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## ORIGINAL ARTICLE

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### Comparison of first-year grade point average and national board scores between alternative admission track students in a chiropractic program who took or did not take preadmission science courses

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**Objective:** We compared first-year cumulative grade point average and a composite score on part I of the National Board of Chiropractic Examiners (NBCE) exam for first-year alternative admission track program (AATP) students who did and did not take three specific undergraduate courses: general chemistry, organic chemistry, and anatomy and physiology.

**Methods:** All AATP students in 2015 ( $n = 50$ ) were evaluated for the course history of general chemistry and anatomy and physiology compared to their first-year cumulative grade point average and NBCE part 1 scores using independent  $t$ -tests.

**Results:** Students in the AATP who took general chemistry tended to score higher overall on the NBCE exams ( $p = .038$ ,  $r = .229$ ). Organic chemistry and anatomy and physiology had no statistical effect on improving board scores. First-year cumulative grade point average seemed to be unaffected by any of the undergraduate courses evaluated.

**Conclusion:** There was a statistically significant difference in composite NBCE part 1 score between AATP students who had and had not taken general chemistry 1 before admission. There were no differences in first-year GPA between AATP students who had and had not taken undergraduate chemistry and A&P courses.

**Key Indexing Terms:** Chiropractic; Education; Chemistry; Undergraduate

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### INTRODUCTION

Doctor of chiropractic programs (DCP) require high academic performance and motivation to succeed. Students accepted into chiropractic programs generally are required to have at least six college hours of biology, six hours of inorganic chemistry, six hours of organic chemistry, and six hours of physics of basic science prerequisites. The Council on Chiropractic Education has determined that chiropractic colleges could determine their own additional admissions standards if approved, but it is the responsibility of the DCP to track and report those students' progress and success due to changes. Recently, our DCP developed an alternative admissions track program (AATP) that accelerates undergraduate students into the program. These students are required to take only one prior undergraduate course in general biology (anatomy and physiology) and general chemistry.

Many other educational programs have attempted to explore the relationship between academic success in given prerequisite courses and program outcomes. A pharmacy program using retrospective data from 309 students found

that American College Testing scores, organic chemistry, math, and prepharmacy course grades, and bachelor degree attainment were the best factors for academic success measured by first-year grade point average (GPA). In medical and dental schools, a high incoming GPA has shown to be a strong predictor for academic success. A more recent study found that Medical College Admissions Test scores were the best predictors for graduation from medical school.

Because American College Testing and Medical College Admissions Tests are not requirements for admissions into the DCP, these factors have not been evaluated. However, other preadmissions predictor requirements have been evaluated in the chiropractic profession. One study assessed the Learning and Study Strategies Inventory, and found that motivation and attitude towards learning significantly affected GPA in a course more so than cognitive activity.<sup>10</sup> Another study found that students with an incoming undergraduate GPA of 3.5 or higher performed significantly better in biochemistry than those with a lower incoming GPA.<sup>11</sup> Surprisingly, other factors, such as the number of science prerequisites, undergraduate

degree type, and hours spent studying, had no significant effect on biochemistry grades in this study.<sup>11</sup>

One study focused on factors that influence success on Canadian Chiropractic Examining Board Licensure assessments. It concluded that second-year GPA was the most significant factor and explained 40% of the variance, while admissions interviews had no statistically significant effect.<sup>12</sup> Another study found that entering GPA and science GPA had a statistically significant positive correlation with students' success in their first year at a chiropractic program and their board scores.<sup>13</sup> Green et al.,<sup>9</sup> at Palmer College of Chiropractic West, revealed that students who began the DCP with a bachelor's degree had a higher first-year GPA. They found that matriculating GPA, physics GPA, and chemistry GPA yielded the strongest regression model and could predict 27% to 33% of the variance of the success in the first year of the DCP, as measured by year 1 GPA. Many of these studies looked at the correlation between prior knowledge success (GPA overall or in an individual course) and success in the first year of a DCP.

The various factors that may predict student success in a DCP may be valuable, especially if this information could be used to identify potentially successful students or if students in the AATP might require remediation assistance. Since there was a change to admission requirements, we had the opportunity to investigate if variables related to preadmission requirements were predictive of first-year students' academic success (measured by first-year GPA) and results on part 1 of their National Board of Chiropractic Examiners (NBCE) examinations. There were two research questions for this study. Will AATP students who take undergraduate chemistry, anatomy, and physiology (A&P) be more successful in the DCP than those who do not, as measured by first-year GPA? Will AATP students who take undergraduate chemistry and A&P be more successful on NBCE part 1 than those who do not, as measured by a NBCE part 1 composite score?

