

Grade Point Average as a Predictor of Work Performance Among Healthcare Professionals: A Systematic Review

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Introduction: Grade point average (GPA) is a widely used measure of academic performance in educational programs. However, its correlation with real-world work performance among healthcare professionals is widely debated.

Objective: To systematically review the literature regarding the relationships between GPA and indicators of job performance and success among healthcare professionals.

Methods: A comprehensive search of the following electronic databases was conducted to retrieve studies published between January 2000 and December 2023: PubMed, EMBASE, CINHALL, and the Cochrane Library. Grey literature was also reviewed for eligibility using ProQuest and Google Scholar. Only original research involving healthcare practitioners after graduation was included in the study. The impact of GPA on relevant work performance indicators was summarized by healthcare professional group. The risk of bias was assessed using the National Institutes of Health (NIH) quality assessment tools.

Results: Fourteen original studies were included in this review. Of these, six studies focused on physicians, six on nurses, and two on pharmacists. Thirteen of the studies were observational cohort studies, whereas one was a case-control study. Four of the studies were rated as “good quality”, five as “fair quality”, and five as “poor quality”. The relationship between GPA and job performance indicators varied across the included studies and healthcare professionals. The findings showed inconsistent correlations: GPA weakly to moderately predicted physicians’ performance, influenced pharmacists’ pursuit of postgraduate training, and had variable effects on nurses’ critical thinking, emotional intelligence, and job turnover.

Conclusion: The link between GPA and work performance differed depending on the healthcare professional group and the specific performance indicator being measured. While GPA may impact certain professional outcomes, its predictive value varies across roles and settings, underscoring the need for further research to clarify its utility as a performance indicator in healthcare.

Keywords: GPA, grade point average, healthcare professionals, physicians, nurses, pharmacists, job performance, work performance indicators, academic achievement

Introduction

In today’s dynamic healthcare landscape, both healthcare systems and practitioners are confronted with escalating demands to meet higher expectations and deliver outstanding healthcare services, while striving to achieve new healthcare goals.¹ Consequently, the demand for highly-skilled healthcare professionals has grown significantly, presenting a challenge for healthcare organizations to identify individuals who are both competent and reliable for their teams.^{1,2} Although various indicators and metrics have been examined to predict work performance in healthcare roles, academic achievement, particularly as reflected by Grade Point Average (GPA) during professional degree programs, has emerged as a potentially significant predictor of effectiveness.³

The study of factors influencing job performance has been a significant area of research in psychology since the early 20th century.⁴ GPA is widely regarded as a reliable predictor of job performance across different fields due to its accessibility and cost-effectiveness.^{5,6} In the healthcare sector, academic achievement, often measured by GPA, has been used to evaluate the performance of medical students, with higher GPAs indicating greater academic success.⁷⁻⁹ In the healthcare sector, where the quality of care directly impacts patient outcomes, it is crucial to understand the relationship between academic achievement and job performance.¹⁰ However, the degree to which GPA accurately reflects the skills and competencies required for effective performance in healthcare settings remains a topic of debate.^{11,12} For instance, a 1962 study in medicine found that only GPA from the two clinical years of medical school predicted residents' performance, while GPA in basic sciences showed a weaker relationship, and pre-medical GPA had no relationship with job performance.¹³ Moreover, in another study done recently in 2024 that examined the association between medical school GPA and postgraduation success among 552 Kuwait University medical graduates, it was found that a higher GPA was linked to pursuing clinical fellowships, higher monthly income, greater career progress, and increased satisfaction with life and career.¹⁴ However, GPA did not predict pursuing postgraduate academic degrees, international practice, or research publications. Gender did not influence fellowship pursuit or international practice, suggesting that while GPA strongly predicts career success and satisfaction, other factors may be more relevant for academic and research achievements.¹⁴ On the other hand, GPA has been identified as the most significant predictor for graduate nurses passing the National Council Licensure Examination in the United States of America (USA).¹⁵ However, to our knowledge, there has yet to be a comprehensive and up-to-date review of the literature examining the relationship between GPA and work performance, especially among healthcare professionals.

This study aimed to systematically review the existing literature on the relationship between GPA and work performance among healthcare professionals. By exploring the predictive value of GPA for job performance in healthcare settings, this research seeks to offer valuable insights for stakeholders involved in the selection, training, and development of healthcare professionals.

Methodology

Sources and Search Strategy

A comprehensive literature search was conducted across several databases, including PubMed, Embase, CINAHL Ultimate, and the Cochrane Library. To capture grey literature such as abstracts and dissertations not indexed in traditional databases, additional searches were performed using Google Scholar and ProQuest. The search strategy was guided by the PICO (Population, Intervention, Comparison, and Outcome) framework that is described below in Population and Outcomes, with relevant keywords identified for each PICO component. Synonyms, related terms, and alternative spellings were also considered. Boolean operators "AND" and "OR" were used to refine the search by linking primary domains and connecting keywords within the same domain, respectively. Appropriate time filters were used to include studies published between 2000 and 2023. This was done to ensure the inclusion of recent evidence relevant to the evolving healthcare labor market and educational context. Mendeley software was initially used to remove duplicates, followed by Rayyan AI application for further refinement of the duplication removal process. The review protocol was registered on PROSPERO on July 3, 2023 (https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42023438503).

Population and Outcomes

This review included studies involving healthcare professionals who had completed a bachelor's degree or an equivalent qualification enabling them to practice their respective professions. The following degree types were considered, which represent widely accepted educational standards that grant eligibility for professional practice in healthcare roles.

