

RESEARCH

Open Access



Comparative analysis of Physician Assistant/ Associate National Certifying Examination (PANCE) performance trends: pre and during COVID-19 era

Joshua Goodman¹, Andrzej Kozikowski^{1*} and Andrew Dallas¹

Abstract

Background COVID-19 significantly impacted physician assistant/associate (PA) education programs. Most programs transitioned didactic and clinical education from in-person to remote, and clinical training opportunities diminished. Graduates of accredited PA programs take the Physician Assistant National Certifying Examination (PANCE), a five-hour exam with 300 multiple-choice questions, and must attain or exceed the scaled passing score of 350 (range: 200–800). We examined first-time examinees' trends in PANCE scores and passing rates three years prior to the pandemic and three years during.

Methods We analyzed data ($N=59,459$) from the National Commission on Certification of Physician Assistants. The two primary outcomes were PANCE scores and pass rates. The main exposure was the timeframe: three years pre-pandemic (2017–2019) and three years during the pandemic (2020–2022). The 2017–2018 scores were equated to the new passing standard implemented in 2019. Covariates included age, gender, years the PA program has been accredited, program region, and rural-urban setting. Analyses consisted of descriptive, bivariate, and multivariate statistics.

Results The mean PANCE score and pass rate during the six-year study period were 463 and 93%, respectively. In unadjusted analyses comparing each year individually, mean PANCE score was highest in 2020 and lowest in 2022 than in all other years except for 2017. When comparing each pandemic year to the pooled three pre-pandemic years and adjusting for test-taker and PA program covariates, examinees scored significantly higher in 2020; there was no difference in 2021, and they scored lower in 2022. When controlling for covariates, examinees had 1.24 higher odds of failing in 2022 compared to the pooled pre-pandemic period.

Conclusion Findings suggest that PANCE scores and pass rates were impacted during the third year of the pandemic. PANCE assesses if examinees have the essential clinical knowledge to enter the PA profession. It is crucial to determine whether the pandemic affected PANCE scores and pass rates to ensure PAs provide safe and high-quality patient care.

*Correspondence:
Andrzej Kozikowski
andrzejk@nccpa.net

Full list of author information is available at the end of the article



© The Author(s) 2024. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

Keywords COVID-19, Initial board certification, Certification testing, Exam performance

Background

The COVID-19 pandemic significantly disrupted and created extraordinary challenges for higher education institutions, including medical schools and physician assistant/associate (PA) programs [1, 2]. Academic learning and mental health of medical school and PA students were affected during the pandemic [3–5]. Given that PA students complete their medical education in a more condensed timeline than medical school matriculants, the pandemic's effects on their educational opportunities may be even more pronounced. PA program duration is 26.7 months on average (ranging from 24 to 36 months) and consists of two phases: didactic and clinical [6]. Most programs start in August or May, and the didactic phase typically occurs in the first year, while the clinical period takes place in the second [6]. To adapt to the new reality of the COVID-19 environment, PA programs transitioned didactic education from in-person to online virtual platforms [2]. The Association of American Medical Colleges (AAMC) recommended suspending clinical rotations for medical students [7], this resulted in substantially diminished clinical training opportunities for both medical and PA students [2].

The Physician Assistant Education Association (PAEA) launched multiple surveys during the pandemic to capture data on how COVID-19 has impacted programs and how they are adapting. The first was conducted between April and May 2020, showing that 20.9% of programs delayed transitioning students to the clinical phase, and 68.8% reported that student stress and emotional health have worsened since the onset of the pandemic [8]. A few months later, in July 2020, PAEA identified that 66.9% of programs had suspended supervised clinical practice experiences, 85.7% indicated that clinical sites are taking fewer students compared to before the pandemic, and a higher proportion than in the previous survey (84.8%) confirmed that student stress and mental health concerns have increased [9]. The third survey collected program data from January through February 2021, revealing that 67.5% of programs experienced suspension of rotations by clinical sites and/or preceptors, 44.8% had unplanned changes to or from online instruction, and 35.6% had cancellations by instructors, guest lecturers, community partners, or other individuals outside of principal faculty [10]. By December of 2021, lower proportions than in the previous survey experienced suspension of rotations (50.6%), and a much lower percentage had unplanned changes to instruction modalities (16.7%) but a similar proportion in lecture cancellations (34.6%) [11].

