts, for all RHIA examinees (N = 2,524) who attempted the exam in the years 2011 to 2013. There were 790 examinees (31.3 percent) who took the exam in 2011, 827 examinees (32.8 percent) in 2012, and 907 examinees (35.9 percent) in 2013. Examinee demographic percentages indicated that the examinee group was predominantly 20 to 29 years old (40.9 percent) and female (69.6 percent). Data available for RHIA exam outcomes indicated that 1,892 examinees (75 percent) passed and 632 examinees (25 percent) failed.

In the AHIMA data (see Table 4), the course delivery method was not collected, demographic data questions were optional for examinees, and the summary data shown in the table may reflect multiple attempts by examinees. Regarding similarities between the examinee data and the data in this study, both groups were predominately female and between 20 and 29 years of age. Accordingly, the demographic analysis indicated no marked difference between the sample and the population of students attempting the RHIA exam, and the sample was considered representative of the population.

Research Question One

The null hypothesis was that cumulative GPA at program completion and course grades in specific HIM academic courses of students who passed the RHIA exam on the first attempt would not differ significantly from students who did not pass the RHIA exam on the first attempt. Thus, the hypothesized logistic regression model for research question 1 was as follows:

$$Y = a + b_1 \text{ cumulative GPA at program completion} + b_2 \text{ Departmental Management grade} + b_3 \text{ Quality Improvement Regulations and Procedures grade} + b_4 \text{ Management of HIM Systems grade} + b_6 \text{ Legal Aspects of HIM grade} + b_7 \text{ HIM Research and Data Analysis grade} + b_8 \text{ Health Information Technology grade} + b_9 \text{ Contemporary Leadership Principles for HIM grade}$$

A backward stepwise logistic regression was conducted to evaluate the effect of cumulative GPA at program completion and course grades in specific HIM academic courses on the likelihood of passing the RHIA exam on the first attempt. A test of collinearity did not reveal issues related to multicollinearity. In this preliminary result, only cumulative GPA (p = .008) and Health Information Technology grade B (p =.019) were significant predictors of passing the RHIA exam on the first attempt, with p = .05 as the cutoff for significance. Table 5 details the initial results of the backward logistic regression with all independent variables remaining in the analysis.

Backward stepwise logistic regression removes one variable in each step, on the basis of its contribution to the model. Our analysis continued for seven steps. Table 6 shows the final results of the backward logistic regression for the fitted model, where variables not contributing to the model have been removed in the regression process. Results of the backward regression indicated that cumulative GPA at program completion was significant, with $\beta = -4.36$, standard error of 1.21, Wald $\chi^2(1, n = 74) = 13.07$, $p < .001$, with an odds ratio of 0.01. Thus, for each one-point increase in cumulative GPA, there is a 1.3 percent increase in the odds of passing the exam on the first try.

In addition, the Health Information Technology course grade was a significant predictor. The odds of passing the first time for students with a C course grade is 0.059, or 2.827 times lower than the odds of passing for students with an A course grade, holding all other independent variables fixed. In percentages,

the odds of passing are 94 percent lower for students with a C grade than for students with an A grade. Similarly, the odds of passing the first time with a B grade is 0.230, or 1.471 times lower than the odds of passing with an A, holding all other independent variables fixed. In percentages, the odds of passing are 77 percent lower for students with a B course grade than for students with an A course grade.

Thus, the backward logistic regression for the fitted model is as follows:

$Y = a + b_1$ cumulative GPA at program completion + b_8 Health Information Technology grade

We next considered the goodness of fit and variance explained by this predictive model. The Hosmer-Lemeshow goodness-of-fit test is a pseudo chi-square statistic that is affected by sample size and missing data. Because this goodness-of-fit test compares actual and predicted dependent values, a finding of nonsignificance (small differences) would indicate a good model fit.[36] This is the case for our model in that there is a small, nonsignificant difference (at $p = .05$).[37] For this study, the Hosmer-Lemenshow values showed a good model fit, $\chi^2(8, N = 64) = 14.01$, $p = .08$.[38, 39] The pseudo-R-squared statistic, Nagelkerke's R-squared, indicated that the model's predictors explained 37.1 percent of the variance of the dependent variable.

