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Predicting Performance on the National Athletic Trainers' Association Board of Certification Examination From Grade Point Average and Number of Clinical Hours

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Objective: To determine whether grade point average, hours of clinical education, or both are significant predictors of performance on the National Athletic Trainers' Association Board of Certification examination and whether curriculum and internship candidates' scores on the certification examination can be differentially predicted.

Design and Setting: Data collection forms and consent forms were mailed to the subjects to collect data for predictor variables. Subject scores on the certification examination were obtained from Columbia Assessment Services.

Subjects: A total of 270 first-time candidates for the April and June 1998 certification examinations.

Measurements: Grade point average, number of clinical hours completed, sex, route to certification eligibility (curriculum or internship), scores on each section of the certification examination, and pass/fail criteria for each section.

Results: We found no significant difference between the scores of men and women on any section of the examination. Scores for curriculum and internship candidates differed significantly on the written and practical sections of the examination but not on the simulation section. Grade point average was a significant predictor of scores on each section of the examination and the examination as a whole. Clinical hours completed did not add a significant increment for any section but did add a significant increment for the examination overall. Although no significant difference was noted between curriculum and internship candidates in predicting scores on sections of the examination, a significant difference by route was found in predicting whether candidates would pass the examination as a whole ($P = .047$). Proportion of variance accounted for was less than $R^2 = 0.0723$ for any section of the examination and $R^2 = 0.057$ for the examination as a whole.

Conclusions: Potential predictors of performance on the certification examination can be useful to athletic training educators in assisting students. These findings must be used cautiously because of the low proportion of explained variance. Low R^2 values suggest that the largest contributors to performance on the examination were not identified in this study. Although the results of this study support the decision to discontinue the internship route to certification, continued research focusing on identification and investigation of the constructs that contribute to examination success is needed.

Key Words: athletic training certification, certification examinations, credentialing examinations, athletic training education

The performance by route of curriculum and internship candidates on the National Athletic Trainers' Association Board of Certification (NATABOC) examination has been consistently reported in the literature. Candidates from the curriculum route to examination eligibility attain consistently higher scores on all 3 sections of the examination than internship-route candidates.[1–7]

This difference in the performance of curriculum and internship candidates on the certification examination raises questions for athletic training educators regarding the students' preparation for the examination. The ability to predict whether a student is likely to pass the certification examination by knowing academic performance as measured by grade point average (GPA) and the number of hours of clinical education completed is of interest to athletic training educators. To our knowledge, only one study[8] in athletic training investigated the ability to predict examination performance from performance in didactic learning and quantity of clinical education. This study only used subjects from a single institution. It is, therefore, important to expand the investigation to study candidates nationwide to determine whether the results are consistent.

The purposes of our study were to determine (1) whether a statistically significant relationship exists among GPA, quan-

tity of clinical education, and performance on any of the sections of the NATABOC examination; (2) whether GPA, the number of hours of clinical education completed, or both are significant predictors of performance of candidates on the NATABOC examination; and (3) whether the ability to predict performance on the examination for candidates who became eligible for the examination via the curriculum versus the internship route is statistically significant.

METHODS

Subjects

Data collection packets were mailed to 1360 first-time candidates for the April and June 1998 administrations of the NATABOC examination. The packets contained a data form and consent forms for study participation and the release of their examination results from Columbia Assessment Services.

Data and consent forms were received from 270 candidates: 117 men (43.33%) and 153 women (56.67%). Of these subjects, 143 (52.96%) were curriculum candidates and 127 (47.04%) were internship candidates. The study and consent forms were approved by the appropriate institutional review board for the protection of human subjects.

Data Collection Procedure

Each subject completed a data form that asked about the following variables: sex, overall GPA at the time of application for the certification examination, number of hours of clinical education completed at the time of application for the examination, and whether the candidate became eligible for the certification examination via the curriculum or internship route. The data forms were to be returned before the certification examination was administered.

Columbia Assessment Services provided quantitative scores on each section of the certification examination, including the written (written), practical (prac), and written simulation (simul) scores and pass/fail status on each section of the examination for each candidate in the study. Candidates who received a score of pass on all 3 sections of the examination also received a score of pass for the entire examination. Candidates not passing all 3 sections of the examination received a score of fail for the examination as a whole (pfall).

Statistical Analysis

We performed a 2-way analysis of variance to determine whether a significant difference existed between the means of the scores for the candidates by route to eligibility and by sex of the candidate. We also examined whether a significant interaction existed between the 2 variables. Because the variable for passing the examination as a whole (pfall) is only a dichotomous variable, we conducted a χ^2 analysis to determine whether curriculum and internship candidates passed the certification examination at significantly different rates.