The pandemic also affected the certification and licensing exam administration processes and testing conditions

[12]. Many testing centers were closed or limited the number of examinees to maintain social distancing. The American Board of Medical Specialties (ABMS) and member boards allowed for greater flexibility in certification requirements and extended deadlines [13]. Similarly, the National Commission on Certification of Physician Assistants (NCCPA) increased support and flexibility with its certification programs during the pandemic. To become certified, a requirement to obtain a license to practice medicine, graduates of accredited PA programs must pass the Physician Assistant National Certifying Examination (PANCE). Testing for NCCPA exams was closed for about two weeks at the beginning of the pandemic. NCCPA worked closely with Pearson VUE to increase testing capacity (more seats and scheduling opportunities) under social distancing guidelines. This was implemented by expanding beyond the Pearson Professional Centers to allow exams to be administered through third-party sites. Pearson VUE worked with various local and state governments to have PAs included as essential workers. NCCPA expanded the timeframe to allow PA students to schedule their exams earlier to help them get a preferred seat and location, moving from 90 days prior to graduation to 180 days.

Although valuable data exist on how PA programs were affected by COVID-19, the pandemic's impact on PANCE performance has not yet been investigated. To address this research gap, we sought to examine whether the pandemic impacted first-time examinees' PANCE scores and passing rates while controlling for covariates. Based on the findings regarding the pandemic's effect on PA programs, we anticipated that PANCE scores for examinees in 2022 would be most affected, given that PA students experienced two years of pandemic-disrupted education (both their didactic and clinical training years), followed by examinees in 2021 who completed their clinical year during COVID-19. First-time PANCE takers in 2020 would have mostly completed their PA education before the start of the pandemic. However, given that they took PANCE during COVID-19, we speculated that their scores might be influenced by changes to exam administration conditions along with societal, economic, and health challenges faced during this difficult time.

Methods

Study design and data

This retrospective repeated cross-sectional study utilized six years (2017 to 2022) of administrative data ($N=59,459$) from the NCCPA, the only certifying board for PAs in the US. The primary exposure of interest,

outcome variables, and covariates had less than 1% missing data and are described below.

Pre-pandemic vs. during timeframe

The main exposure was the timeframe. We categorized the three-year pre-pandemic period as separate years for the descriptive and bivariate analyses and pooled 2017–2019 for the multivariate analyses to use as a reference category. The three pandemic years (2020, 2021, and 2022) were analyzed separately, given that examinees may have been impacted differently in each of those years.

PANCE score and passing rate

Graduates of accredited PA programs take PANCE, a five-hour exam with 300 multiple-choice questions. The vast majority (99%) of PA graduates take PANCE within a year of completing PA school. The scaled scoring involves the number correct and the relative item difficulty. The cut score is determined via standard setting using the modified Angoff method [19], and scores can range from 200 to 800. Examinations using this scale are built to standard specifications defined in the NCCPA PANCE blueprint [20]. Item difficulty and the ability estimate of examinees are equated to the same scale; thus, direct comparisons of performance from year to year can be made. However, scores on PANCE tend to decrease temporarily after a new standard setting and cut score is implemented. The most recent passing standard was established in 2019, and pass rates decreased slightly during that year. For this study, we rescaled PANCE scores in the two prior years (2017 and 2018) to be on the same metric as 2019 through 2022. We applied the new standard retroactively so that we could compare the pre and during-COVID yearly cohorts using the same policy-based standard. Essentially, we converted the same IRT-based scale to the new scale score metric so we could make direct comparisons. This was done to prevent bias, as the old pass score was more permissive and would have exaggerated the performance difference. Examinees must attain or exceed the scaled passing score of 350. There were 64,436 total PANCE administrations (including multiple attempts) between 2017 and 2022; only first-time PANCE scores were included for the purposes of this study (59,459).

Covariates

We included examinee (age when taking PANCE and gender) and PA program characteristics (number of years the program has been accredited, US region, and rural-urban setting) as control variables. The number of PA programs grew substantially during the study period: 194 in 2017, 207 in 2018, 221 in 2019, 226 in 2020, 243 in 2021, and 252 in 2022.

Data analysis

First, we calculated descriptive statistics (mean [M] and standard deviations [SD] for continuous variables and counts and percentages for categorical) for all examinee and PA program characteristics. Then, we conducted bivariate analyses (chi-square tests of independence, Pearson correlations, t-tests, or one-way analysis of variance [ANOVA] followed by Scheffé post-hoc tests, as appropriate) to determine if there were significant associations between examinee and program characteristics and time period. Similarly, to assess if there were statistically significant associations between test-taker and PA program characteristics with PANCE scores, we conducted Pearson correlations, independent t-tests, or ANOVA followed by Scheffé post-hoc tests, as appropriate. Independent t-tests or chi-square tests of independence were used to assess significant associations between the examinee and program characteristics and pass rates. Given that directly comparing unadjusted results from before to during the pandemic can provide misleading estimates due to differences in examinee characteristics [21], multiple linear regression was performed to examine the association of timeframe (pooled pre-pandemic years [reference group] vs. each pandemic year) with PANCE scores controlling for all examinee and PA program characteristics. Finally, multivariate logistic regression examined the relationship between time period and odds of failing PANCE when adjusting for covariates. To ensure that multicollinearity was not an issue in linear regression and multivariate logistic regression, we computed the variance inflation factor (VIF). All VIF values were well under 5, indicating an absence of multicollinearity [22]. All statistical tests were two-tailed; analyses were conducted in R version 4.2.1.