Research Question Two

This question explored the relationship between first-time pass rate on the RHIA exam and the cumulative GPA of graduates in 2011–2013 for on-campus students and online students. A logistic regression analysis using cumulative GPA as a predictor of first-time success showed that $\beta = -2.31$, with standard error of 0.77, $\chi^2(1, n = 74) = 8.97$, $p < .003$, with an odds ratio of 0.10 for all students. Cumulative GPA was a significant predictor of passing the RHIA exam. These results are provided in Table 7.

Research Question Three

This question considered the relationship between educational format and achieving a first-time pass or fail on the RHIA exam. Logistic regression using course delivery method as a predictor of first-time success showed $\beta = -1.18$, standard error of .55, $\chi^2(1, n = 74) = 4.60$, $p < .032$, with an odds ratio of .31 for all students. To examine the variance explained, Nagelkerke's R-squared was calculated, indicating that educational format accounted for 9.1 percent of the variance of the predictive model. This result suggests that online students have greater success in passing the RHIA exam on their first attempt than on-campus students have.

A post hoc chi-square test was conducted to examine the differences between on-campus and online students. For on-campus students, 57.1 percent ($n = 24$) passed, and 42.8 percent ($n = 18$) failed. For the online group, 81.3 percent ($n = 26$) passed, and 18.8 percent ($n = 6$) failed. See Table 8 for these results and Figure 2 for a summary of logistic regression for all variables.

Discussion

This work provided insight into the predictors of first-time success on the RHIA exam. The topic is important because increasing the rate of first-time success on the RHIA exam is one way to increase the number of credentialed HIM professionals in the workforce. Moreover, students' first-time exam pass rates are typically assessed as part of HIM program accreditation; therefore, program directors should stay informed regarding factors predicting exam success. Three questions were explored in this study.

The first research question considered the relationship between first-time pass rate on the RHIA exam, specific HIM course grades, and cumulative GPA. Results indicated that cumulative GPA and Health Information Technology course grade improved the predictive model. Other variables did not add to the model's predictive ability. Overall, these results are consistent with the findings of Condon's 2013

study. However, following Condon's recommendations that future researchers consider other academic variables, a different set of academic courses grades were selected for this research question because their course content largely addressed RHIA Content Domain 1: Information Access, Disclosure, Archival, Privacy and Security (23–27 percent) and Domain 3: Informatics, Analytics and Data Use (22–26 percent), which together represent more than 50 percent of the exam content.[40]

Given the significant impact of the Health Information Technology course grades, program directors may wish to disseminate these results to the HIT course instructors so that they can provide further knowledge building opportunities aimed at the content of this RHIA domain. Health Information Technology course instructors could add practice activities covering key concepts or offer rework opportunities for key assignments tied to domain content.

Second, the study aimed to explore the association between the first-time pass rate on the RHIA exam and the cumulative GPA. Results indicate that cumulative GPA significantly affected the success rate, consistent with Condon's study.[41] Regarding the other studies in the conceptual framework, two studies examined some form of GPA. McNeill and Brockmeier explored the relationship between cumulative GPA, program resources, faculty, curriculum, and students and first-time pass rates on the RHIA exam.[42, 43] These researchers did not find significant relationships, and they suggested further exploration of the GPA and grades in HIM courses. Our results indicate some significant coursework, but not all courses were predictive indicators.

