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Comparing UNMC's MD-PhD Applications Pre- (2018/2019) and Mid- (2020/2021) COVID-19 Pandemic

Jennifer L. Brady

University of Nebraska at Omaha, jbrady113@gmail.com

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**Comparing UNMC's MD-PhD Applications Pre- (2018/2019) and Mid- (2020/2021)
COVID-19 Pandemic
Jennifer L. Brady**

Executive Summary: Through completing a series of statistical analyses, this research provides observations and conclusions regarding the quality and quantity of applications received to UNMC's MD-PhD Scholars Program pre- and mid-COVID-19 Pandemic. After a review of relevant literature related to the impacts of the COVID-19 Pandemic on learners and educational institutions, this research presents the following findings:

- 1) There is no observable impact on the quantity of applications or matriculants within the mid-pandemic group.
- 2) While there is an observable decrease in MCAT score submitted by applicants within the mid-pandemic group, this finding is likely due to chance.
- 3) There is a statistically significant decrease in GPA seen in applicants within the mid-pandemic group. This is likely due to academic challenges brought on by the transition to online coursework, the postponement or cancellation of courses or exams, and/or needing to complete their courses from a different environment than they were accustomed to.
- 4) While there is an observable increase in research hours completed by applicants within the mid-pandemic group, this finding is likely due to chance.
- 5) While there is an observable decrease in MCAT score submitted by matriculants within the mid-pandemic group, this finding is likely due to chance.
- 6) While there is an observable increase (though marginal) in GPA submitted by matriculants within the mid-pandemic group, this finding is likely due to chance.
- 7) While there is an observable (and substantial) increase in research hours completed by matriculants within the mid-pandemic group, this finding is likely due to chance.

Abstract: This project seeks to examine how the application pool for the UNMC MD-PhD Scholars Program compares in pre-pandemic and mid-pandemic admission cycles. This is an important contribution to the field of public administration as it informs administrators working in higher education how the global pandemic impacts higher education admission processes and outcomes. Secondly, this research will explore if and how the pandemic has observable impacts on the quality (GPA, MCAT, prior research experiences) and quantity of applications submitted by applicants of the UNMC MD-PhD Scholars Program. These trends contribute to the larger body of research on how the pandemic (among other crises) impact individuals pursuing higher education.

I. INTRODUCTION

The MD-PhD Scholars Program at the University of Nebraska Medical Center (UNMC) is a dual-degree scholarship program for individuals training to become a physician-scientist. Each year, the program accepts applications from United States residents who have completed UNMC's pre-requisite medical school coursework, taken the MCAT entrance examination, and acquired significant experience in biomedical research. As of August 2022, there are 42 scholars enrolled in the eight-year program, which reflects an average five scholars per cohort. The program is supported by university funds (generated primarily through federal funding), the

University of Nebraska Foundation, and private donations. The application and admissions processes included in-person interviews, engagement activities, and campus tours until the World Health Organization declared COVID-19 a pandemic in March of 2020. This global event catalyzed a chain of significant changes to the application and admissions experiences of both the applicants and the administrators and faculty members working with MD-PhD training programs. Changes include the reduction of research opportunities due to lab closures, exacerbated stress levels, undergraduate courses converting from in-person to virtual, MD-PhD interviews converting from in-person to virtual, and the rescheduling or cancellation of MCAT testing dates. This paper seeks to explore if and how these changes have impacted the quantity and quality of applications received to the UNMC MD-PhD Scholars Program.

I will compare the applications received in pre-pandemic years 2018 and 2019 to those received during mid-pandemic years 2020 and 2021. To make conclusions on the quality of applications, I will compare the three key qualifications listed within submissions (GPA, MCAT, research hours completed) associated with the applications within my analysis window (2018-2021). As such, this paper frames itself around three key research questions: 1) What effects did the pandemic have on the MCAT score of mid-pandemic applicants? 2) What effects did the pandemic have on the GPA of mid-pandemic applicants? 3) What effects did the pandemic have on the number of completed research hours of mid-pandemic applicants? In addition, this paper will examine how the pandemic has affected the quantity of the mid-pandemic application pool.

This paper begins with a review of two bodies of research: 1) literature that describes how COVID-19 has affected individuals seeking and/or receiving higher education and 2) literature that describes the impact of COVID-19 on the education system and institutions, such as UNMC, that are providing education and services during these times. I draw upon the research of public administrators to determine if and how the current pandemic –as well as prior cases of economic downturn or health/safety crises– have affected both the individuals and institutions engaged in higher education. After a review of the relevant literature, I examine the application data of the applicants within my analysis window (2018-2021). I then discuss the challenges mid-pandemic applicants may have endured during their application cycle and conclude with limitations on this research project and recommendations on how to grow upon this research in the future.

II. LITERATURE REVIEW

The outbreak of the novel coronavirus SARS-CoV-2 (COVID-19) began its global spread at the start of year 2020 (Velavan & Meyer, 2020). The World Health Organization (WHO) declared the COVID-19 outbreak a global pandemic on March 11, 2020 (WHO Timeline – COVID-19, 2020). As of August 2022, there have been over 6.4 million reported COVID-19 deaths worldwide with over 1 million of these deaths occurring in the United States (The New York Times, 2022). To slow down the spread of the deadly virus, the United States has implemented measure to protect the health and safety of their citizens. Such measures include travel restrictions, restrictions on social gatherings, an emphasis or requirement to work from home, and social distancing (Mogaji & Jain, 2020). The impact of these safety measures is particularly disruptive to the delivery of education for primary, secondary, and post-secondary learners. This section will provide an overview of how COVID-19 has impacted both schools and learners associated with higher education.