Results

Examinee and PA program characteristics

Table 1 presents test-taker and PA program characteristics overall and by time period. During the study period, the mean age when taking PANCE was 28.3 (ranging from 21 to 72), and the majority (74.0%) were female. There was a statistically significant difference in mean age by time period, $F(5, 59453)=19, p<.001$. Scheffé test for multiple comparisons showed that the mean age in 2017 ($M=28.6, SD=5.2$) was not significantly different from 2018 ($M=28.5, SD=5.0, p=.597$) but higher compared to 2019 ($M=28.2, SD=4.7, p<.001$), 2020 ($M=28.2, SD=4.7, p<.001$), 2021 ($M=28.1, SD=4.5, p<.001$) and 2022 ($M=28.1, SD=4.4, p<.001$). Similarly, mean age was higher in 2018 vs. 2019 ($p=.032$), 2020 ($p=.003$), 2021 ($p<.001$) and 2022 ($p<.001$). None of the other age-by-year comparisons were statistically significantly different. There was also a significant association of gender with time period $X^2(5)=30, p<.001$. The mean

Table 1 Participant and PA program characteristics overall and by time period

Characteristics	ALL (N=59,459)	Pre-COVID-19 Pandemic			During COVID-19 Pandemic			p-value
		2017 (n=8732; 14.7%)	2018 (n=9220; 15.5%)	2019 (n=9774; 16.4%)	2020 (n=9989; 16.8%)	2021 (n=11,063; 18.6%)	2022 (n=10,681; 18.0%)	
Test-taker characteristics								
Age at exam year (M, SD)	28.3 (4.7)	28.6 (5.2)	28.5 (5.0)	28.2 (4.7)	28.2 (4.7)	28.1 (4.5)	28.1 (4.4)	<0.001
Gender								<0.001
Female	44,014 (74.0%)	6303 (72.2%)	6833 (74.1%)	7197 (73.6%)	7409 (74.2%)	8197 (74.1%)	8075 (75.6%)	
Male	15,435 (26.0%)	2429 (27.8%)	2387 (25.9%)	2576 (26.4%)	2578 (25.8%)	2861 (25.9%)	2604 (24.4%)	
PA program characteristics								
Years PA program accredited (M, SD)	22.0 (14.3)	21.4 (13.5)	21.8 (13.9)	21.4 (14.3)	21.8 (14.3)	22.5 (14.7)	22.8 (14.9)	<0.001
PA program region								<0.001
South	21,184 (35.7%)	3111 (35.6%)	3239 (35.1%)	3401 (34.8%)	3527 (35.3%)	4066 (36.8%)	3840 (36.1%)	
Northeast	18,607 (31.3%)	2798 (32.0%)	2976 (32.3%)	3087 (31.6%)	3218 (32.2%)	3306 (29.9%)	3222 (30.3%)	
Midwest	11,024 (18.6%)	1629 (18.7%)	1718 (18.6%)	1898 (19.4%)	1781 (17.8%)	2043 (18.5%)	1955 (18.4%)	
West	8607 (14.5%)	1194 (13.7%)	1287 (14.0%)	1388 (14.2%)	1463 (14.6%)	1648 (14.9%)	1627 (15.3%)	
PA program rural-urban setting								0.326
Urban	56,450 (96.0%)	8289 (96.0%)	8757 (96.0%)	9290 (96.1%)	9471 (95.9%)	10,528 (96.1%)	10,115 (96.0%)	
Large Rural	1885 (3.2%)	286 (3.3%)	309 (3.4%)	293 (3.0%)	318 (3.2%)	341 (3.1%)	338 (3.2%)	
Small Rural	463 (0.8%)	56 (0.7%)	57 (0.6%)	87 (0.9%)	90 (0.9%)	91 (0.8%)	82 (0.8%)	

Note Values are numbers (percentages) unless stated otherwise. Numbers may not sum to the total sample number, as there were some missing data