The third research question explored online versus on-campus course delivery as a predictor of RHIA exam success. The academic delivery method was found to be a significant predictor of first-time success, with online students faring better than on-campus students. In fact, 81 percent of the online students passed the RHIA exam the first time, compared with only 57 percent of the on-campus students. One previous study compared RHIA exam success for both on-campus and online baccalaureate degree students and postbaccalaureate online certificate program students at the same university.[44] Results indicated that online and on-campus graduates passed at similar rates, suggesting that course delivery was not a significant predictor of success. Our results varied from the previous work of Russell et al.,[45] who found no difference between on-campus and online students' RHIA exam success. However, the authors of that study did not develop a predictive model and evaluated only one year of student data.

While these results are intuitively surprising, several potential reasons could explain this outcome. First, online students use computers for class much more than face-to-face students who listen to lectures on campus do. Familiarity in using the computer, taking tests online, and using more interactive technical skills may mean that online students are better able to take the RHIA exam on a computer. Second, online students tend to be working professionals, who may be older and more experienced than on-campus students. Older and more experienced students may also perform better on the RHIA certification exam because of their prior success in achieving work goals.

Results of the current study may be useful to HIM department faculty for the purpose of revising curriculum content and examining content delivery systems with the goal of increasing the number of students passing the RHIA exam. Currently, most students take the RHIA exam online, and it may be the case that online students are more familiar with this environment. Course instructors in on-campus classes should consider providing opportunities for online coursework. Program directors may wish to work with instructors to provide online RHIA review modules during the last semester.

Limitations of the Study

This study had several limitations. The study sample included bachelor of HIM graduates at only one university, so the results may not generalize to all bachelor of HIM graduates or to other universities. The sample size was adequate to support the power analysis, but a larger sample could have different results. Moreover, differences between content delivery, instructors, media, and other factors for on-campus students and online students should be explored so that administrators can be better informed of the reasons that may explain the lower pass rate of on-campus students.

Future Research

Based on the findings of this study, future research should be conducted with larger study populations at several universities over longer periods of time to more fully evaluate longitudinal effects of the variables on the RHIA exam pass rates. A study with a larger number of participants would allow researchers to control for a number of student characteristics of online and campus-based cohorts. Another area for consideration might be the effects of prior healthcare or related work experience. This area could include students having other healthcare certifications or having taken the associate-level Registered Health Information Technician (RHIT) exam. Prior work on practice exams provided mixed results, indicating that further research is needed.

In this study, we found that academic delivery method was a significant predictor of success, with online students performing better than on-campus students. This finding may be due to differences in students' self-selection of online classes. These students tend to be older, more motivated, and better organized. Potentially, this "online effect" might be operationalized for on-campus students. For example, students could be required to take online RHIA practice exams during their senior year. Obviously, differences among content delivery, instructors, and other factors for on-campus students and online students should be explored to understand the reasons for the lower first-time pass rates of on-campus students. Finally, future research should include an examination of the time that students wait to take the exam after graduation.

Conclusion

This study considered the shortage of graduates of bachelor of HIM programs by assessing factors related to success in passing the RHIA exam on the first attempt. The research is important because the projected growth rate for the HIM occupation exceeds the supply of new graduates. This gap between the educational systems' ability to supply graduates and the industry's demand for qualified HIM professionals is an important driving force in successfully passing the RHIA certification exam. One efficient way to close this gap would be to increase the number of qualified graduates who pass the RHIA exam. This work examined potential predictors with the aim of developing a predictive model that might be useful for students and schools. In light of these results, continued research on predictors of RHIA exam success is essential.

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Figure 1

Conceptual Relationship of Factors Hypothesized to Influence Health Information Management (HIM) Students' Success on the Registered Health Information Administrator (RHIA) Exam