The Impact of COVID-19 on Post-Secondary (Undergraduate/Graduate) Students

According to UNESCO (United Nations Educational, Scientific and Cultural Organization), more than 1 billion learners (from pre-primary to post-secondary) have been affected by school or university closures worldwide (UNESCO, 2020). These short and long-term school closures have led students to pursue their coursework online, oftentimes away from their educators and peers. While some schools and individuals experienced a smoother transition into virtual learning, this was not a universal experience. Education leaders indicate that online learning can lead to loss of motivation, self-discipline, and interest in studying (Michelle, 2021). Michelle goes on to state that “the lack of efficiency of technology, the difficulty for pupils to understand the concepts taught, and online learning causes social isolation and results in pupils not developing the necessary communication skills” (2021).

Not only did the transition to remote learning cause challenges for current students, but national enrollment data indicates that hundreds of thousands of students decided to put off higher education during the pandemic (Nadworny, 2020). According to the National Student Clearinghouse Research Center, undergraduate enrollment declined by 3.6 percent in fall 2020 and by 3.1 percent in fall 2021; in total, this represents a loss of just over a million students (Conley & Massa, 2022). This exacerbates an issue that leaders of higher education have been observing for more than a decade. Both community colleges and four-year colleges have seen a decline in enrollment that precedes the pandemic; however, years 2020 and 2021 have exposed these concerning trends to the public.

Throughout the pandemic, higher education researchers, public administrators, and educators have conducted research to inform communities, schools, and legislators on the impacts of COVID-19 on the classroom. While schools and students will continue to feel the impacts of the pandemic for years – if not decades – to come, research suggests that the most significant short-term impacts have already occurred. A study out of Montclair State University in Montclair, New Jersey indicates that college students at the epicenter of the pandemic (spring 2020) were most deeply affected by academic, financial, and COVID-related stressors (Reyes-Portillo et al., 2022). This research group surveyed more than 4,700 students from public and private institutions in New York and New Jersey to identify the how the pandemic affected mental, physical, and financial health. The findings indicate that the pandemic affected the mental health of the entire sample and that students of color were disproportionately affected by financial stressors (Reyes-Portillo et al., 2022).

Not all students have experienced the impacts of the pandemic in the same way. Research indicates COVID-19 has taken a particularly large toll on Black, Hispanic, and Indigenous communities. Emma Dorn oversees an education research group out of San Francisco. Her research focuses on education outcomes and equity for all students, with a focus on post-COVID-19 learning recovery. Along with her team, Dorn examined how “school shutdowns were likely to compound racial disparities in learning and achievement, analyzing the toll on learning, dropout rates, and the overall economy” (Dorn et al., 2021). Their data shows that, students of color were about three to five months behind in learning while white students were about one to three months behind. This is consistent with a larger body of research indicating that the pandemic exacerbated existing achievement gaps.

It is equally important to observe how parents and guardians working to provide for their children and youth are affected by the pandemic. For example, in June 2020, NPR described how Black Americans face the greatest economic impact due to COVID-19 due to their higher

likelihood of working essential jobs (i.e., food industry, health services, transportation), which many opted to quit to protect the health of themselves and their families (Smith & Rosalsky, 2020). In addition, the COVID-19 pandemic has exacerbated poverty levels across the world; both developed and developing countries have experienced significant economic hardship due to the reduction of jobs, investments and exports, and tourism (Kharas and Dooley, 2021). This, undoubtedly, shifts the family and household dynamics surrounding the children and youth involved in schooling. Coupling race with gender is a critical intersection to consider.

Additional factors, such as race and gender, increase a person's likelihood of living in poverty (Sauter, 2018.) Women are at a greater risk of poverty due to the gendered wage gap, members of the Latinx community report lower earnings levels often due to their lower education levels, and Black Americans are more than twice as likely to live in poverty than their non-Black counterparts due to a variety of factors such as systemic racism (Sauter, 2018). Sauter also lists "growing up in difficult homes, poor neighborhoods, and inadequate school systems" and "facing discrimination and limited work or advancement opportunities, and the effects of generational poverty" as reasons certain individuals are more likely to experience poverty. The pandemic has exacerbated these ongoing trends, which greatly impact the children and youth experiencing short or long-term poverty. These out-of-school experiences play a significant role in how students receive and engage in their in-school experiences. This is particularly complicated if students are receiving their education from home and unable to comfortably access (or access at all) their learning materials.

Despite challenges faced by students and their families, a separate body of research shows an increase in post-graduate applications during times of economic downturn (Lipsett, 2009). A notable increase of students seeking postgraduate training occurs as individuals work to improve their qualifications in a more competitive employment market or wish to delay their entrance into the workforce by embarking on continued studies (Lipsett, 2009). Similarly, Stanford economist Caroline Hoxby noted in 2016 that a benefit of the last United States recession was that students were more likely to enroll in – and stay in – undergraduate or graduate coursework despite the rising cost of admission. Hoxby also noted that college admissions have increased following every United States recession since the 1960s (Parker, 2016). This paper seeks to identify if these trends, which were observed during times of economic recession, also exist during a global health crisis.

The Impact of COVID-19 on Post-Secondary (Undergraduate/Graduate) Programs

Higher education institutions are often creatures of habit and tradition; however, the pandemic has brought on an immediate need for fluidity and flexibility for coursework, education delivery, teaching objectives, and program outcomes. Beyond the impacts on the student, there are a variety of challenges the pandemic has inflicted on the institutions themselves. The most immediate challenge is financial security. According to an article on the marketplace challenges of COVID-19 on higher education, institutions are "losing out on parking fees, dining outlet sales, and other auxiliary revenues; they also face unexpected expenses, including partial refunds on fees, room, and board, and the need to scale virtual engagement modalities" (Fishman, 2020). Financial loss is also seen through the decreased volume of program applications, which are often submitted with a fee delivered directly to the schools in which they have applied.