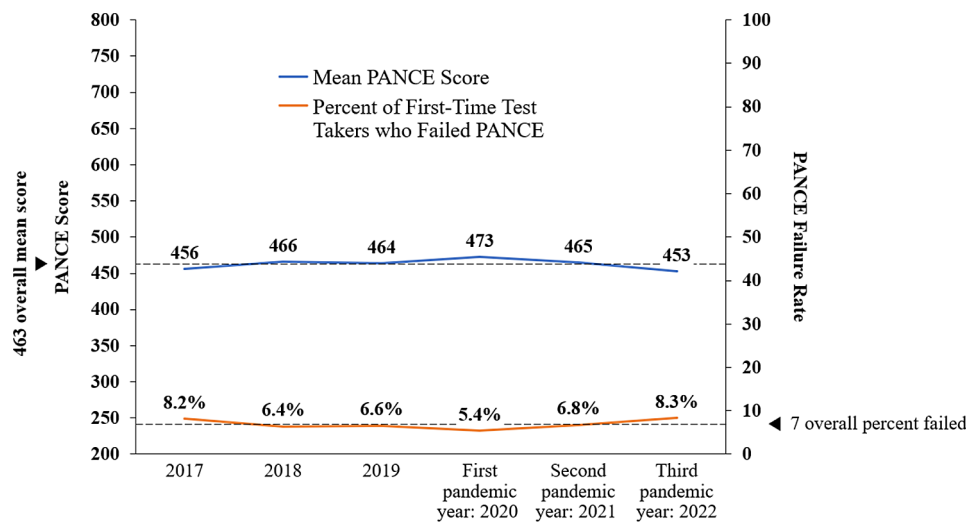


Fig. 1 PANCE mean scores and failure rates by time period. Note PANCE Physician Assistant National Certifying Examination

number of years PA programs have been accredited was 22.0 (ranging from 1 to 50 years), and the vast majority were located in urban settings. The highest proportion of examinees was from programs in the southern US region (35.7%), and the lowest was from the West (14.5%).

Figure 1 illustrates the overall and three years before and during the pandemic mean PANCE scores and failure rates. There was a statistically significant association between time period and mean PANCE scores $F(5,$

$59453)=85, p<.001$). Post-hoc tests showed that the mean PANCE score in 2017 ($M=456.0, SD=80.1$) was lower than in 2018 ($M=466.0, SD=77.5, p<.001$), 2019 ($M=464.5, SD=77.1, p<.001$), 2020 ($M=473.1, SD=79.1, p<.001$), 2021 ($M=464.6, SD=80.3, p<.001$) but not 2022 ($M=453.1, SD=77.4, p=.280$). Mean PANCE scores in 2018 were not significantly different from 2019 ($p=.867$) but lower than 2020 ($p<.001$), not significantly different than 2021 ($p=.887$), and significantly lower than 2022

Table 2 Bivariate associations of test-taker and program characteristics with PANCE scores

Variable	PANCE score (N=59,459)	p-value
Test-taker characteristics		
Age at exam year (Pearson r)	-0.153	<0.001
Gender		
Female	466 (78.5)	<0.001
Male	454 (79.3)	
PA program characteristics		
Years PA program accredited (Pearson r)	0.024	<0.001
PA program region		
South	461 (78.0)	<0.001
Northeast	465 (79.9)	
Midwest	470 (76.9)	
West	453 (80.0)	
PA program rural-urban setting		
Urban	464 (79.0)	<0.001
Large rural	446 (74.5)	
Small rural	453 (73.3)	

Note Values are means and standard deviations unless stated otherwise. PANCE Physician Assistant National Certifying Examination

($p < .001$). Mean PANCE scores in 2019 were lower than in 2020 ($p < .001$), not significantly different than 2021 ($p = 1.000$) and significantly higher than in 2022 ($p < .001$). Mean PANCE scores were higher in 2020 than in 2021 ($p < .001$) and 2022 ($p < .001$). Finally, mean PANCE scores were higher in 2021 than 2022 ($p < .001$). There was also a significant association between time period and PANCE failure rate $\chi^2(5) = 97, p < .001$. The highest failure rate was observed in the third year of the pandemic (8.3%) and the lowest in the first (5.4%).

In terms of examinee characteristics, we found that age during PANCE was negatively correlated with exam performance ($r = -.153, p < 0.001$), such that with increasing age, scores decreased (Table 2). When assessing differences by gender, we found that female examinees had significantly higher PANCE scores ($M = 465.9, SD = 78.5$) than males ($M = 454.2, SD = 79.3$), $t(59447) = 15.97, p < .001$. Regarding PA program characteristics, there was a positive correlation between the number of years programs have been accredited and PANCE scores ($r = .024, p < 0.001$). One-way ANOVA revealed a significant relationship between PA program US region and PANCE scores $F(3, 59418) = 83.04, p < .001$. Scheffé test for multiple comparisons demonstrated significant differences between all regions (all $p < .001$). PANCE scores were highest in the Midwest ($M = 470.5, SD = 76.9$), followed by Northeast ($M = 464.9, SD = 79.9$), South ($M = 461.1, SD = 78.0$) and West ($M = 453.5, SD = 80.0$). We also detected a significant association between PA rural-urban setting and PANCE scores $F(2, 58795) = 49.76, p < .001$. Results of the post-hoc analysis showed that PA programs located in urban areas ($M = 463.6, SD = 79.0$)