- Physicians: MD or MBBS degrees
- Pharmacists: BSc Pharm or PharmD degrees
- Nurses: Bachelor of Science in Nursing (BSN) or equivalent

- Dentists: Bachelor of Dental Surgery (BDS) or Doctor of Dental Medicine (DMD)
- Allied Health Professionals: Bachelor's degrees in fields such as physiotherapy, occupational therapy, and clinical laboratory science
- Public Health Practitioners: Bachelor's degrees in public health or health administration

The primary outcome of this study is postgraduation work performance at all career levels as measured by any appropriate indicator for any aspect of work performance. These indicators included clinical competence, decision-making abilities, and the delivery of high-quality patient care. Professional communication skills, teamwork effectiveness, and emotional intelligence were also considered as essential markers of job performance. Furthermore, leadership capabilities, participation in postgraduate training, and contributions to professional development were evaluated. Additional measures included career advancement, staff retention, and turnover rates, all of which capture the dynamic aspects of healthcare professionals' performance in real-world practice environments. The following PICO format further illustrate the study outcomes:

- Population (P): Healthcare professionals who have completed a bachelor's degree or equivalent enabling them to practice in their respective fields (eg, MD/MBBS for physicians, BSc. Pharm/PharmD for pharmacists, BSN for nurses, BDS/DMD for dentists, and equivalent degrees for other healthcare practitioners).
- Intervention (I): Grade Point Average (GPA) as an indicator of academic performance.
- Comparison (C): No specific comparison, but implicit comparisons were made between different levels of GPA and their association with outcomes.
- Outcome (O): Various indicators of work performance, including clinical competence, decision-making, communication skills, teamwork, leadership roles, postgraduate training pursuits, job satisfaction, retention rates, and contributions to professional development.

Eligibility Assessment

Following the literature search, the identified studies were uploaded to the Rayyan AI application and reviewed by two independent reviewers for screening and eligibility assessment. Studies were deemed eligible for inclusion if they were original research investigations published in full-text format, written in the English language, and published between 2000 and 2023. Studies were excluded if they were reviews, personal or expert opinions, conference abstracts only, or did not meet the PICO criteria. The inclusion/exclusion decisions were made using Rayyan by two independent reviewers in a blinded manner. Disagreements between the two reviewers were initially addressed through consensus; if consensus could not be reached, a third reviewer was consulted for an independent assessment. Finally, manual screening of the references from the articles deemed potentially eligible was performed according to the same criteria above.

Quality Assessment

The quality of each article included in the review was independently assessed by two reviewers using the National Institute of Health (NIH) Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies, or the NIH Quality Assessment Tool for Case-Control Studies, as applicable.¹⁶ The NIH Tool for Observational Cohort and Cross-Sectional Studies is designed to assess the methodological quality of cohort and cross-sectional studies and consists of 14 questions that address different aspects of study design and conduct. On the other hand, the NIH Tool for Case-Control Studies consists of 12 questions focused on assessing the methodological rigor and robustness of case-control studies. For each tool, the domains were rated as “yes”, “no”, “cannot determine (CD)”, “not applicable (NA)”, or “not reported (NR)”. A score of “yes” indicates that the study meets the criterion for that question, while a score of “no” or “NR” indicates that the study does not meet the criterion. A score of “NA” or “CD” denotes that there was insufficient information to determine whether the study meets the criterion or that the criterion does not apply.

Each question was assigned a numeric score of 1 if the answer was “yes”, and a score of 0 for all other response options. A study was classified as “good quality” if the overall score was at the 75th percentile or more, a “fair quality” if the score was between the 50th and the 75th percentiles and, and of a “poor quality” if the score was below the 50th

percentile. For the NIH Tool for Case-Control Studies, a score of 9 or above was considered “good”, a score between 7 and 8 was considered “fair”, and a score of 6 or below was categorized as poor. Any discrepancies in the quality assessment were resolved by consulting a third reviewer.

Results

Search results

The comprehensive literature search yielded a total of 1316 studies: 235 from PubMed, 174 from EMBASE, 498 from CINAHL, and 24 from the Cochrane Library. In addition, 385 articles were identified from grey literature sources through Google Scholar and ProQuest. After removing 222 duplicates, the titles and abstracts of the remaining 1094 articles were screened for eligibility. From this initial screening, 11 studies proceeded to full-text review for eligibility.^{17–27} All 11 studies were confirmed eligible for inclusion. Further, the references of these 11 articles were manually reviewed, leading to the identification of three additional eligible studies based on full-text screening.^{28–30} The study inclusion process is outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram (Figure 1).

Characteristics of the Included Studies

Fourteen studies were included in this systematic review.^{17–30} These studies were published in various journals with varying quality levels, ranging from Q1 to Q3, according to the Scimago Journal Rank metrics. However, two of the studies were theses and dissertations available through ProQuest,^{24,26} while one study was published in “Dubai Medical Journal”, which is not ranked by Scimago.¹⁸ Thirteen of the included studies were cross-sectional,^{17–26,28–30} and one was a case-control study.²⁷ The geographical distribution of the studies was diverse: nine from the United States of America,^{21,22,24–26,28–30} two from Australia,^{19,23} two from South Korea,^{17,20} and one from the United Arab Emirates (UAE).¹⁸ The studies were published between 2001 and 2023 and involved various healthcare professionals: six focused on physicians,^{18,19,23,27–29} six on nurses,^{17,20,21,24–26} and two on pharmacists^{22,30} only. The detailed characteristics of the included studies are summarized in Table 1.

Quality Assessment of the Studies

Overall, four out of the 14 included studies were rated as “good quality”,^{17,23,27,29} five were rated as “fair quality”,^{19,20,24,25,28} and the remaining five were classified as “poor quality”.^{18,21,22,26,30} Among the 13 cross-sectional studies assessed, none complied with the quality assessment criterion for “outcome assessors’ blindness”, resulting in a 0% compliance rate. The criterion for “measurement of exposure at multiple times” was met by only one study, indicating a compliance rate of 8%. Moreover, “sample size calculations and power justification” criterion was addressed in only three of the 13 cross-sectional studies, reflecting a compliance rate of 23%. On the other hand, there was full compliance in the domains of “clarity of research objective”, “population definition”, and “measurement of exposure before the outcome”. This was followed by 92% compliance with the domain related to “clear definition and reliability of outcome”, with only one study not meeting this criterion. Additionally, the “uniformity of subjects’ recruitment” domain achieved a compliance rate of approximately 77%, with 10 out of 13 studies meeting the standard. The compliance rates for the remaining domains according to the NIH Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies were as shown in Figure 2. In contrast, the included case-control study showed 100% adherence to all the criteria of the NIH Quality Assessment Tool for Case-Control Studies. Figure 3 represents the compliance rates for the case-control study.