However, while the pandemic has affected many students' plans for post-secondary training, the trends for medical school applications have yet to indicate such drastic shifts, if any. Medical school officials from across the United States are report receiving just as many applications in 2020 and 2021 (as compared to 2019), and some med schools report that they have gotten more applications than seen in previous cycles (Kowarski, 2020). Additionally, the Association of American Medical Colleges (AAMC) reported a record high for medical school applicants and enrollments in 2021. Applicants to medical school increased by a record-setting 17.8% during the 2021-22 school year; this increase was led by historical increases among underrepresented minorities, according to data from the AAMC (Boyle, 2021). However, what remains unknown about these increases is the driving force behind the uptick. Boyle writes that "admissions leaders believe an unprecedented mix of developments compelled many medical school aspirants to leap from "someday" to "now": pandemic-related shutdowns that cut off other opportunities and accelerated medical career plans; increased awareness of how doctors can help to alleviate social injustices; and changes that reduced fees for some students and eliminated travel costs associated with applying" (2021). What also remains unknown is data indicating an increase or decrease on international student interest in medical schools; because a finite number of schools presently accept international applications, this appears to be an undeveloped area of observation. Most accredited MD programs limit foreign student applications to those with a permanent resident status.

This increase, or lack of decrease, in application supply is a notable discovery given the turbulent experience of today's prospective students. Students are told by medical school administrators and institutional admissions counselors to wait to apply until they feel ready and qualified for medical school; however, it is less obvious for students to identify their level of preparedness now that their experiences with physician shadowing, in-person research experiences, and completing the MCAT have been altered, reformatted, or cancelled. It would be logical for students to delay their pursuit of medical school due to the uncertainties that surround their applications and career ahead of them. To better comprehend the pandemic's influence on pre-medical students' approach to medical school applications, researcher Jenny Leigh interviewed 48 pre-medical students at a private university in the northeastern United States. The findings of Leigh's research reinforced the upward trends seen for American medical school applications. Leigh found that "for many students, witnessing physicians' role during the pandemic made them more aware of both the vulnerability of physicians and the limits of their power in the medical field and society at large. Despite acknowledging these limitations, students emphasized that the pandemic had reinforced their interest in becoming a physician by validating their perception of the vital role that physicians play in society" (2021).

III. METHODOLOGY

Research Context

The MD-PhD Scholars Program at UNMC receives applications from pre-medical students each year. These applications come from undergraduate and post-graduate students across the country, which makes the decrease in undergraduate enrollment and successful participation of undergraduate coursework a significant threat to the size and strength of this program's applicant pool. The cancellation or virtual reformatting of national recruitment fairs, such as the Annual Biomedical Research Conference for Minority Students (ABRCMS), has also influenced this program's ability to connect with and recruit talented undergraduate students

during the pandemic. Additional challenges particular to premedical students include a decrease in comprehension and performance in core science courses due to the online teaching style, the cancellation of medical shadowing and volunteering experiences, and a reduced ability for students to partake in laboratory research due to campus closures/personnel limitations (Dowd, McKenney, & Elkbuli, 2021).

However, despite these challenges, the quantity of applications to the MD-PhD Scholars Program appears to remain steady with pre-pandemic admissions cycles, which is consistent with the national AAMC trends described in the previous section. Additionally, the quantity is seen to slightly increase during the 2021 year, which is also consistent with the national trends. Within the Findings section of this paper, the trends related to application quantity and quality will be documented and discussed in greater detail to determine if and how the pandemic has affected applications and admissions for this specific program. To assess these trends, I will examine the application data from pre-pandemic years 2018 and 2019 – which I will label “Group A” – and compare to mid-pandemic years 2020 and 2021 – which I will label “Group B”. As discussed earlier in the Literature Review section of this paper, literature suggests that significant global events – such as a pandemic – may impact the interest levels and/or qualifications of prospective students. As such, I have three hypotheses to explore with regards to students that apply to the MD-PhD Scholars Program:

H1: There will be a statistically significant difference in MCAT scores between Group A (2018, 2019) applicants and Group B (2020, 2021) applicants.

H2: There will be a statistically significant difference in undergraduate GPA between Group A (2018, 2019) applicants and Group B (2020, 2021) applicants.

H3: There will be a statistically significant difference in the number of completed research hours between Group A (2018, 2019) applicants and Group B (2020, 2021) applicants.

I also intend to review the data associated with the matriculated (enrolled) students in Group A (2018, 2019 applicants) and Group B (2020, 2021 applicants). This creates three additional hypotheses:

H4: There will be a statistically significant difference in MCAT scores between Group A (2018, 2019) matriculants and Group B (2020, 2021) matriculants.

H5: There will be a statistically significant difference in undergraduate GPA between Group A (2018, 2019) matriculants and Group B (2020, 2021) matriculants.

H6: There will be a statistically significant difference in the number of completed research hours between Group A (2018, 2019) matriculants and Group B (2020, 2021) matriculants.