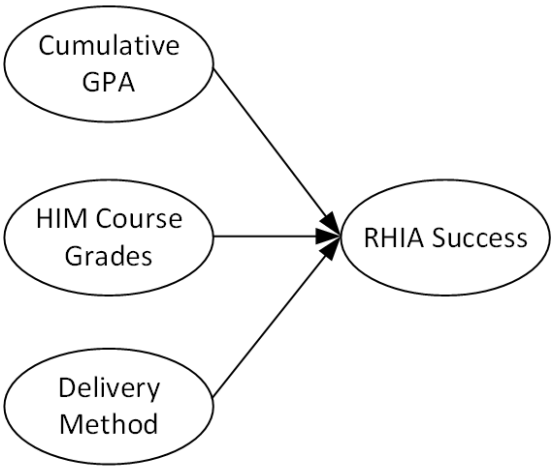
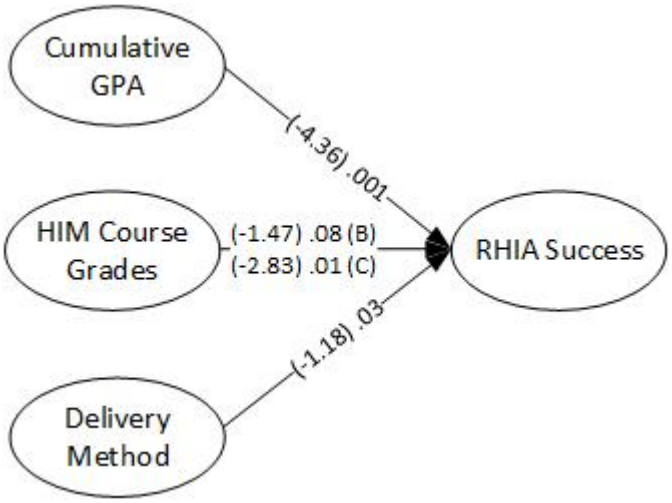


Figure 2

Logistic Regression Independent Variable Results



Note: β values are in parentheses, followed by the corresponding *p* value. "(B)" represents a B course grade as compared with an A course grade, and "(C)" represents a C course grade as compared with an A course grade.

Table 1

Journal Articles Examined for Independent Variables

Author's Names	Year	Journal/Publisher	Discipline
Choe & Mahoney	2013	Global Education Journal	Business
Baker-Eveleth et al.	2014	Journal of Education for Business	Business
Madan	2012	Doctoral dissertation (FIU)	Clinical lab
Austin	2011	American Dental Hygienists Association	Dental
Ward et al.	2010	Journal of Dental Hygiene	Dental
Adebayo	2008	Journal of College Admission	General
Lanham et al.	2011	Journal of College Teaching & Learning	General
King-Jones	2008	Unpublished doctoral dissertation (NSU)	General
Mattson	2007	Journal of College Admission	General
Angiello	2010	Education Digest	General
Keramidas	2012	Rural Special Education Quarterly	General
Wilson	2013	The Journal of Negro Education	General
Ragan	2000	The Journal of General Education	General
Lilley & Murray	2013	Doctoral dissertation (MSU)	General
Cummings et al.	2015	Journal of Social Work Education	General
Motii & Sanders	2014	Global Education Journal	General
Schwartz	2012	Journal of Research in Innovative Teaching	General
Lyke & Frank	2012	Journal of Instructional Psychology	General
Schofield & Dismore	2010	Journal of Further and Higher Education	General
Wolff et al.	2014	Journal of Online Learning and Teaching	General
McNeill	2009	Journal of Allied Health	HIM
Condon	2013	Doctoral dissertation (GSU)	HIM
Davidian	2010	ERIC database	HIM
Kyriakos	2009	Doctoral dissertation	HIM
Poole et al.	2012	Medical Education	Medical education
Shulruf et al.	2012	Advances in Health Sciences Education	Medical education
Siu & Reiter	2009	Advances in Health Sciences Education	Medical education
Schimming	2008	Journal of the Medical Library Association	Medical education
Trofino	2013	Teaching and Learning in Nursing	Nursing
Grossbach &Kuncel	2011	Journal of Professional Nursing	Nursing
Truman	2012	International Journal of Applied Science & Technology	Nursing
Knaus & Willson	2013	Journal of Professional Nursing	Nursing
Lint	2011	(not provided in reference)	Nursing
Breckenridge et al.	2012	Journal of Nursing Education	Nursing
Erickson	2013	Unpublished Doctoral Dissertation (NSU)	Nursing
Romeo	2013	Nursing Education Perspectives	Nursing
O-Neil & Fisher	2008	Journal of Nursing Education	Nursing
Kumrow	2007	The Journal of Nursing Education	Nursing
Wolkowitz & Kelley	2010	Journal of Nursing Education	Nursing
Houglum et al.	2005	American Journal of Pharmaceutical Education	Pharmacy
McCall et al.	2007	American Journal of Pharmaceutical Education	Pharmacy
Maize et al.	2010	American Journal of Pharmaceutical Education	Pharmacy
Dockter	2001	Journal of Physical Therapy Education	Physical Therapy
Maring et al.	2013	Journal of Physical Therapy Education	Physical Therapy
Utzman et al.	2007	Physical Therapy	Physical Therapy
Riddle et al.	2009	Physical Therapy	Physical Therapy
Hollman et al.	2008	Journal of Allied Health	Physical Therapy
Guffey et al.	2002	Journal of Allied Health	Physical Therapy
Kosmahl	2005	Journal of Physical Therapy Education	Physical Therapy
Flores & Simonsson	2012	Radiologic Technology	Radiology