Study Outcomes

The included studies assessed a range of outcomes related to the relationship between GPA and the work performance of healthcare practitioners. Positive outcomes included performance measured by objective examinations, continuation of higher education, clinical management, communication skills, emotional intelligence, critical thinking, diagnostic reasoning, and professionalism. Negative outcomes reported included job turnover, transition shock, and disciplinary action. Overall, the outcomes were highly heterogenous and the ability of GPA to predict professionalism has shown inconsistent

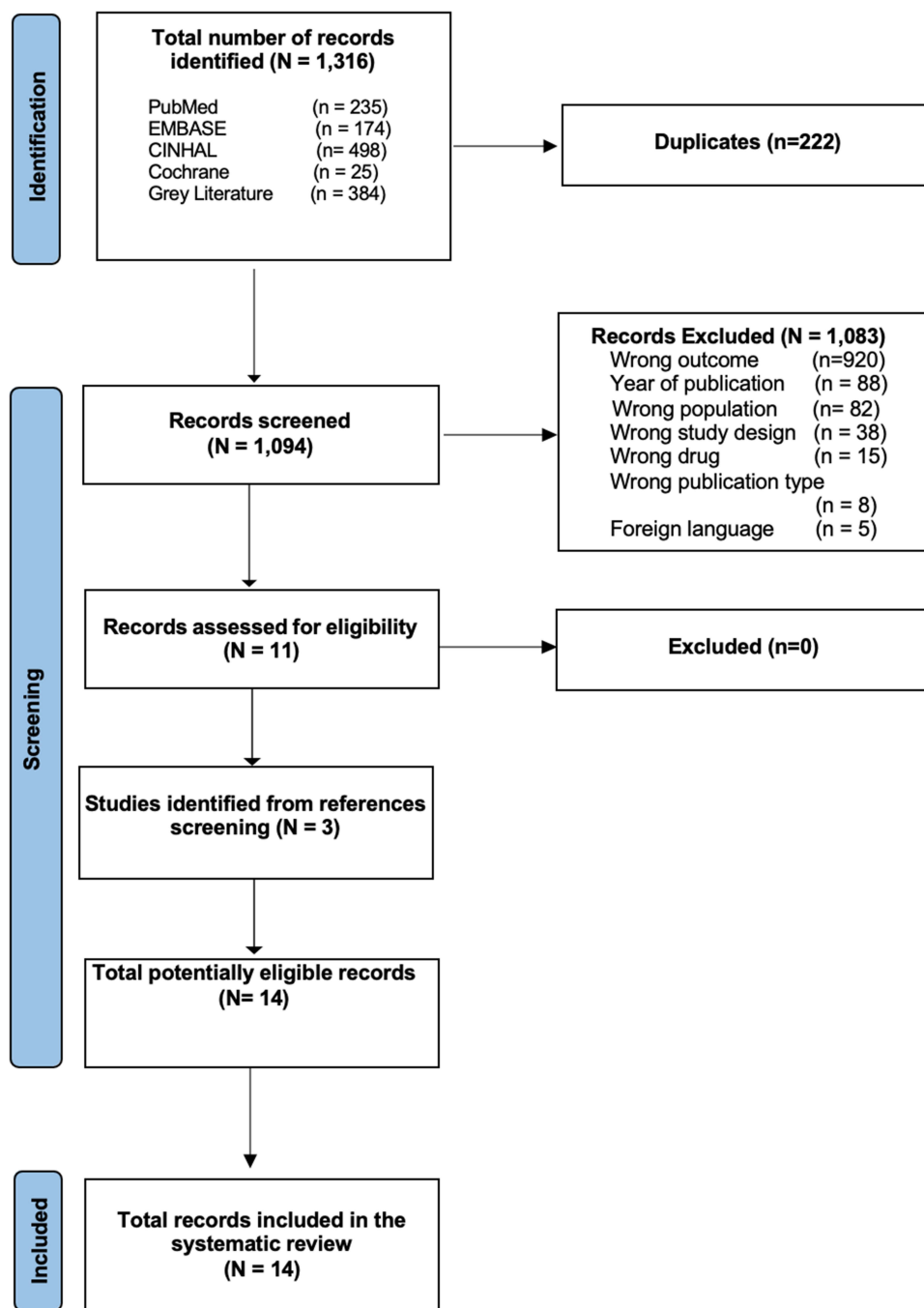


Figure 1 PRISMA flow diagram for the systematic review records.

results across different professional groups and settings. A summary of the study outcomes is presented in [Table 2](#). For clarity and comparison, the study outcomes were grouped according to the healthcare professional groups (ie, physicians, pharmacists, and nurses).

Relationship Between GPA and Physicians' Work Performance

GPA was examined as a measure of work performance, knowledge, and professionalism among physicians in six of the included studies.^{18,19,23,27–29} The Majority of them (n=5) focused on early career-level physicians, particularly those at the residency level.^{18,19,23,28,29} Only one study investigated the relationship between GPA and professionalism across all career-level physicians.²⁷ Performance markers included objective assessment tools such as the Junior Doctor

Table 1 General Characteristics of the Included Studies

Publication by Author	Publication Year	Country	Journal/Source	Journal Category
Al-Shamsi G.S., et. al ¹⁸	2023	UAE	Dubai Medical Journal	Not classified
Kim E., et. al ¹⁷	2022	South Korea	Journal of Nursing Management	Q1
Sevak R. et.al ²²	2022	USA	Currents in Pharmacy Teaching and Learning	Q1
Kim E. and Yeo J. ²⁰	2019	South Korea	Nurse Education Today	Q1
Carr S., et.al ²³	2018	Australia	Medical Teacher	Q1
Phillips J. et al ³⁰	2015	USA	American Journal of Pharmaceutical Education	Q1
Reemts G. ²⁵	2015	USA	Asia Pacific Journal of Oncology Nursing	Q3
Carr E. S et. al ¹⁹	2014	Australia	BMC Medical Education	Q1
Greenburg D. et. al ²⁹	2007	USA	Journal of General Internal Medicine	Q1
King P. ²⁶	2006	USA	ProQuest	N/A
Papadakis M. et. al ²⁷	2004	USA	Academic Medicine	Q1
Paolo A. and Bonaminio G. ²⁸	2003	USA	Academic Medicine	Q1
Martin C. ²¹	2002	USA	Nursing Education Perspectives	Q2
Sands HM. ²⁴	2001	USA	ProQuest	N/A