Research Approach

I use pooled cross-sectional data, made available by UNMC, to test my research hypotheses. I access the MD-PhD applications submitted to UNMC in application cycles 2018-2021 and extract and organize pertinent information. This information refers to the data tied to my dependent and independent variables. My dependent variables are the applicant’s MCAT score, undergraduate GPA, and the number of completed research hours. When applying to the MD-PhD Scholars Program at UNMC, applicants provide their score on the Medical College

Admission Test (MCAT). The total MCAT score ranges from 472 to 528 where the midpoint is 500 (Association of American Medical Colleges, 2016). Applicants also provide their undergraduate Grade Point Average (GPA). An individual's undergraduate GPA is a number (usually on a scale between 1.0 and 4.0) that indicates how high they scored in coursework (Study Portals, 2020). Lastly, applicants provide the number of research hours obtained to date. Applicants typically acquire research hours by working with researchers or laboratory staff located on their undergraduate campus and/or through a summer research opportunity available through a separate university or private company. My research seeks to identify how my independent variable, the COVID-19 Pandemic, affects my dependent variables. I will measure the impact of the pandemic by comparing the dependent variables in pre-pandemic and mid-pandemic application years. While it is impossible to conclude that the pandemic is the only contributor to potential changes seen in my dependent variables, it will be useful to academic research to determine identify any significant changes seen over this four-year period.

Method of Data Collection

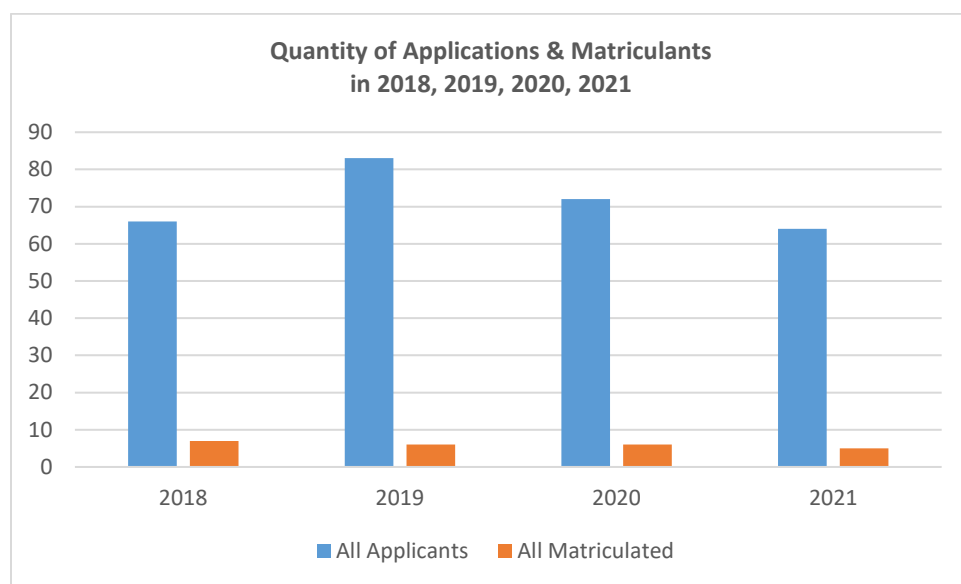
I have access to the four data spreadsheets (one for each year I am observing) through my work with the UNMC MD-PhD Scholars Program. As applications are submitted to my office – which occurs from June 1 to November 1 during each year – I input all application data (including MCAT, GPA, and number of completed research hours) into a data spreadsheet. This spreadsheet, available only to myself and the three Program Directors, is updated throughout the application cycle and, by November 1st, it contains all of application data for the associated cycle. The spreadsheets also contain information on the applicants' permanent residence, local residence, socioeconomic status, race and ethnicity, gender, and information on other professional degrees completed. Future studies could determine if there are trends to any of these factors between Group A and Group B applicants; however, I will maintain my focus on MCAT, GPA, and completed research hours. I will utilize Microsoft Excel to identify trends related to my six hypotheses. More specifically I will:

- 1) Conduct a t-test to determine if there is a statistically significant difference between the MCAT means of Group A (2018, 2019) applicants and Group B (2020, 2021) applicants.
- 2) Conduct a t-test to determine if there is a statistically significant difference between the GPA means of Group A (2018, 2019) applicants and Group B (2020, 2021) applicants.
- 3) Conduct a t-test to determine if there is a statistically significant difference between the completed research hour means of Group A (2018, 2019) applicants and Group B (2020, 2021) applicants.
- 4) Conduct a t-test to determine if there is a statistically significant difference between the MCAT means of Group A (2018, 2019) matriculants and Group B (2020, 2021) matriculants.
- 5) Conduct a t-test to determine if there is a statistically significant difference between the GPA means of Group A (2018, 2019) matriculants and Group B (2020, 2021) matriculants.
- 6) Conduct a t-test to determine if there is a statistically significant difference between the completed research hour means of Group A (2018, 2019) matriculants and Group B (2020, 2021) matriculants.

IV. FINDINGS & DISCUSSION

Application Quantity

Prior to observing the quality metrics (MCAT, GPA, and research hours) of applications and matriculants associated with admissions cycles 2018-21, I calculated the total number of applications received each year as well as the number of matriculated students. As seen in the table below, the number of total applications is typically in the range of 65-75 with a unique peak of 83 in 2019. The number of students matriculated falls within the range of 4-7 for all four years. While application years prior to 2018 are not reflected in this research, both ranges are consistent with observations made prior to 2018. Thus, I cannot conclude that the COVID-19 Pandemic has had an observable impact on the quantity of applications or matriculants during 2018-21.