Table 2

Significance of Variables from Previous Studies

Variables	Total No. of Times Examined	No. of Times Significant	No. of Times Not Significant
Course/professional grade point average (GPA)	9	8	1
SAT/ACT/TEAS testing	9	7	2
Overall/cumulative GPA	7	6	1
Course grades	6	6	0
High school or transfer GPA	5	4	1
Age	9	3	6
Undergraduate GPA	5	3	2
Gender	7	2	5
Preadmission science GPA	4	2	2
Interview scores	4	2	2
Attainment of a previous degree	3	1	2
Ethnicity	5	0	5
Totals	**73**	**44**	**29**

Table 3

Demographic Characteristics of Participants by Year

Characteristic	Entire Sample		2011		2012		2013	
	No.	%	No.	%	No.	%	No.	%
Educational format								
On-campus	42	56.8	9	50.0	16	57.1	17	60.7
Online	32	43.2	9	50.0	12	42.9	11	39.3
Gender								
Male	12	16.2	4	22.2	6	21.4	2	7.1
Female	62	83.8	14	77.8	22	78.6	26	92.9
Age in years on program admission								
<20	3	4.2	0	0.0	1	3.6	2	66.7
20–29	46	62.2	10	55.6	19	67.9	17	60.7
30–39	13	17.6	5	27.8	2	7.1	6	21.4
40–49	6	8.1	2	11.1	3	10.7	1	3.6
>50	6	8.1	1	5.6	3	4.1	2	7.1
Ethnicity								
Unassigned	2	2.7	0	0.0	0	0.0	2	7.1
White Non-Hispanic	50	67.6	13	72.2	21	75.0	16	57.1
Black Non-Hispanic	12	16.2	4	22.2	1	3.6	7	25.0
Hispanic	8	10.8	1	5.6	5	17.9	2	7.1
Asian	2	2.7	0	0.0	1	3.6	1	2.7
Native Hawaiian or Pacific Islander	0	0.0	0	0.0	0	0.0	0	0.0
Unknown	0	0.0	0	0.0	0	0.0	0	0.0