Assessment Tool (JDAT), which is a validated tool for evaluating clinical management, communication skills, and professional behavior, as well as the number of disciplinary actions taken against physicians.^{19,23} However, the remaining studies relied on either subjective measure such as program directors' evaluations of knowledge, performance, and clinical management, or a combination of subjective measures and end-of-the-year exam scores. Overall, the results regarding GPA as a predictor of work performance were inconsistent. For the two studies conducted in Australia using JDAT,^{19,23} there was a weak correlation between GPA and the JDAT scores ($r=0.257$; $p<0.0001$).

The six studies consistently found a relationship between GPA and physicians' performance, although the strength of this association varied. Al-Shamsia et al found a strong positive correlation ($r = 0.665$, $p < 0.05$) between GPA and residents' self-reported outcomes at the end of the PGY-1 year. Conversely, studies utilizing the JDAT assessment tool reported weak positive correlations ($r = 0.229$, $P = 0.002$; and $r=0.255$, $p=0.006$, respectively). Another study reported a moderate correlation between basic sciences GPA ($r = 0.41$) and clinical GPA ($r = 0.49$) and Residency Directors' Ratings. Notably, one study revealed that only third-year GPA predicted lower scores for both knowledge (OR = 4.9;

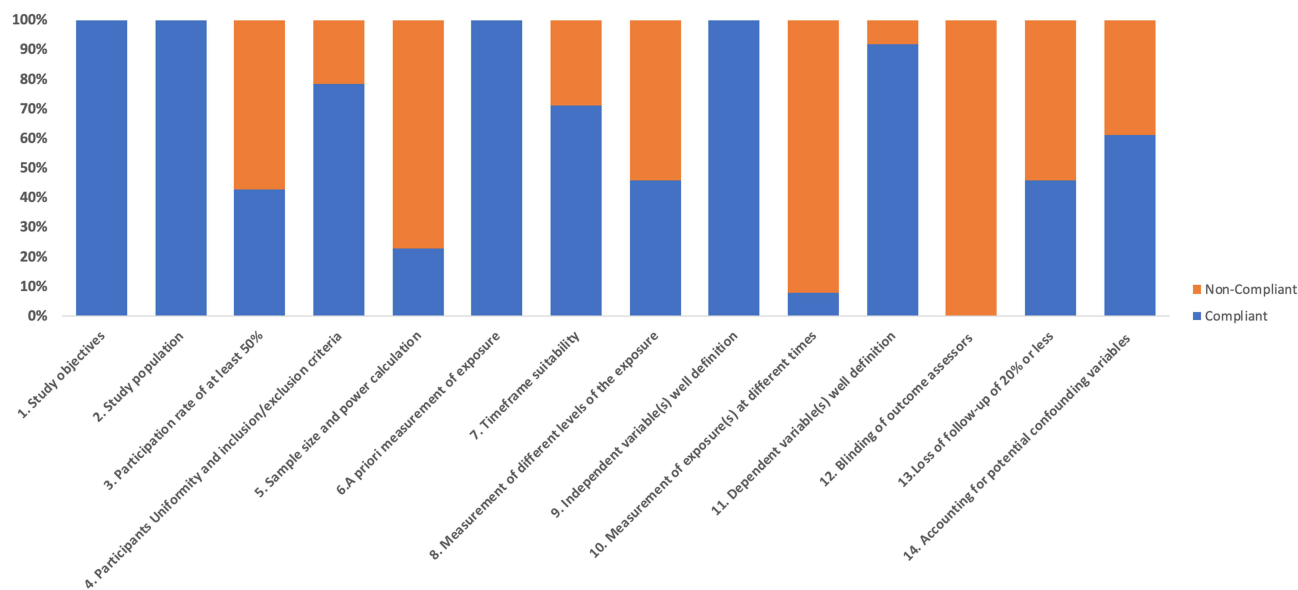


Figure 2 Compliance rate to each of the NIH Quality Assessment Tool for Observational and Cohort Studies. The quality of 13 out of the 14 included studies were examined using the NIH Quality Assessment Tool of Observational and Cohort Studies. Blue labeling represents compliance, and Orange represents non-compliance.