Correlation coefficients were calculated to assess the degree of relationship among the variables in the study. Correlation coefficients among predictor variables were examined to assess the possibility of collinearity among the predictor variables.

We used multiple regression analysis to determine the ability to predict the outcome on each section of the examination and the examination as a whole from the predictor variables of GPA and clinical hours completed. Stepwise linear regression analysis was used to examine the ability to predict the quantitative score on each section of the certification examination from GPA and number of hours of clinical education completed. We examined the ability to predict whether the candidate received a score of pass or fail on the entire examination from GPA, number of clinical hours completed, or both using stepwise logistic regression analysis. This was done because the examination results are reported to the candidates as a dichotomous variable.

To determine whether the regression coefficients were significantly different among the groups in the regression analysis, the candidates were effect coded. We calculated an interaction vector consisting of the product of the value of the significant independent variables and the effect code. The variables GPA, clinical hours, effect code, and the interaction variable were entered sequentially into the appropriate equations. The significance of the regression coefficient for the interaction vector was used to determine whether a significant interaction existed between the independent variable(s) and route to examination eligibility. This test is equivalent to a test of the difference between the regression coefficients for the 2 groups.[9] Analyses were performed using the Statistical Package for the Social Sciences for Windows (version 6.0, SPSS Inc, Chicago, IL). For all analyses, the α level was set at $P < .05$.

Table 1. Descriptive Statistics by Route to Examination Eligibility

Variable	Mean (SD)
Grade point average	
Curriculum	3.375 (0.290)
Internship	3.306 (0.360)
Total	3.343 (0.326)
Hours	
Curriculum	1360.320 (366.020)
Internship	1767.940 (467.940)
Total	1551.953 (463.474)
Written score	
Curriculum	112.804 (10.204)
Internship	109.365 (11.165)
Total	111.137 (10.803)
Practical score	
Curriculum	37.091 (5.234)
Internship	35.500 (6.610)
Total	36.285 (5.881)
Simulation score	
Curriculum	533.042 (90.960)
Internship	531.865 (99.181)
Total	531.963 (94.943)

RESULTS

Descriptive statistics were calculated for each variable (Table 1).

The analysis of variance results indicated that the interaction between route to examination eligibility and sex of the candidate was not significant for all 3 sections of the examination ($P \geq .46$). The mean values for the written ($F_{3,266} = 7.05$, $P = .008$) and practical sections ($F_{3,266} = 6.09$, $P = .01$) of the examination showed a significant difference between curriculum and internship candidates. Neither the difference between the means of the scores on the written simulation section

Table 2. Correlation Coefficients Among Study Variables

	Grade Point Average	Hours	Sex	Written Score	Practical Score	Simulation Score	pfall*
Grade point average	1.000						
Hours	−0.072 ($P = .24$)	1.000					
Sex	0.097 ($P = .11$)	−0.041 ($P = .50$)	1.000				
Written score	0.404 ($P = .00$)	0.005 ($P = .93$)	−0.097 ($P = .11$)	1.000			
Practical score	0.266 ($P = .00$)	0.049 ($P = .43$)	−0.101 ($P = .10$)	0.519 ($P = .00$)	1.000		
Simulation score	0.267 ($P = .00$)	0.090 ($P = .14$)	0.101 ($P = .10$)	0.532 ($P = .00$)	0.364 ($P = .00$)	1.000	
pfall	0.203 ($P = .001$)	0.109 ($P = .07$)	−0.023) ($P = .71$)	0.553 ($P = .00$)	0.516 ($P = .00$)	0.597 ($P = .00$)	1.000

*pfall reflects passing score on entire examination for candidates passing all 3 sections and failing score on entire examination for candidates not passing all 3 sections.

Table 3. Linear Regression Analysis

	Written	Oral Practical	Simulation
Grade point average			
b (SE)	13.370 (1.851)	4.794 (1.062)	77.585 (17.140)
t value	7.226	4.515	4.527
P value	0.000	0.000	0.000
R^2	0.163	0.071	0.071
Hours			
b	0.034	0.068	0.110
t value	0.614	1.155	1.870
P value	0.540	0.249	0.063
Incremental R^2	0.000	0.000	0.000

Table 4. Regression Coefficients for Comparison of Regressions

	Written	Practical	Simulated
b (SE)	2.357 (1.869)	1.676 (1.072)	18.420 (17.473)
P value	0.208	0.119	0.293

by route to eligibility ($F_{3,266} = .04$, $P = .85$) nor the means of the scores of men and women on any section of the examination ($P > .05$) were statistically significant.