Table 3 Bivariate associations of test-taker and program characteristics with passing vs. failing PANCE

Variable	Passed (n=55,319; 93.0%)	Failed (n=4,140; 7.0%)	p-value
Test-taker characteristics			
Age at exam year (M, SD)	28.2 (4.6)	30.0 (6.1)	<0.001
Gender			<0.001
Female	41,189 (93.6%)	2,825 (6.4%)	
Male	14,123 (91.5%)	1,312 (8.5%)	
PA program characteristics			
Years PA program accredited (M, SD)	22.0 (14.3)	21.8 (14.4)	0.391
PA program region			<0.001
South	19,676 (92.9%)	1,508 (7.1%)	
Northeast	17,326 (93.1%)	1,281 (6.9%)	
Midwest	10,459 (94.9%)	565 (5.1%)	
West	7,829 (91.0%)	778 (9.0%)	
PA program rural-urban setting			<0.001
Urban	52,579 (93.1%)	3,871 (6.9%)	
Large rural	1,713 (90.9%)	172 (9.1%)	
Small rural	425 (91.8%)	38 (8.2%)	

Note Values are numbers (percentages) unless stated otherwise. Numbers may not sum to the total sample number, as there were some missing data. PANCE Physician Assistant National Certifying Examination

had higher scores than those in large rural ($M = 445.9, SD = 74.5, p < .001$) and small rural ($M = 453.0, SD = 73.3, p = .015$). There was no significant difference in PANCE scores between PA programs located in large vs. small rural settings.

Table 3 shows the results of bivariate analyses examining test-taker and PA program characteristics and passing vs. failing PANCE. Examinees who passed had significantly lower age during the exam ($M = 28.2, SD = 4.6$) than those who failed ($M = 30.0, SD = 6.1$), $t(59457) = -24.86, p < .001$. We detected a statistically significant difference in passing rate by gender $\chi^2(1) = 76.49, p < .001$, whereby female vs. male examinees were more likely to pass (93.6% vs. 91.5%). There was also a significant difference in passing rate by PA program region $\chi^2(3) = 115.85, p < .001$ and program rural-urban setting $\chi^2(2) = 15.68, p < .001$.

Given the significant associations of the examinee and PA program characteristics with PANCE scores as well as with time period in bivariate tests, the next set of analyses sought to adjust for these covariates when assessing the relationship between pre-pandemic vs. each of the three pandemic years on PANCE performance. As shown in Table 4, results of multiple regression accounting for covariates demonstrate that compared to the pooled three-year pre-pandemic period, during the first pandemic year, PANCE scores increased ($B = 10.23, SE = 0.91, p < .001$); were not significantly associated with the second pandemic year ($B = 0.93, SE = 0.88, p = .290$); and significantly decreased in the third pandemic year ($B =$

Table 4 Multivariate regression results: associations of time period, test-taker, and program characteristics with PANCE scores

Variable	B	95% CI		p-value
		LL	UL	
Before vs. during COVID-19 pandemic				
Before pandemic: 2017–2019 (reference)				
First pandemic year: 2020	10.23	8.44	12.01	<0.001
Second pandemic year: 2021	0.93	-0.79	2.65	0.290
Third pandemic year: 2022	-10.27	-12.02	-8.53	<0.001
Age at exam year	-2.40	-2.53	-2.26	<0.001
Gender				
Female (reference)				
Male	-5.88	-7.34	-4.41	<0.001
Years PA program accredited	0.14	0.10	0.19	<0.001
PA program region				
South (reference)				
Northeast	-0.94	-2.51	0.62	0.237
Midwest	6.61	4.82	8.40	<0.001
West	-4.36	-6.36	-2.36	<0.001
PA program rural-urban setting				
Urban (reference)				
Large rural	-17.48	-21.09	-13.86	<0.001
Small rural	-9.20	-16.33	-2.07	0.011

Note CI confidence interval; LL lower limit; UL upper limit. PANCE Physician Assistant National Certifying Examination

Table 5 Multivariate logistic regression results: associations of time period, test-taker, and program characteristics with failing PANCE