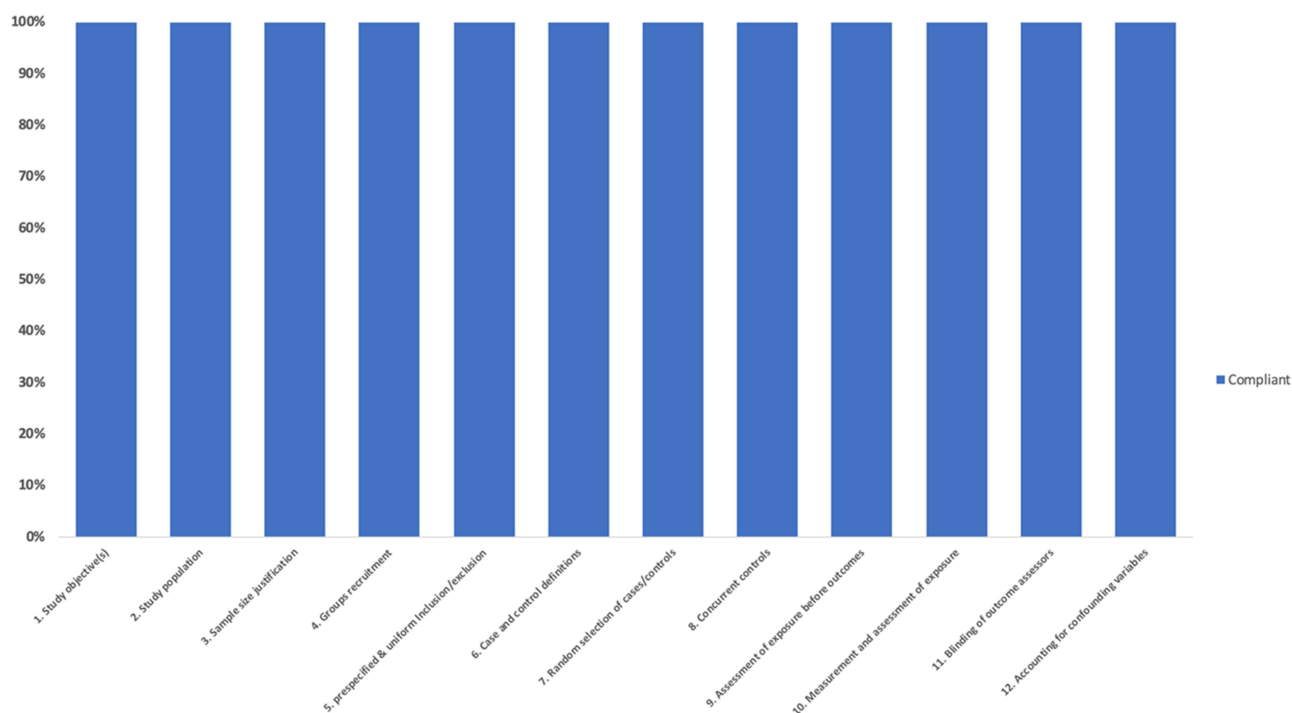


Figure 3 Compliance rate to each of the NIH Quality Assessment Tool for Case-Control Studies. The quality of one case-control study was examined and found in complete compliance of all the criteria of the NIH Quality Assessment Tool for Case-Control Studies. The study fully complies with all the criteria of NIH Quality Assessment Tool for Case-Control Studies.

95% CI = 2.7–9.2) and professionalism (OR = 7.3; 95% CI = 4.1–13.0), highlighting the potential importance of performance during a specific timeframe. Finally, a case-control study found a small but statistically significant difference in undergraduate GPA between physicians who received disciplinary actions and those who did not (3.3 vs 3.4, respectively; $p=0.04$).

Relationship Between GPA and Pharmacists' Work Performance

The direct association between GPA and pharmacists' work performance has been largely unexplored. However, two studies provide insight into the potential influence of GPA on pharmacists' career aspirations and personal growth.^{22,30} Both studies, conducted in the USA, used the pursuit and achievement of postgraduate qualifications, such as residencies or fellowships, as indicators of professional growth. The findings from these studies suggest that GPA may influence professional development among pharmacists. Sevak et al found a significant correlation between GPA and the likelihood of applying for and securing a postgraduate residency or fellowship, among various career stages in pharmacy.²² Every one-point increase in the cumulative GPA, research activity score, and APRS-16 score was associated with increased odds of applying to a residency program by 6.3, 3.3, and 1.07 times, respectively.²² To attain a position, each one-point increase in GPA and self-reported interview performance score was associated with an increase in the odds of matching with a residency position by 9.93 and 5.32 folds, respectively.²² In another study focusing on early career-level pharmacists, a small difference was reported in the median (IQR) pharmacy school GPA between students who applied for residency and those who did not [3.6 vs 3.5, respectively; ($p=0.01$)].³⁰ In addition, there was a statistically significant difference in the median pharmacy school GPA between students who successfully matched to a residency program and those who did not, with medians of 3.7 and 3.5, respectively ($p=0.035$).³⁰

Relationship Between GPA and Nurses' Work Performance

Six studies investigated the effect of GPA on various performance indicators among nurses.^{17,20,21,24–26} These indicators included early job turnover, transition shock, critical thinking skills, decision-making abilities, and emotional intelligence.^{17,20,21,24–26} The studies encompassed nurses at different career stages: entry-level ($n=1$),²⁴ early career

Table 2 Results Summarization for the Included Studies with Their Objectives and Job-Performance Indicator as Classified Based on Healthcare Professional Practice

Study (Author, Year)	Aim	Design	Study Period	Work Performance Indicator	Work Performance Indicator Definition	Study Groups and Sample Size	Results on the Relationship Between GPA and Professional Indicators
Physicians (n=6)							
Al-Shamsi G.S., et. al, 2023 ¹⁸	T measure the relationship between the Emirates Medical Residency Entry Examination (EMREE, GPA, and MMI) and the performance of residents in year 1	Quantitative, descriptive, and correlational In UAE	September 2021 to July 2022	Performance of residents in year 1	The residents' performance in year one was measured by residents' self-reported outcomes using a tool that the authors developed based on previous literature (<i>the tool was not shared in the article</i>).	Early career – Residency level (year 1) N = 106 participants	There was a strong, positive correlation between GPA and the score of end-of-year-one performance, (r = 0.665, p < 0.05)
Carr E. S et. al., 2014 ¹⁹	To explores the relationship between the academic performance of medical students and workplace performance as junior doctors	Descriptive retrospective cohort In Western Australia	2008-2009	Performance of doctors during the first postgraduate year (PGY1) as measured by The Junior Doctor Assessment Tool (JDAT)"	The performance was measured by "The Junior Doctor Assessment Tool (JDAT)" as completed by the supervising clinician 5 times during the PYG1 year. JDAT is composed of 10 discrete items that align to the areas of competency described in the Australian Junior Doctor Curriculum Framework to measure competency in clinical management, communication skills, and professional behavior of junior doctors.	Early career – Residency level (year 1) N = 200 participants	There were significant week correlations between the performance and the GPA (r = 0.229, P = 0.002)
Carr S., et.al, 2018 ²³	To explore the predictive validity of selected variables (those already reported in the literature to predict performance in medical school) on a junior doctor's performance in the workplace during the first postgraduate year.	Prospective cohort In Western Australia	2008-2009	The junior doctor performance in PGY1 as measured by the JDAT, and subscales or JDAT	The description of JDAT is mentioned above by the previous publication of the same author and research group in 2014. GPA was correlated to the combined overall score (out of 40), the mean score for the Clinical Management subscale (out of 24), and the mean score for the Communication skills subscale (out of 16).	Early career – Residency level (year 1) N = 237 participants	There was a weak but significant correlation of GPA with overall performance on the JDAT (r=0.255, p=0.006)