χ^2 analysis indicated that the difference in pass rate by route for the examination as a whole was not significant ($P = .25$). There was also no significant difference by sex of the candidate ($P > .05$).

The correlation coefficients among the independent variables of GPA, hours, and sex were not statistically significant ($P > .05$) (Table 2), but the correlation coefficients between GPA and the dependent variables written, prac, simul, and pfall were all statistically significant ($P < .05$). No significant correlation coefficients existed between the predictor variable clinical hours and any of the dependent variables, written, prac, simul, or pfall ($P \geq .07$). The correlations between sex and the variables written, prac, and simul were not significant ($P \geq .10$).

We used stepwise linear regression of the quantitative variables to determine if scores for each section of the examination could be predicted (Table 3). For each of the dependent variables (ie, written, prac, and simul), the regression coefficient for GPA was significant ($P \leq .05$). The regression coefficients for the quantitative dependent variables (ie, written, prac, and simul) were not significant ($P \geq .06$). Because there is no quantitative variable for passing the entire certification examination, we did not perform linear regression for this dependent variable.

To examine the ability to predict whether a candidate will pass the entire examination, pfall was regressed on GPA and clinical hours using logistic regression. The regression coefficient for GPA was significant ($P = .001$), and the coefficient for hours provided a significant incremental prediction of pfall ($P = .04$). The proportion of variance explained for the logistic regression model was 0.58 ($R = 0.0762$).

The regression coefficients for the interaction vectors between the effect code and each of the variables (ie, written, prac, and simul) were not significant ($P \geq .12$). These results indicated no significant difference between the regression coefficients for curriculum and internship candidates. We can infer from these results that no difference exists in the ability to predict examination scores for candidates who became eligible for the examination by different routes (Table 4).

The regression coefficient for the interaction vector among GPA, clinical hours, and effect code for the dependent variable pfall was significant ($\beta = 1.34 \times 10^{-5}$, $P = .03$). We can infer from these results a statistically significant difference in the ability to predict whether a curriculum or internship candidate will pass the entire examination from GPA and number of clinical hours completed.

DISCUSSION

Our examination of the data and the tests of differences in the means of examination scores suggests that curriculum candidates scored significantly higher than internship candidates on the written and practical sections of the examination, consistent with the previously reported literature.[1–7] Candidates from approved or accredited athletic training curriculums may have been better prepared for these sections of the certification examination than the internship candidates. Turocy et al[7] addressed potential reasons for the difference in scores, proposing that the more stringent didactic requirements of curriculum programs provide a wider knowledge base from which curriculum students can draw to enhance their clinical learning experiences.

The difference between the scores on the written simulation section of the examination for this sample was not statistically

significant, a result inconsistent with that reported in the literature. We have not found a specific reason for this departure from the pattern demonstrated in the past. However, potential explanations include bias in the sample due to subjects' self-selection in volunteering for participation in the study or the sample's inclusion of only 20% of the total pool of first-time candidates for the selected examination administration dates. The lack of significant difference in the simulation scores may also be explained by the type of questions used in this section of the examination and their relationship to the type of educational experience received by the candidates.

We found statistically significant positive correlations between GPA and scores on all 3 sections of the NATABOC examination and between GPA and whether a student passed the entire certification examination. These results imply that students who received higher grades were more likely to pass the certification examination than those who had a lower GPA.

We used the number of hours of clinical education as a predictor because currently no universally accepted measure of the quality of clinical education exists. Our analysis of the quantity of clinical education as measured by hours completed during the education of the candidates revealed no significant relationship between the number of hours accumulated and performance on any section of the examination. Draper[10] concluded that accumulating a high number of hours of clinical education does not necessarily result in passing the certification examination. Although he compared the number of clinical hours of internship and curriculum candidates in their preparation for the examination, he did not look at the combination of quantity of clinical education and academic performance as predictors of certification examination performance, as we did. We examined the ability to predict scores on the certification examination from both GPA and number of clinical hours completed.

The lack of a significant relationship between quantity of clinical education and performance on any section of the examination supports the current recommendations of the NATA Education Council to eliminate a count of the number of clinical hours as the sole criterion for examination eligibility based on the clinical portion of a candidate's preparation and replace it with a competency-based measure of student clinical education. This finding suggests that the nature of the students' clinical education differs among programs.