## METHODS

This study was approved by the institutional review board of Parker University (A-00125). All data were obtained from the registrar's office. AATP student data were collected from the fall, spring, and summer 2015 trimesters of 2015. Demographic data, grades in undergraduate science prerequisite courses, first-year DCP GPA, and NBCE part 1 scores were collected. The first-year GPA was calculated after the first two trimesters. GPAs were classified as follows: 4.0 (100%–89.5%), 3.0 (89.4%–79.5%), 2.0 (79.4%–69.5%), and 0.0 (69.4%–0%). In the fifth trimester, these students took part 1 of the NBCE examinations. For NBCE results, we used a composite score from scores in the general anatomy, spinal anatomy, and chemistry sections of NBCE part 1.

All data analyses were done with IBM SPSS Statistics version 22 (IBM Corporation, Armonk, NY). Data were divided into AATP students who took the specific courses general chemistry, organic chemistry, or A&P and those

who did not. The minimum number of participants required for adequate study power ( $1 - \beta = 0.8$ ) was  $n = 29$ . Separate independent *t*-tests were used to determine if there was a statistical difference between group (course enrollment) and first-year DCP GPA and NBCE part 1 composite scores. A Levene's test was run to insure homogeneity of variance for the independent *t*-test. In addition, correlation ( $r = 0.642$ ) and reliability ( $\alpha = .844$ ) of the NBCE scores were run and satisfied all requirements to create a composite score.

## RESULTS

### Participants

This study targeted a sample pool of ( $n = 50$ ) prechiropractic AATP students admitted into the DCP alternative admissions track program. They all had taken chemistry and A&P courses at Parker or other institutions. The sample consisted of 62.5% white, 13.8% black, 11.4% Hispanic, and 56.6% male students. Average entering GPA of the participants was 3.25, and average science GPA was 3.03 with 22 incoming science hours.

### Undergraduate Chemistry and A&P Completion

AATP student GPA data were separated into two groups; those who took the specific science course (group 1) and those who did not (group 2) before admission into the DCP. Overall, no statistically significant results were found ( $p > .05$ ; Table 1). Therefore, there was no difference between GPA achievement and taking the undergraduate chemistry and A&P courses.

### Science Courses and NBCE Part 1 Scores

Students who passed general chemistry I did better overall using the composite NBCE score ( $p = .038$ ,  $r = .229$ ; Table 2, Fig. 1). A Levene's test was run to determine the variances. Based on results; we used the correction for unequal variance. Students who took organic chemistry or A&P did not statistically improve their composite NBCE score ( $p > .05$ ).

## DISCUSSION

It was important to study and understand factors that may help students succeed in their first trimester of our DCP, because they were admitted on an AATP track in accordance with the defined parameters of the Council on Chiropractic Education. Some studies have focused on first-year GPA, while others have looked at external factors, such as number of undergraduate science courses taken, sex, and so forth.<sup>2–4</sup> Standardized tests for other medical programs exist to aid professional school admissions in selecting effective students, but chiropractic education does not currently have a time-tested preadmission exam, making student selection to ensure success more challenging. These results may help administrators find at-risk students and determine if any undergraduate science courses are important to student success. In 2006, Cunningham et al.<sup>14</sup> found that short-term preparation courses for the NBCE part 1 did not have a statistically

**Table 1 - Results of Student Data Undergrad Course to First-Year DCP GPA**

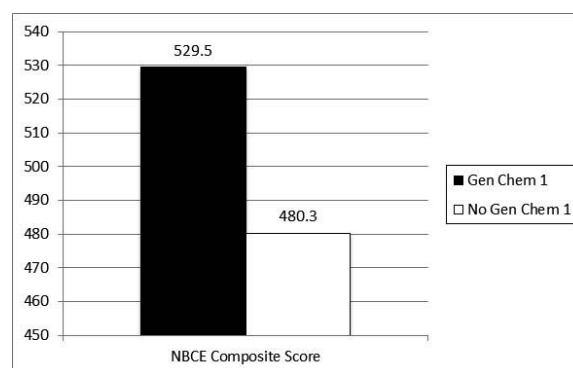
Undergraduate Course Enrollment	First-year GPA of Those Who Took Listed Course	First-year GPA of Those Who Did Not Take Listed Course
General chemistry 1	2.83	2.47
General chemistry 2	2.80	2.77
Organic chemistry 1	2.90	2.73
Organic chemistry 2	2.83	2.64
Anatomy physiology 1	2.72	2.86
Anatomy physiology 2	2.63	2.85