Papadakis M. et. al., 2004 ²⁷	To determine if medical students who demonstrate unprofessional behavior in medical school are more likely to have subsequent state board disciplinary action, and to identify associated student-based factors	Case-control In USA, California	1990 to 2000.	Receiving a disciplinary action by the Medical Board of California	Disciplinary action as defined by the Medical Board of California is any reason of discipline under any of these nine categories: negligence, inappropriate prescribing, unlicensed activity, sexual misconduct, mental illness, acts, endangering patients through the physician's use of drugs or alcohol, fraud, conviction of a crime, and unprofessional conduct.	All career-level physicians N = 264 -68 cases - 196 controls	There was a small, but statistically significant, difference in undergraduate GPA (3.3 for the case group of those who received a disciplinary action and 3.4 for the control group for those who did not; p=0.04).
Paolo A. and Bonaminio G., 2003 ²⁸	To investigate the relationship between undergraduate medical education (UME) and achievements during residency by providing reliability and validity evidence for a residency rating scale	Prospective cohort In University of Kansas School of Medicine Graduates of the 1998–2000 classes	Nor indicated	Performance of PGY-I resident	The residents' performance in year one was measured by residency program directors using a validated reliable tool comprised of five rating areas: Interpersonal communication, clinical skills, population-based health care, record-keeping skills, and critical appraisal skills	Early career – Residency level (year 1) N=485	There was a low to moderate correlation between the basic sciences GPA (0.41) and the clinical GPA (0.49) and Residency Directors' Ratings.
Greenburg D. et. al., 2007 ²⁹	To assess whether data available to medical schools predicts poor ratings of knowledge or professionalism by internship program directors at the end of the PGY-I year	Prospective cohort In Uniformed Services University.	1993 to 2002	Knowledge and professionalism of a PGY-I resident	Knowledge and professionalism as per the program director assessment using a rating form survey. The survey items were developed by interdepartmental academicians with expertise spanning undergraduate and graduate medical education programs, and is a modification of the American Board of Internal Medicine resident assessment tool.	Early career – Residency level (year 1) N=1069	Only GPA earned during the third year predicted low ratings in both knowledge (odds ratio [OR]=4.9; 95% CI=2.7–9.2) and professionalism (OR= 7.3; 95% CI=4.1–13.0)
Pharmacists (n=2)							
Sevak R. et.al., 2022 ²²	To evaluate factors predicting students' pursuit and attainment of postgraduate pharmacy training positions.	A web-based survey (16 April 2020 to 8 May 2020) Classes of 2019 and 2020 at the study university	April-May 2020	Pursuit and attainment of post-graduate training (professional development)	Pursuit of postgraduate training included the application to a residency program, a fellowship program, or both. The attainment of postgraduate training included getting an acceptance at any of these programs. Both of these indicators were measured using self-reported answer to a previously developed and validated questionnaire.	All career levels – Unspecified N = 185	High GPA positively influences pursuit and attainment of postgraduate positions. Every point increase in GPA and self-reported score on interview performance increased the students' odds of matching with a residency position by 9.93 and 5.32 times, respectively.

(Continued)

Table 2 (Continued).

Study (Author, Year)	Aim	Design	Study Period	Work Performance Indicator	Work Performance Indicator Definition	Study Groups and Sample Size	Results on the Relationship Between GPA and Professional Indicators
Phillips J. et al, 2015 ³⁰	To identify predictors for postgraduate matching success	A paper-based survey (April 2014) All pharmacy students completing their final professional year at five schools of pharmacy, USA	2014	Pursuit and matching to post graduate clinical residency	Pursuit a residency training was defined by whether or not respondents applied for residency. Success in matching was defined by whether an applicant was offered interviews to at least 50% of programs to which they applied (for those who applied), or successfully matched (for those who applied).	Very early career level – graduates who just completed year 4 undergraduate pharmacy N = 577 (426 with work experience)	Applying to residency was significantly associated with higher median (IQR) pharmacy school GPA [3.6 (3.4–3.8) vs 3.5 (3.2–3.7); p=0.01]. Applicants who matched had a higher median pharmacy school GPA (3.7 vs 3.5; p=0.035).
Nurses (n=6)							
Kim E., et. al, 2022 ¹⁷	To identify the job change status and related factors among nurses during the first 4 years of their professional life.	Prospective longitudinal observational Five nursing schools in South Korea	2016 to 2020	Early job turnover	Early turnover was defined by changing jobs in nurses with <4 years of experience. Job change status was classified as one of five types: (1) Staying in the same hospital as first job, (2) staying at the same nonhospital as first job, (3) moving to another hospital, (4) changing to a nonhospital job, and (5) unemployed.	Early career level – nurses with 4 months to 4 years of experience. N=338	GPA had a statistically significant influence on job change status (turnovers). Moving to another hospital was 6.44 times higher among those with a GPA of <3.5 compared to those with ≥ 3.5 GPA (p<0.001).

<p>Kim E. and Yeo J., 2019²⁰</p>	<p>To determine the effects of pre-graduation characteristics and working environments on the transition shock of newly graduated nurses</p>	<p>Prospective longitudinal observational Five nursing schools in South Korea (graduates in Feb. 2016)</p>	<p>2016</p>	<p>Transition shock</p>	<p>Transition shock was defined as the shock perceived by the graduates in transitioning from school to workplace. It was measured using the Transition Shock Scale for Newly Graduated Nurses consists of 6 subscales: "Conflict between theory and practice", "overwhelming workload", "loss of social support", "shrinking relationship with coworkers", "Confusion in professional nursing values", and "incompatibility in work and personal life". A total of 18 items were measured using a 4-point scale, with a higher score indicating a stronger transition shock.</p>	<p>Very early career level – nurses who have recently graduated with 4-months experience N=312</p>	<p>GPA was not a significant factor in affecting transition shock (2.78 ± 0.51 for GPA <3.5 vs 2.85 ± 0.49 for GPA ≥ 3.5; $p=0.241$).</p>
<p>Martin C., 2002²¹</p>	<p>To examine if there are any differences in different nursing groups in terms of critical thinking. And examine the relationship of baseline characteristics (eg, GPA,) on decision making and critical thinking.</p>	<p>Descriptive correlational study</p>	<p>No indicated</p>	<p>Critical thinking and quality of decision making</p>	<p>Critical thinking is described as the ability to effectively analyze information and form a judgment, and was measured by Elements of Thoughts Instrument (ETI)</p>	<p>All career levels – (However, the average population was expert level with > 5 years of experience) N= 102 nurses (48 graduate nurses; 54 registered nurses)</p>	<p>GPA had a statistically significant correlation with critical thinking and decision making abilities</p>

(Continued)

Table 2 (Continued).