Changes in clinical education that move toward competency-based criteria are also supported by the lack of a significant correlation between GPA and number of hours of clinical education. The need to identify appropriate factors contributing to candidate performance on the certification examination is also supported. The lack of significant prediction of examination scores from the number of clinical hours completed and the low amount of the total variance accounted for by the data suggest factors contributing to examination performance that have not been identified.

Athletic training educators may find the ability to predict a candidate's performance on the certification examination useful in advising students during their professional preparation. An indication of the types of factors that are significant predictors of examination scores would assist educators in identifying students' areas of strength and weakness, allowing for early intervention. Therefore, a student with a low GPA could be directed to support services and resources that may improve the student's academic profile and, hence, the chances of success on the examination.

We regressed scores on the sections of the NATABOC examination on GPA and number of hours of clinical education completed by each subject. The regression coefficients of the curriculum and internship candidates on all sections of the examination were not significantly different from those of the internship candidates ($P > .05$). Lack of a significant difference in the regression coefficients implies no significant difference in the ability to predict performance on the individual sections of the examination, given the predictors of GPA and number of hours of clinical education completed.

The statistically significant difference in the regression coefficients of curriculum and internship candidates for the variable pfall implies a significant difference in the ability to predict whether a candidate will pass the entire certification examination based on the route to examination eligibility. On initial examination, the athletic training educator may be encouraged by these results, which may provide information to help predict a student's potential for success on the certification examination. Our examination of the proportion of variance accounted for in the regression analyses suggests that use of these results to predict a student's potential for success should be tempered. The proportion of variance accounted for in the prediction of the scores on the written ($R^2 = 0.16$), practical ($R^2 = 0.07$), and simulation ($R^2 = 0.07$) sections is very low. The proportion of variance accounted for in prediction of passing the entire examination ($R^2 = 0.057$) is also low. The low proportions of variance for the regression models imply that many other potential factors may contribute to a candidate's scores on the NATABOC examination.

The regression analyses in this study are consistent with those of studies in athletic training[7] and other allied health professions.[10–17] In general, GPA is a statistically significant predictor of performance on credentialing examinations. This may be due to the fact that most credentialing examinations are written, and they may tend to focus on material and testing methods that emphasize knowledge and understanding of the concepts normally developed in the classroom setting.

LIMITATIONS OF THE STUDY

Generalizability of our results may be influenced by the fact that subjects were self-selected for participation in the study by voluntarily responding to a request from the researchers. The results may also be affected by the return rate of 20%. The data should also be interpreted in light of the fact that this was a 1-time sampling of candidates from 2 examination administration dates in the same calendar year.

Using this study's findings to make decisions about how a student might score on the certification examination must be done cautiously because the proportion of variance accounted for was between 7.1% and 16.3% of the variance in the raw scores of the data and was 5.7% of the variance in the prediction of success on the examination as a whole. The relatively low proportion of variance accounted for also suggests that the factors accounting for success on the certification examination have not yet been identified. When evaluating the statistical significance of the correlation coefficients, we must also remember that the values fall in the low-to-moderate range.

CONCLUSIONS

Although potential predictors of examination performance can help athletic training educators advise their students, it

remains important to identify those factors that contribute significantly to that performance. No researchers have yet objectively identified the factors that contribute to student success on practical examinations. Research attempting to relate criterion-based performance to clinical education often uses subjective instructor assessments as a predictor. Additional research is required to identify factors that can be used to help predict candidates' performance on the certification examination. Issues relating to competency-based clinical education and specific didactic requirements for athletic training education need to be investigated further to determine those factors that more directly affect the candidates' outcome on the certification examination.

The development of a universal method to assess the content and quality of athletic training clinical education based on factors that contribute to examination scores would allow athletic training educators to assess students' professional preparation. Future research should focus on identification and investigation of the constructs that contribute to success on the NATABOC examination and appropriate methods for assessing student achievement within those constructs.

The evidence from this study against quantity of clinical education as a predictor of examination performance supports the efforts of the NATA Education Council to investigate competency-based clinical education. The process of revising the guidelines for athletic training education has already begun. Athletic training educators continue to strive for information to help them better prepare students for the certification examination. The identification of GPA as a significant predictor of performance on all sections of the examination is a first step toward identifying the factors that contribute to the success of candidates on the examination. More research is needed to identify content and psychometric factors that affect candidate performance on the examination.

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