significant effect on success on the NBCE. Preadmissions GPA, in-program GPA, and courses taken before entering the program were the best predictors of improved NBCE performance. In our study, we found similar results, which determined that taking general chemistry 1 specifically before entering into the DCP could have an influence on future NBCE scores.<sup>14</sup>

Having completed general chemistry 1 was associated with significantly higher NBCE composite scores. One explanation of the results could be that general chemistry 1 is a science-intensive course that requires a number of cognitive skills, including math, spatial, memorization, and biological science.<sup>15,16</sup> It also is the first introduction to chemistry ideas and the course gives a good survey of the basic concepts. General chemistry 2 and organic chemistry seemed to have no relation to improving the NBCE composite score. This could be attributed to students taking biochemistry in the first year of the DCP. Students could be receiving enough chemical structure and reactions knowledge to minimize the influence of organic chemistry. Other studies have correlated biochemistry GPA with NBCE scores.<sup>17</sup>

Students who took A&P did not seem to do better on any of the NBCE sections. This includes the general anatomy and spatial anatomy sections. When students take a specific anatomy course in the first year of the DCP, they perhaps minimize the impact of passing and failing the undergraduate course. By completion of the DCP first trimester anatomy course, the students seem to be on the same cognitive level, even if they had previously taken A&P courses. The students, perhaps, learn enough in the DCP anatomy course that the undergraduate course has little effect on student success.

Surprisingly, none of the courses was associated with a statistically different first-year GPA between the AATP



**Figure 1 - Comparison of composite scores of National Board of Chiropractic Examiners part 1 for students who did or did not take general chemistry 1.Comp.**

groups. We did not look at individual classes within the first year, but overall there seemed to be no influence. All students came in with a strong science background, so this could have minimized the effect of chemistry and A&P on the overall GPA in the first-year DCP. In addition, the effect size was small for the statistical analyses, so there was little practical significance.

Overall, it seems that students who take general chemistry 1 tend to have higher NBCE part 1 composite scores. This course might be analyzed by administrators at our institution to identify at-risk students who could do poorly on the NBCE. If a student was admitted into the program without having successfully completed this course, possible remediation in this subject area could conceivably improve their scores.

This study has limitations that may affect the result interpretation. First, our study was performed at one university and so the sample accessed was limited and small. In addition, our study only analyzed students in the AATP program; however, future analysis should compare AATP to non-AATP students to see if there are differences between these groups. It would be beneficial to further study these results at other institutions and over a longer period including more than three cohorts. It also would be interesting to see if the undergraduate courses had any effect on individual DCP courses: that is, first-year anatomy and biochemistry. Last, it would be fascinating to determine if students taking the undergraduate courses at a different school had an effect. For instance, did students taking our undergraduate courses do statistically better on the board than students taking them at other universities?

**Table 2 - Results of Student Data Comparing Course Completion to NBCE Composite Score**

Course	t	Degrees of Freedom	p Value	r
General chemistry I	3.309	26.850	.003	0.229
General chemistry II	1.447	0.557	.582	0.103
Organic chemistry I	1.804	12.722	.095	0.374
Organic chemistry II	0.085	10.520	.934	0.015
A&P I	0.741	29.000	.465	-0.136
A&P II	0.274	9.477	.795	-0.051

## CONCLUSION

Our study indicated that for AATP students, there was a statistically significant difference in a composite NBCE part 1 score between students who had and had not taken general chemistry 1 before admission. There were no differences in first-year GPA between AATP students who had and had not taken undergraduate chemistry and A&P courses.

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This work was funded internally. The authors have no conflicts of interest to declare relevant to this work.

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### Author Contributions

Concept development: CM, GG. Design: CM, GG. Supervision: CM. Data collection/processing: GG, CM. Analysis/interpretation: CM. Literature search: CM. Writing: CM, GG. Critical review: CM, GG.

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