Variable	OR	95% CI		p-value
		LL	UL	
Before vs. during COVID-19 pandemic				
Before pandemic: 2017–2019 (reference)				
First pandemic year: 2020	0.76	0.68	0.84	<0.001
Second pandemic year: 2021	1.00	0.92	1.09	0.975
Third pandemic year: 2022	1.24	1.14	1.35	<0.001
Age at exam year	1.06	1.06	1.07	<0.001
Gender				
Female (reference)				
Male	1.15	1.07	1.23	<0.001
Years PA program accredited	1.00	1.00	1.00	0.209
PA program region				
South (reference)				
Northeast	1.09	1.00	1.18	0.041
Midwest	0.76	0.68	0.84	<0.001
West	1.19	1.08	1.30	<0.001
PA program rural-urban setting				
Urban (reference)				
Large rural	1.43	1.21	1.69	<0.001
Small rural	1.22	0.86	1.69	0.247

Note OR odds ratio; CI confidence interval; LL lower limit; UL upper limit. PANCE Physician Assistant National Certifying Examination

-10.27, SE=0.89, $p < .001$). This model accounted for only 3.5% of the variance in PANCE scores.

Similarly, when controlling for all covariates, multivariate logistic regression (see Table 5) showed that when compared to the pre-pandemic period, the first pandemic year was associated with lower odds of failing PANCE (Odds Ratio [OR] = 0.76, $p < .001$); there was no significant association with the second pandemic year (OR = 1.00, $p = .975$). In the third year, examinees had 1.24 higher odds of not passing PANCE than in the pooled three-year pre-pandemic period.

Discussion

The purpose of this study was to investigate the trajectory of PANCE performance from before to during the COVID-19 pandemic. Using six years of data (three pre-pandemic years and three during), we compared PANCE scores and passing rates. In unadjusted analyses comparing each year individually, mean PANCE score was highest in 2020 and lower than all other years in 2022 except for 2017. In adjusted analyses, we observed that PANCE scores and pass rates increased in 2020, did not differ in 2021, and decreased only in the third pandemic year compared to the pooled three-year pre-pandemic period. There could be a number of potential explanations accounting for this pattern in our findings.

The observation that PANCE scores and pass rates increased in 2020 during the first year of the pandemic compared to before is counterintuitive. We expected performance to either remain the same, given that the pandemic did not impact examinees' education, or deteriorate, given the immense disruption caused by COVID-19 to daily life and changes to exam administration at testing centers. However, testing for NCCPA exams was closed for only about two weeks at the pandemic's beginning, and NCCPA worked closely with Pearson VUE to maximize capacity. Moreover, NCCPA expanded the timeframe enabling PA students to schedule their exams up to 180 days prior to graduation to help them get a preferred seat and location. One plausible explanation for the increase in PANCE scores and pass rates in 2020 is that the most confident prospective PAs self-selected to complete the exam at the beginning of the pandemic. Although we did not assess and control for this unobservable, almost all (99%) of PA program graduates eligible to take the PANCE do so within a year after graduation. Another potential explanation is that given the 2019 standard increased the amount of medical knowledge required for successfully passing the examination, PA faculty may have implemented additional preparations for their students. PA programs may have adapted teaching and implemented flagging and remediation of at-risk PA students right after NCCPA set a new passing standard. The observed increase in performance in

2020 is similar to increases in the years following when the passing standard was previously changed. Nonetheless, more research is needed to better understand the increased PANCE performance in 2020.

A concerning finding was that compared to before the pandemic, in 2022, performance decreased: examinees' scores were approximately 10 points lower and had 1.24 higher odds of failing when adjusting for covariates. As demonstrated by prior reports, many PA programs had to rapidly adapt their operations because of the pandemic, including transitioning to online instruction and temporarily suspending supervised clinical practice experiences for students [2, 8–11]. First-time PANCE takers in 2022 completed both their didactic and clinical years during the pandemic. The pattern in PANCE pass rates from before to during each of the pandemic years contrasts with descriptive data from the American Board of Family Medicine (ABFM) [17]. The Family Medicine Certification Examination first-time pass rates remained similar between 2018 and 2022. This is not surprising given that family physician training is longer (typically four years of medical school followed by three years of residency and potentially at least one year of fellowship); students who started medical school in 2020 will not be completing Family Medicine Certification Examination until at least 2027. Those who took the board exam in 2020–2022 had completed the majority of their training before the onset of the pandemic. However, there were decreases in the ABFM In-Training-Examination performance, which is offered to residents; it has similar content and predicts passing the Family Medicine Certification Examination [18;23–24]. Moreover, the American Board of Internal Medicine indicated that initial certification pass rates for general internal medicine physicians were lower in 2021 (88%) and 2022 (87%) than in the previous three years (91–93%) [15]. The American Board of Pediatrics observed similar trends for general pediatrics, with pass rates decreasing from 91% in 2018 to 87% in 2019 and 2020 and further dropping to 81% in 2021 and 80% in 2022 [16].