	2018	2019	2020	2021
All Applicants	66	83	72	64
All Matriculated	7	6	6	5

As discussed in the Literature Review section of this paper, global crises are shown to have a variety of impacts on students' desire to pursue higher education. For some individuals, a crisis such as the COVID-19 Pandemic can deter students from pursuing higher education; for others, it may serve as a motivating factor. This mix of varied responses to global crises may be a possible explanation for the stable application quantity seen with the MD-PhD Scholars Program. While some prospective students may have chosen to delay or withdraw their application to this program due to stress and/or goal adjustments brought on by the pandemic, other students may have developed a stronger calling to pursue additional training and education.

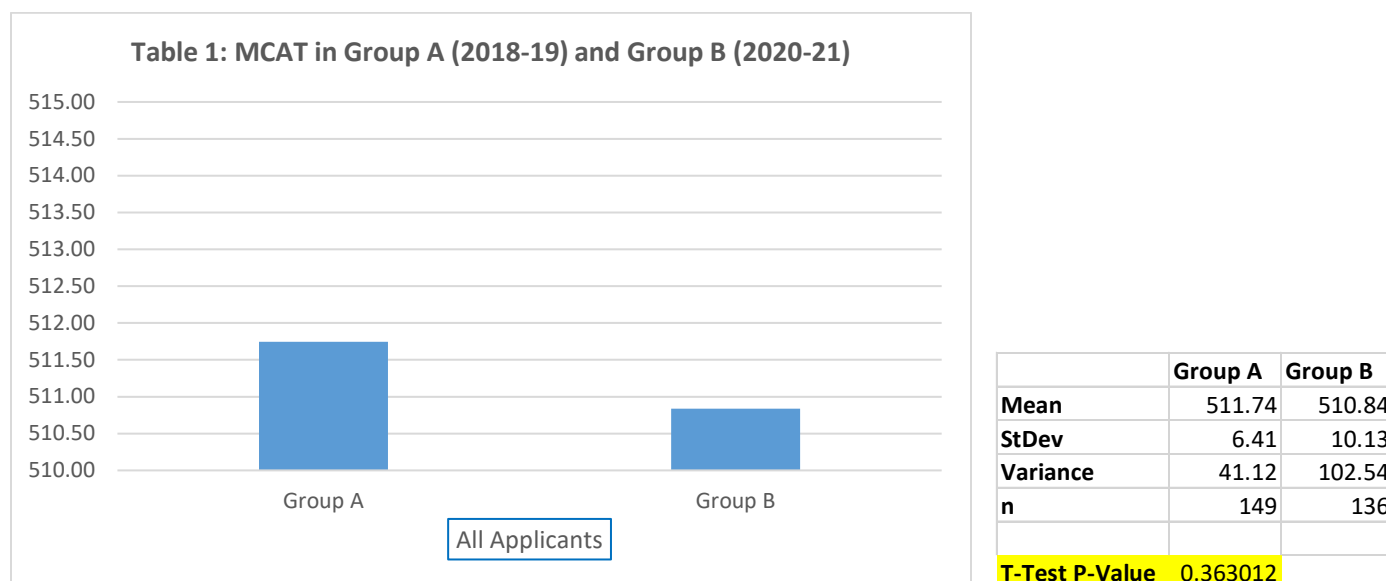
While the Association of American Medical Colleges (AAMC) found that applications to medical school have increased throughout the Pandemic, this plateau seen with the MD-PhD Scholars Program is still encouraging. It is also possible that applicants who delayed or withdrew their application in 2020 or 2021 will submit in 2022 or 2023 instead. As such, the program may observe a spike in applications from the students who took time to recuperate and/or prepare during the pandemic.

Application Quality

To assess the application quality between pre-pandemic and mid-pandemic applicants, I looked at the applicants' MCAT score, GPA, and number of research hours. To observe any changes between Group A (2018, 2019) and Group B (2020, 2021) applicants and matriculants, I ran a series of t-tests. Below are the results; Tables #1-3 show the data related to all applicants in Groups A and B and Tables #4-6 show the data related only to the applicants who matriculated into the UNMC MD-PhD Scholars Program.

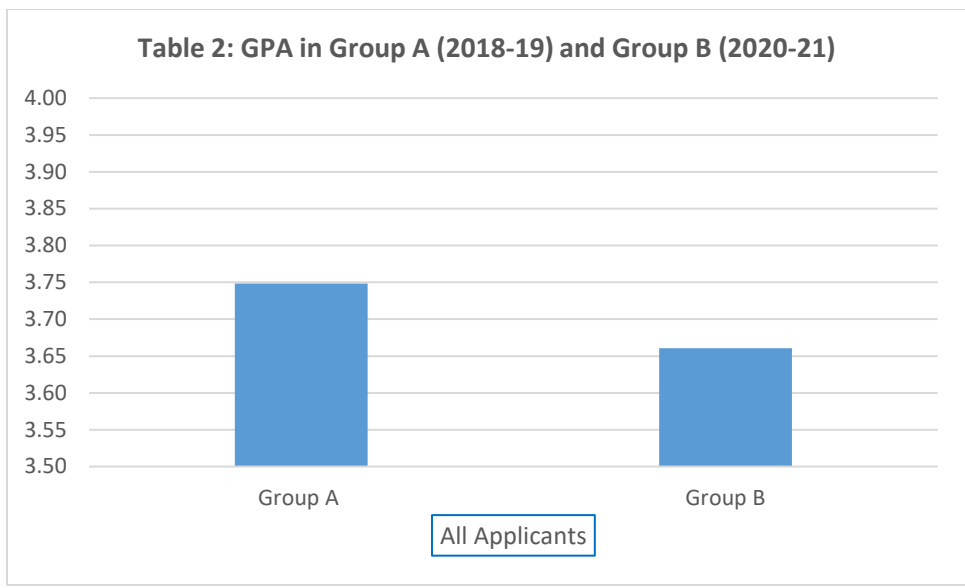
MCAT Score for All Applicants

Table 1 compares the mean MCAT score for Groups A and B applicants and includes the results of a t-test that determines if my independent variable (COVID-19 Pandemic) affected the MCAT scores in a statistically significant way. In interpreting this table, we see that the mean MCAT score, which is on a scale from 472 to 528, is higher for Group A than it is for Group B. According to the p-value yielded by a two tailed t-test, however, the statistical significance of the decrease in MCAT score seen in Group B is weak; in other words, my findings are likely due to chance. This rejects my first hypothesis [H1] stating that there will be a statistically significant difference in MCAT scores between applicants in Group A and Group B.