Study (Author, Year)	Aim	Design	Study Period	Work Performance Indicator	Work Performance Indicator Definition	Study Groups and Sample Size	Results on the Relationship Between GPA and Professional Indicators
Sands HM., 2001 ²⁴	1- To describe diagnostic reasoning, critical thinking dispositions, decision style, and individual characteristics among entry-level nursing practitioners (NPs). 2- Describe the relationships among individual characteristics, decision style, critical thinking dispositions, and diagnostic reasoning among entry-level NPs.			Diagnostic reasoning, decision styles and critical thinking dispositions	Decision style was defined as a distinctive or characteristic patterning of thinking processes based on the individual's predisposition to cognitive complexity and their values orientation measured by the Decision Style Inventory (DSI) Critical thinking dispositions defined as a network of attitudes or habits of mind that would tend to direct oneself to think critically. It was measured by the California Critical Thinking Dispositions Inventory (CCTDI) Diagnostic reasoning: defined as the thinking and decision-making processes required for an understanding of a clinical problem and measured by the Diagnostic Reasoning (DxR) computer program	Entry-level NPs N=70	Decision style: the difference in decision styles between different GPA categories was not reported. Diagnostic reasoning: there was a relationship between overall GPA attained in the graduate program and diagnostic reasoning score obtained on the DxR ($r = .38, p=0.001$). Critical thinking: there was no relationship between critical thinking dispositions as measured by the CCTDI and overall GPA among entry NPs ($r = -0.02, p=0.84$).
Reemts G., 2015 ²⁵	To explore if there was growth of emotional intelligence (EI) with registered nurses' (RN) experience and to determine if the variables of age, gender, grade point average (GPA), and years of total healthcare work experience predicted EI.	cross-sectional, Web-based survey RNs who graduated during the years 2007–2010 from 3 institutions, USA	Not indicated	Emotional Intelligence	Emotional intelligence was defined as the ability to cope with stress, manage conflict, and effectively lead. It was measured using Mayer–Salovey–Caruso Emotional Intelligence Test (MSCEIT). MSCEIT is composed of 141 items to measure "perceiving emotions in oneself and others", "facilitating thoughts", "understanding emotions", and "managing emotions".	Early-career RNs of less than 5 years of experience (divided into two groups: 1-2-year experience and 3–5 year experience) N= 165	GPA ($t=4.31, P<0.001$) and being female ($t=2.30, P=0.023$) were significant predictors of emotional intelligence on the understanding emotions branch. However, GPA was not statistically significant predictor for any of the remaining 3 domains of the tool (perceiving emotions, facilitating thoughts, and managing emotions branches).

<p>King P., 2006²⁶</p>	<p>To examine the relationship between diagnostic reasoning ability and intuition, and selected background (age, GPA, years of experience, and type of RN registration) variables</p>	<p>Survey-Based cross sectional Attendees of a conference held in April 2005 in Lexington, Kentucky, USA</p>	<p>April, 2005</p>	<p>Diagnostic reasoning ability and intuition</p>	<p>Diagnostic ability was measured by the use of the Nurse Practitioner Problem Set (NPPS) and the Diagnostic Thinking Inventory (DTI). NPPS is a tool developed to measure the ability of participants to obtain the correct diagnosis when presented with specific scenarios. The DTI is a measure of overall diagnostic reasoning ability and includes sub scores in flexibility in thinking (20 items) and the degree of knowledge structure in memory (21 items) as they relate to diagnostic reasoning. Intuition was measured by the use of the Acknowledging Use of Intuition in Nursing Scale (AUINS) which is a 7-item tool that has been found to be a valid and reliable measure of intuition in nursing.</p>	<p>All career levels (mean years of experience was 7.4) N= 164 (+65 nurse practitioner students)</p>	<p>There was no relationship between diagnostic skill and registered nurse experience or GPA ($r=-0.06$, $p=0.18$ on NPPS tool), ($r=0.1$, $p=0.09$ on DTI tool), and ($r=0.03$, $p=0.35$ on the flexibility scale tool).</p>
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(<5 years) (n= 3),^{17,20,25} expert level (>5 years of experience) (n= 1),²¹ or any career level with a mean of 7.3 years of experience (n= 1).²⁶ The impact of GPA on nurse performance was found to be inconsistent across the six studies. Two of the studies explored the relationship between GPA and negative professionalism indicators, specifically, turnover rate and transition shock.^{17,20} One of these studies revealed a significant association between GPA and job changes and turnover. Nurses with a GPA below 3.5 were about 6 times more likely to change hospitals compared to those with a GPA above 3.5.¹⁷ However, regarding transition shock among early career nurses, GPA was not identified as a significant predictor of transition shock.²⁰ On the other hand, other studies examined the relationship between GPA and positive professionalism indicators, including critical thinking, diagnostic reasoning, decision styles, and emotional intelligence. In two of the studies focusing on early career nurses, GPA had a statistically significant influence on diagnostic reasoning score ($r = 38$, $p = 0.001$),²⁴ and on one component of emotional intelligence ($P < 0.001$).²⁶ However, there was no significant relationship between critical thinking dispositions and overall GPA among early career nurses ($r = -0.02$, $p = 0.84$).²⁴ Nonetheless, for expert-level nurses, GPA showed a statistically significant correlation with critical thinking and decision-making in one of the studies,²¹ but no significant relationship with diagnostic skill in another study.²⁶

Discussion

The primary objective of this systematic review was to assess whether GPA is a dependable indicator of work performance success among healthcare professionals. The included studies focused exclusively on physicians, nurses, and pharmacists, excluding other healthcare professions. While the review aimed to assess the relationship between GPA and work performance across various levels of healthcare practitioners, the majority of studies focused on early-career professionals, such as medical residents, pharmacy graduates pursuing postgraduate training, and entry-level employees. Notably, only four of the identified studies addressed practitioners at all career stages, whereas the remaining concentrated on early-career professionals. Our findings from the 14 included studies revealed that the relationship between GPA and work performance varies based on the specific profession, career level, performance indicators/metrics used, and contexts.