Table 4

National Demographics for all RHIA Examinees in 2011–2013

	Entire Sample		2011		2012		2013	
Characteristic	No.	%	No.	%	No.	%	No.	%
Exam attempt								
Pass	632	25.0	229	29.0	191	23.1	212	23.4
Fail	1,892	75.0	561	71.0	636	76.9	695	76.6
Gender								
Male	290	11.5	98	14.5	96.2	14.0	96	13.7
Female	1,756	69.6	571	84.0	582.0	85.0	603	85.8
Unknown	18	0 .7	7	1.0	7.0	1.0	4	0.6
Missing	460	18.2	–	–	–	–	–	–
Age in years on program admission								
<20	7	0.3	5	0.6	2	24.4	0	0
20–29	1,032	40.9	302	38.2	355	42.9	375	41.3
30–39	662	26.2	226	28.6	202	24.4	234	25.8
40–49	440	17.4	136	17.2	147	17.8	157	17.3
>50	383	15.2	1,212	15.3	121	14.6	141	15.5

Table 5

First Step of Backward Logistics Regression Analysis with All Independent Variables Included

Predictors	β	**S.E.**	**Wald** χ^2	**Sig**	**OR**
Cumulative GPA	−4.766	1.809	6.941	.008	0.009
Departmental Management (B grade)	−0.372	1.511	0.061	.805	0.689
Departmental Management (C grade)	−0.881	0.990	0.791	.374	0.414
Quality Improvement Regulations and Procedures for HIM (B grade)	−0.180	2.942	0.004	.951	0.835
Quality Improvement Regulations and Procedures for HIM (C grade)	0.456	1.084	0.177	.674	1.578
Management of HIM Systems (B grade)	0.328	1.598	0.042	.837	1.388
Management of HIM Systems (C grade)	0.409	1.030	0.158	.691	1.505
Legal Aspects of HIM (B grade)	−1.067	2.086	0.261	.609	0.344
Legal Aspects of HIM (C grade)	0.486	1.154	0.177	.674	1.626
HIM Research and Data Analysis (B grade)	−1.607	1.731	0.862	.353	0.200
HIM Research and Data Analysis (C grade)	0.723	0.857	0.712	.399	2.061
Health Information Technology (B grade)	−3.189	1.358	5.512	.019	0.041
Health Information Technology (C grade)	−1.788	1.033	2.993	.084	0.167
Contemporary Leadership Principles for HIM (B grade)	1.299	1.384	0.881	.348	3.666
Contemporary Leadership Principles for HIM (C grade)	1.494	1.327	1.269	.260	4.456
Constant	15.399	6.427	5.741	.017	

Note: β = regression coefficient, S.E. = standard error, Sig. = significance, OR= odds ratio.

Table 6

Final Fitted Model Including Significant Independent Variables Resulting from Backward Logistic Regression Analysis

Predictors	β	**S.E.**	**Wald** χ^2	**Sig.**	**OR**	**95% CI for OR**	
						Lower	**Upper**
Cumulative GPA	−4.36	1.21	13.07	.00	0.01	0.001	0.14
Health Information Technology (B grade)	−1.47	0.84	3.08	.08	0.23	0.04	1.19
Health Information Technology (C grade)	−2.83	1.15	6.03	.01	0.06	0.01	0.57
Constant	14.47	4.16	12.12	.00			

Note: β = regression coefficients, S.E. = standard error, Sig. = significance, OR= odds ratio, CI = confidence interval.

Table 7

Logistic Regression Analysis for Cumulative GPA

Predictors	β	**S.E.**	**Wald** χ^2	**Sig.**	**OR**	**95% CI for OR**	
						Lower	**Upper**
Cumulative GPA	−2.31	0.77	8.97	.003	0.10	.02	.45
Constant	6.51	2.40	7.36	.007	674		

Note: β = regression coefficient, S.E. = standard error, Sig. = significance, OR= odds ratio, CI = confidence interval.

Table 8

Logistic Regression Analysis for Academic Course Delivery Method

Predictors	β	**S. E.**	**Wald** χ^2	**Sig.**	**OR**	**95% CI for OR**	
						Lower	**Upper**
Academic course delivery method	−1.18	0.55	4.60	.032	0.31	.11	.45
Constant	0.891	0.771	1.336	.248	2.437		

Note: β = regression coefficient, S. E. = standard error, Sig. = significance, OR= odds ratio, CI = confidence interval.