GPA for All Applicants

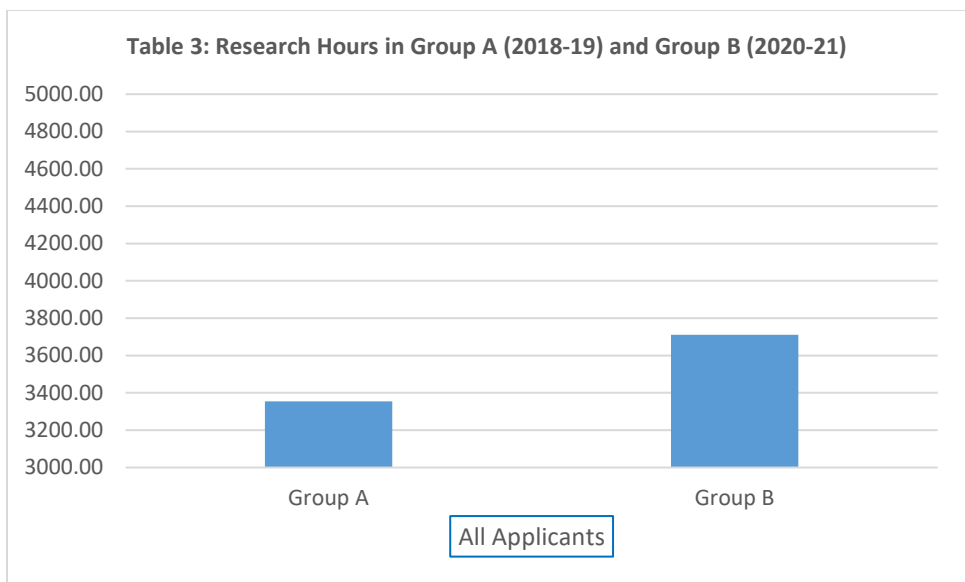
Table 2 (*seen on the next page*) compares the mean GPA for Groups A and B applicants and includes the results of a t-test that determines if my independent variable (COVID-19 Pandemic) affected the GPA in a statistically significant way. In interpreting this table, we see that the mean GPA score, which is on a scale from 1.00 to 4.00, is higher for Group A than it is for Group B. According to the p-value yielded by a two tailed t-test, the statistical significance of the decrease in GPA seen in Group B is strong (p-value less than 0.05); in other words, my findings are unlikely to be due to chance. This supports my second hypothesis [H2] stating that there will be a statistically significant difference in GPA scores between applicants in Group A and Group B.



	Group A	Group B
Mean	3.75	3.66
StDev	0.25	0.34
Variance	0.06	0.11
n	149	136
T-Test P-Value	0.013036	

Research Hours for All Applicants

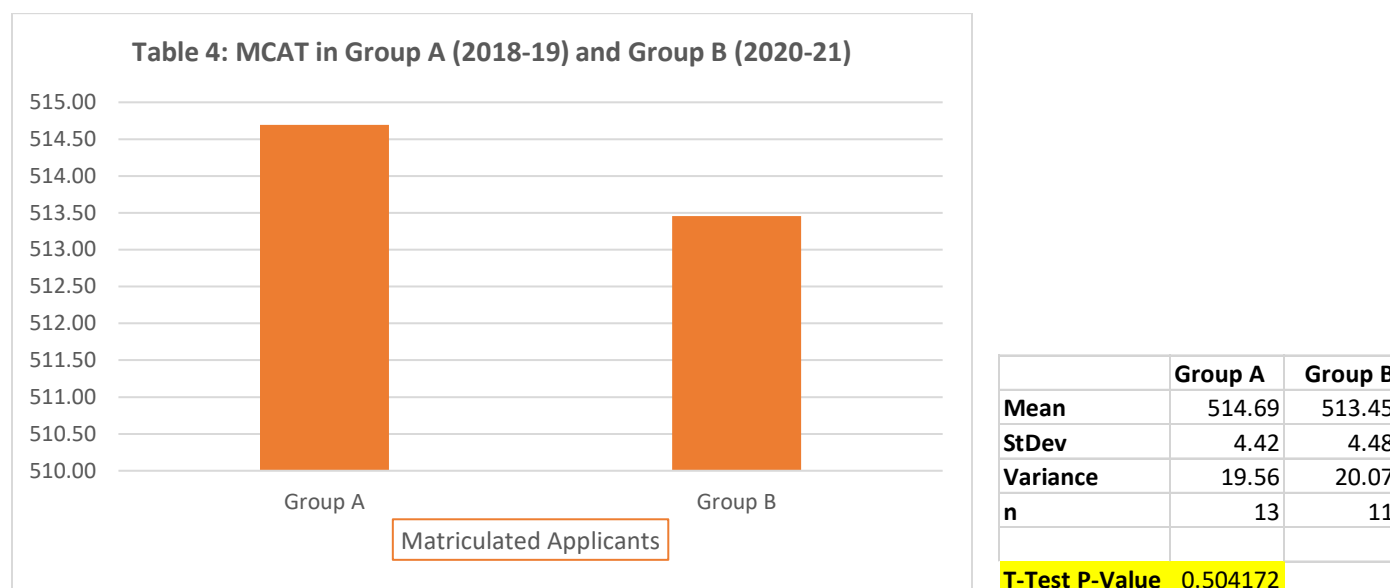
Table 3 compares the mean number of research hours for Groups A and B applicants and includes the results of a t-test that determines if my independent variable (COVID-19 Pandemic) affected the number of research hours completed in a statistically significant way. In interpreting this table, we see that the mean number of research hours is higher for Group B than it is for Group A. According to the p-value yielded by a two tailed t-test, however, the statistical significance of the increase in research hours seen in Group B is weak; in other words, my findings are likely due to chance. This rejects my third hypothesis [H3] stating that there will be a statistically significant difference in research hours completed by applicants in Group A and Group B.