Some boards changed examinations from in-person to remote, such as the American Board of Surgery's oral certifying exam (CE) [14]. Barry et al. determined that performance on the CE from before to during the pandemic did not meaningfully differ [14]. During COVID-19 surges, many elective operations were canceled, limiting surgical residents' and fellows' training and learning opportunities from surgical cases. However, the analysis conducted by the authors used data from CE candidates who completed their surgical training either before or in the initial stages of the pandemic; thus, their training was most likely unaffected [14].

We acknowledge that this repeated cross-sectional study has several limitations. The most important is the

threat to internal validity when determining the causal effect of the pandemic on PANCE performance. Our research was exploratory, relying on an observational study design, and thus was hypothesis-generating rather than confirming. Cross-sectional designs can suffer from substantial bias due to unmeasured shifts in the characteristics of the examinees over time or due to other unmeasured contextual confounders affecting performance as time progresses [25]. We assessed PANCE score and pass rate data from six years, of which three years prior to the onset of the pandemic served as the counterfactual and three years during as the exposure. However, how examinees in 2020, 2021, and 2022 would have scored if the pandemic had never occurred can never be determined. We statistically controlled for potentially confounding variables that were significantly associated with year and PANCE performance. These covariates included examinee gender and age, and number of years PA program has been accredited and program US region and rural-urban setting. They were derived from NCCPA administrative records and had little missing data. NCCPA also collects detailed demographic information on the PA workforce that would have been useful and important to control for in our linear and logistic models. However, this information is self-reported after examinees pass the PANCE, and it usually takes a few years for the data to be provided and complete. Thus, we could not include this information in our analyses, given that most of the demographic information for 2021 and 2022 was still missing. Another limitation was that in our analysis, PANCE scores from the first few months of 2020 were included as part of the first pandemic year. Lastly, there was a change in passing standard in 2019. However, we rescaled PANCE scores in the two prior years (2017 and 2018) to be on the same metric as 2019 through 2022 to prevent bias, as the previous passing score was more permissive and would have exaggerated the performance difference. Moreover, when only using 2019 as the pre-pandemic year, the pattern in results was similar. Compared to 2019, scores in 2020 were higher, with no difference in 2021 and lower in 2022. Future studies are needed to further validate the findings.

Despite these limitations, our study is the first to explore the potential impact of the pandemic on PANCE scores and pass rates. Our findings demonstrate that PANCE performance decreased in 2022 but not in the first two years of the pandemic. However, more work is needed to understand what direct impact the pandemic has had on PA student didactic and clinical education and how this affects performance on PANCE. Future research is needed to assess and closely monitor the trajectory of PANCE performance over the next few years. Moreover, given that the pandemic disproportionately affected racial and ethnic minority groups [26, 27], research is needed

to elucidate if different subgroups of PANCE examinees were impacted differently by the pandemic and, as a result, differences exist in PANCE performance.

Conclusion

Our study indicates a potential influence on the scores and pass rates of the PANCE examination during the pandemic's third year. The observed decline in performance is likely due to a multitude of factors, and our findings serve as a basis for generating hypotheses that necessitate further research. PANCE is designed to assess if examinees have the essential clinical knowledge to enter the PA profession. It is crucial to assess whether the pandemic is associated with decreased PANCE scores and pass rates to ensure PAs are provided with the necessary support to successfully transition into practice and render safe and high-quality patient care.

Author contributions

Concept and design (JG, AK, AD); acquisition of data (JG, AK, AD); analysis and interpretation of data (JG, AK, AD); drafting of the manuscript (JG, AK, AD); critical revision of the manuscript (JG, AK, AD); statistical analysis (JG, AK, AD).

Funding

No funding was received for conducting this study.

Data availability

The datasets generated and analyzed during the current study are not publicly available due to confidentiality of individualized data, but deidentified data can be available if requested from the corresponding author.

Declarations

Ethics approval and consent to participate

All methods were carried out in accordance with relevant guidelines and regulations.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

¹National Commission on Certification of Physician Assistants, Johns Creek, 12000 Findley Road, Johns Creek, GA 30097, USA