	Group A	Group B
Mean	3354.68	3710.99
StDev	2674.84	2869.98
Variance	7154750.15	8236760.41
n	149	136
T-Test P-Value	0.2789323	

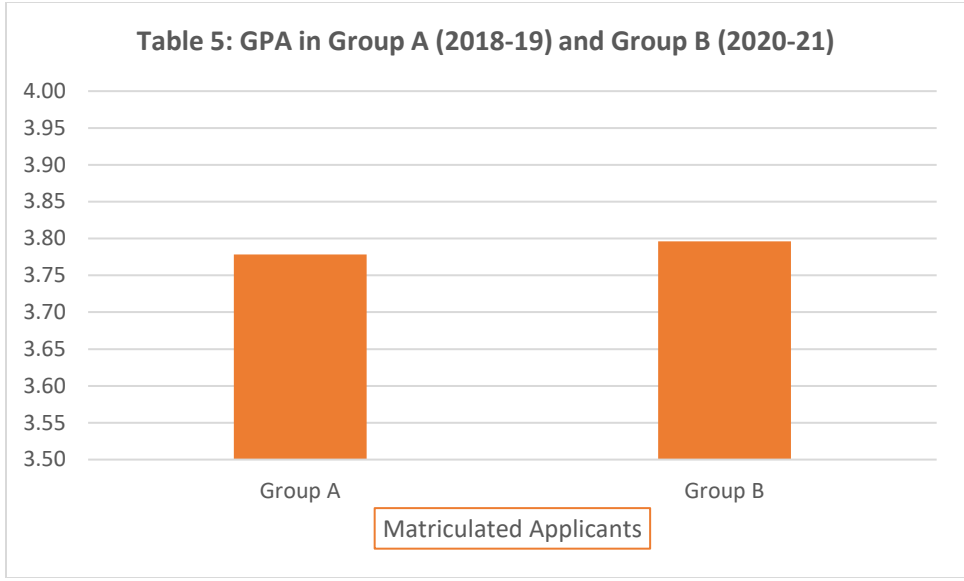
MCAT Score for Matriculated Applicants

Table 4 compares the mean MCAT score for Groups A and B matriculants and includes the results of a t-test that determines if my independent variable (COVID-19 Pandemic) affected the MCAT scores in a statistically significant way. In interpreting this table, we see that the mean MCAT score, which is on a scale from 472 to 528, is higher for Group A than it is for Group B. According to the p-value yielded by a two tailed t-test, however, the statistical significance of the decrease in MCAT score seen in Group B is weak; in other words, my findings are likely due to chance. This rejects my fourth hypothesis [H4] stating that there will be a statistically significant difference in MCAT scores between matriculants in Group A and Group B.



GPA for Matriculated Applicants

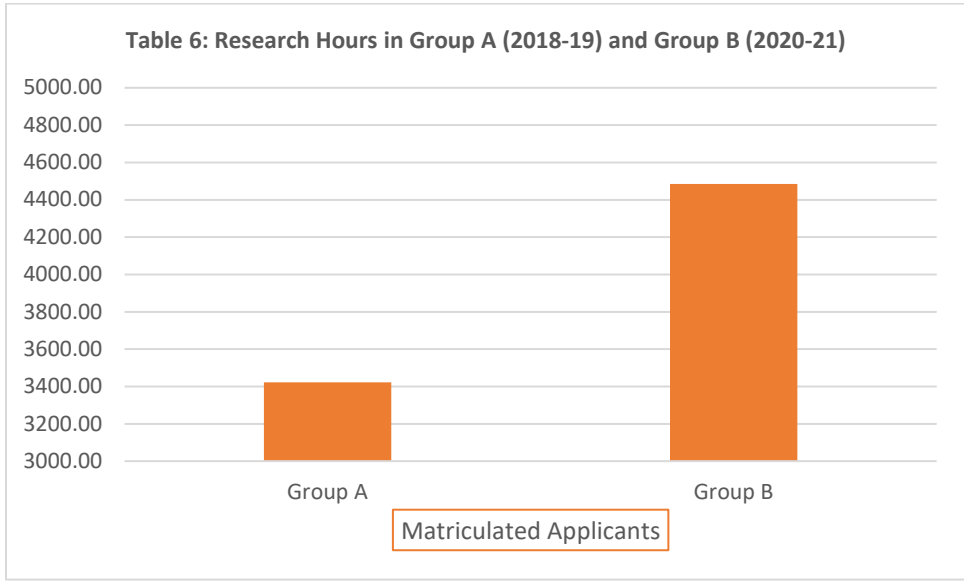
Table 5 (*seen on the next page*) compares the mean GPA for Groups A and B matriculants and includes the results of a t-test that determines if my independent variable (COVID-19 Pandemic) affected the GPA in a statistically significant way. In interpreting this table, we see that the mean GPA score, which is on a scale from 1.00 to 4.00, is slightly higher for Group B than it is for Group A. According to the p-value yielded by a two tailed t-test, however, the statistical significance of the slight increase in GPA seen in Group B is weak; in other words, my findings are likely due to chance. This rejects my fifth hypothesis [H5] stating that there will be a statistically significant difference in GPA scores between matriculants in Group A and Group B.



	Group A	Group B
Mean	3.78	3.80
StDev	0.22	0.16
Variance	0.05	0.03
n	13	11
T-Test P-Value	0.823279	

Research Hours for Matriculated Applicants

Table 6 compares the mean number of research hours for Groups A and B matriculants and includes the results of a t-test that determines if my independent variable (COVID-19 Pandemic) affected the number of research hours completed in a statistically significant way. In interpreting this table, we see that the mean number of research hours is higher for Group B than it is for Group A. According to the p-value yielded by a two tailed t-test, however, the statistical significance of the major increase in research hours seen in Group B is weak; in other words, my findings are likely due to chance. This rejects my sixth hypothesis [H6] stating that there will be a statistically significant difference in research hours completed by matriculants in Group A and Group B.



	Group A	Group B
Mean	3421.31	4485.27
StDev	2111.12	3393.54
Variance	4456821.90	11516141.82
n	13	11
T-Test P-Value	0.358414	

Discussion

In observing the findings in Tables #1-6, I must reject five of my six hypotheses due to statistically insignificant results. Before I discuss various reasons for this insignificance, I would like to provide an interpretation of the one acceptable hypothesis. My second hypothesis [H2] stated that there will be a statistically significant difference in undergraduate GPA between Group A (2018, 2019) applicants and Group B (2020, 2021) applicants. For this metric, Group B had a substantially lower GPA (3.66) than that of Group A (3.75). While a 0.09 difference may appear marginal, one must consider the context of the GPA scale, which ranges from 1.00 to 4.00. A GPA of 3.66 falls in the 91st percentile while a GPA of 3.75 is at the 93rd percentile. In highly competitive professional programs such as the MD-PhD Scholars Program, this dip is considered obvious and notable.

Furthermore, I was able to establish statistical significance for this finding by receiving a p-value less than 0.05 in my t-test. Reasons for this statistically significant decrease in GPA include the disruption applicants in Group B (2020, 2021) would've received in their educational experience. Most MD-PhD applicants apply to the Program while pursuing the third or fourth year of their undergraduate training. As such, most – if not all – of these undergraduates would have experienced modifications to their educational experience. Such modifications may be the transition to online coursework, the postponement or cancellation of courses or exams, and/or needing to complete their courses from a different environment than they were accustomed to. The taxing experience and mental toll of the COVID-19 Pandemic could have also contributed to this decrease GPA seen in mid-pandemic applicants.

With regards to the statistical insignificance yielded for the other five hypotheses, here are possible explanations:

- 1) The MCAT score decreased for both applicants and matriculants in Group B (2020, 2021). I believe the decrease was too small for both pools for a t-test to rule out chance. To yield more conclusive results, I believe larger sample sizes are needed in both groups. To grow the size of Group B, additional mid-pandemic years must occur. At the conclusion of the pandemic, future research should also include a third group – Group C – which would look at post-pandemic applicants and matriculants.
- 2) The number of completed research hours increased for both applicants and matriculants in Group B (2020, 2021); however, the increase is much larger when observing the matriculants only. To yield more conclusive results, I again believe larger sample sizes are needed in both groups. Additionally, it does not come as a surprise to me that the number of research hours did not decrease – and increased – for applicants and matriculants in Group B. Most laboratories at UNMC were able to remain fully operational throughout the pandemic and continued to allow undergraduate and medical students to contribute to their research from home. I anticipate other institutions and laboratories to have had similar experiences. This allowed mid-pandemic applicants and matriculants to maintain or increase their involvement with research projects.
- 3) While GPA was seen to have a statistically significant decrease for applicants in Group B, there was a statistically insignificant increase seen for matriculants in

Group B. I attribute the insignificance due to the very low sample sizes of matriculants in Group A (n=13) and Group B (n=11). It is very difficult to prove any changes to these groups isn't due to chance. In addition, the change in GPA for matriculants was very marginal (3.78 to 3.80). To yield more conclusive results, sample sizes must be larger. To access more data, multiple medical schools would need to compile their data. There is an association of MD-PhD Administrators; perhaps future research could invite all administrators to share their matriculant data for pre- and mid-pandemic years to observe more conclusive shifts.

V. CONCLUSION

It is imperative to the field of public administration and higher education research to observe how the COVID-19 Pandemic impacts institutions and learners. Regardless of the statistical insignificance yielded in this study, the observations and conclusions remain valuable contributions to the field of Public Administration and to higher education research. A major limitation of this study is the small sample sizes for both applicants and matriculants. To draw broader and more conclusive results, more data must be collected. Including data from other MD-PhD Programs could occur by connecting with the MD-PhD Administrator Membership Group organized by the Association of American Medical Colleges (AAMC). Exploring the trends of a larger dataset would be of significant value to the growing body of higher education research that relates to the impacts of global crises on post-secondary learners.

About the Author: Jennifer L. Brady is a Masters of Public Administration (MPA) student at the University of Nebraska at Omaha. Her research focus is evaluating higher education experiences and outcomes.

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