Received: 31 October 2023 / Accepted: 30 August 2024

Published online: 30 September 2024

References

- Harries AJ, Lee C, Jones L, Rodriguez RM, Davis JA, Boysen-Osborn M, et al. Effects of the COVID-19 pandemic on medical students: a multicenter quantitative study. *BMC Med Educ.* 2021;21:1–8.
- Valentin V, Najmabadi S, Warner M, White R, Dehn R. Initial impact of the COVID-19 pandemic on Physician Assistant Education. *J Physician Assistant Educ.* 2022;33(2):78–86.
- Andersen S, Leon G, Patel D, Lee C, Simanton E. The impact of COVID-19 on academic performance and personal experience among first-year medical students. *Med Sci Educ.* 2022;32(2):389–97.
- Chakladar J, Diomino A, Li WT, Tsai JC, Krishnan AR, Zou AE, et al. Medical student's perception of the COVID-19 pandemic effect on their education and well-being: a cross-sectional survey in the United States. *BMC Med Educ.* 2022;22(1):1–10.
- Kuriakose S, Timko-Swaim L, Loscalzo C, L'Epattienier M. Assessing the Effect of the COVID-19 outbreak on Didactic Education and Mental Health of Physician Assistant students in the New York City Region. *J Physician Assistant Educ.* 2022;33(3):216–21.
- Physician Assistant Education Association, By the Numbers: Program Report 35: Data from the 2019 Program Survey [Internet], Washington DC. 2020 [cited 2023 Mar 28]. <https://paeaonline.org/wp-content/uploads/2020/11/program-report35-20201014.pdf>
- Guidance on Medical Students. 'Participation in Direct In-person Patient Contact Activities [Internet]. 2020 [cited 2023 Mar 31]. <https://www.aamc.org/system/files/2020-08/meded-August-14-Guidance-on-Medical-Students-on-Clinical-Rotations.pdf>
- COVID-19. Rapid Response Report #1. Washington, DC: May; 2020.
- COVID-19. Rapid Response Report 2. Washington, DC: Jul; 2020.
- COVID-19. Rapid Response Report 3. Washington DC: Feb; 2021.
- COVID-19. Rapid Response Report 4. Washington DC: Dec; 2021.
- Jodoin MG, Rubright JD. When examinees cannot test: the pandemic's assault on certification and licensure. *Educational Measurement. Issues Pract.* 2020;39(3):31.
- American Board of Medical Specialties Statement Regarding Continuing Certification During COVID-19 [Internet]. [cited 2023 Mar 29]. <https://www.abms.org/wp-content/uploads/2020/11/abms-statement-on-continuing-certification-during-covid-19.pdf>
- Barry CL, Jones AT, Ibáñez B, Grambau M, Buyske J. The impact of the COVID-19 pandemic on American Board of Surgery's oral certifying exams. *Educational Measurement: Issues Pract.* 2022;41(1):42–5.
- American Board of Internal Medicine. Initial Certification Pass Rates 2008–2022 [Internet]. 2022 [cited 2023 Mar 26]. <https://www.abim.org/Media/yeqiumdc/certification-pass-rates.pdf>
- The American Board of Pediatrics Initial Certifying Examination. First-Time Taker Pass [Internet]. [cited 2023 Mar 26]. <https://www.abp.org/sites/public/files/pdf/exam-pass-rates-init-cert.pdf>
- One-Day Family Medicine Certification Examination Information | ABFM. | American Board of Family Medicine [Internet]. [cited 2023 Mar 29]. <https://www.theabfm.org/continue-certification/cognitive-expertise/one-day-fmc-exam/exam-info>
- Newton WP, Wang T, O'Neill TR. The decline in Family Medicine in-training examination scores: what we know and why it matters. *The Journal of the American Board of Family Medicine*; 2023.
- Angoff WH. Norms, scales, and equivalent scores. *Educational Meas.* 1971;2.
- PANCE Blueprint - NCCPA [Internet]. [cited 2023 Mar 26]. <https://www.nccpa.net/become-certified/pance-blueprint/>
- Shear BR. Causal Inference and COVID: Contrasting Methods for Evaluating Pandemic Impacts Using State Assessments. *Educational Measurement: Issues and Practice.* 2023.
- O'Brien RM. A caution regarding rules of thumb for variance inflation factors. *Qual Quant.* 2007;41:673–90.
- Hanrahan KD. Ready (or Not)—Here they come. *J Am Board Family Med.* 2022;35(6):1187–90.
- Newton WP, O'Neill TR, Wang T. High-stakes knowledge Assessment at ABFM: what we have learned and how it is useful. *Ann Fam Med.* 2022;20(2):186–8.
- Bonell CP, Hargreaves J, Cousens S, Ross D, Hayes R, Petticrew M et al. Alternatives to randomisation in the evaluation of public health interventions: design challenges and solutions. *J Epidemiol Community Health* (1978). 2011;65(7):582–7.
- Tai DBG, Sia IG, Doubeni CA, Wieland ML. Disproportionate impact of COVID-19 on racial and ethnic minority groups in the United States: a 2021 update. *J Racial Ethn Health Disparities.* 2021;1–6.
- Oster E, Jack R, Halloran C, Schoof J, McLeod D, Yang H, et al. Disparities in learning mode access among K–12 students during the COVID-19 pandemic, by race/ethnicity, geography, and grade level—United States, September 2020–April 2021. *Morb Mortal Wkly Rep.* 2021;70(26):953.

Publisher's note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.