Among physicians, GPA was investigated in relation to residency performance, knowledge, and professionalism, particularly for those at the early stages of their careers. Despite the consistent reported positive correlation between GPA and various performance indicators, the strength of this association varied, ranging from weak^{19,23,27} to moderate,²⁸ and strong correlations.¹⁸ For instance, GPA was found to be positively but weakly correlated with disciplinary actions, suggesting that academic achievement may not be a reliable predictor of future professional conduct.²⁷ Remarkably, GPA from particular academic years, such as the third year of medical school, was found to have more predictive potential than cumulative GPA.²⁹ This observation suggests that performance in particular professional years of education might be a better predictor of future work performance. However, the use of various tools in the studies, including both objective and subjective measures, makes it challenging to make a holistic judgment about the reliability of GPA as an indicator of physicians' work performance. Additionally, a range of competencies, such as communication skills with the multidisciplinary team and patients, ongoing professional development, and board certification scores, also play significant roles in a physician's overall clinical performance.^{31–33} In addition, studies have reported that certain factors such as the use of audit and feedback approaches can contribute to improving physicians' clinical performance.^{34,35} Therefore, further studies looking at more robust and holistic outcomes should be performed to determine if GPA can be considered a reliable indicator of various aspects of physicians' performance. While no studies explored the direct association between GPA and pharmacists' work performance, two publications examined how GPA influences career pursuits and professional development.^{22,30} This was particularly regarding the pursuit of postgraduate residency or fellowship opportunities.^{22,30} Both studies implied that a high GPA might increase the likelihood of applying for and securing residency programs opportunities, potentially fostering a commitment to lifelong learning endeavor. Indeed, research has indicated that various factors can contribute to pharmacists' attainment of higher postgraduate qualifications,^{36,37} and numerous elements can influence their clinical competence.^{38–40} For instance, a retrospective study among PharmD students evaluated the predictive value of academic and coursework assessments in identifying factors associated with failure or poor performance in advanced pharmacy practice experiences (APPEs).⁴¹ The study found that a professional GPA below 2.7, pharmacotherapy course failure, and professionalism issues during introductory pharmacy practice

experiences (IPPEs) were significant predictors of APPE failure.⁴¹ Importantly, pursuing higher education alone cannot be considered a definitive indicator of pharmacists' professional performance. Similar to physicians, the nature of pharmacists' job is complex, encompassing distinct aspects such as communication skills, clinical reasoning, and the delivery of patient-centered pharmaceutical care.^{42,43} Pharmacists work in diverse practice settings, including community pharmacies, hospitals, and the pharmaceutical industries.^{44,45} They can also hold different types of job positions, including operational roles, clinical roles, drug information, quality assurance, and pharmacy informatics.^{44,45} Hence, future research endeavors should explore the relationship between specific pharmacy job roles and academic GPA. Other assessment methods beyond GPA also merit exploration for their relationship with professional clinical performance. For instance, Heldenbrand et al demonstrated that the multiple mini-interview (MMI) serves as an independent predictor of preceptor-rated performance during the APPE year among PharmD students.⁴⁶

Studies exploring the predictive value of GPA on nurses' performance have yielded mixed findings. Although most of the studies reported positive associations,^{17,21,25} some reported no difference or negative relationships.^{20,24,47} Similar to the findings for physicians, these results varied depending on the performance indicators and career levels examined. In the two studies that examined GPA in relation to turnover rate and transition shock, GPA was found to be significantly associated with job changes and turnover, especially among entry-level nurses;¹⁷ however, it did not affect the transition shock.²⁰ This may be explained by the fact that early career nurses may face challenges in adapting to and understanding their work environment as well as applying their theoretical knowledge into practice. This finding aligns with existing reports indicating that healthcare graduates commonly experience challenges in their early career stages.^{48–50} Another study targeting the same population of early career nurses, has identified GPA as a significant factor influencing diagnostic reasoning.²⁴ This connection may be attributed to the fact that problem-solving and analytical thinking skills are correlated with higher GPAs.⁵¹ However, GPA did not impact critical thinking dispositions, as measured by the CCTDI tool.²⁴ Concerning emotional intelligence, early career nurses' GPA was found to be a predictor of the "understanding emotions" domain of emotional intelligence, as measured by the MSCEIT tool.²⁵ Nevertheless, it did not influence any of the remaining three emotional intelligence domains of the MSCEIT tool (perceiving emotions, facilitating thoughts, and managing emotions).²⁵ Similarly, a study among first-year nursing students demonstrated a modest but significant correlation between total emotional intelligence and experiential emotional intelligence with GPA.⁵² However, the study also highlighted lower-than-average scores in several emotional intelligence domains, suggesting that traditional academic metrics, such as GPA, may not fully capture the broader competencies required for postgraduation performance.⁵² These findings emphasize the need for further research to explore the relationship between traditional and nontraditional measures of success and their correlation with professional performance. In one study focusing on expert-level nurses, GPA was found to have a significant correlation with critical thinking and decision-making skills²¹ but not with diagnostic abilities.²⁶ This inconsistency could be due to differences in assessment methods, with some studies employing objective standardized tests to evaluate critical thinking, diagnostic reasoning, or decision-making, while others relied on self-reported scales or qualitative approaches. Therefore, there is a need for more rigorous studies to explore the potential relationship between GPA and nurses' work performance, while taking into consideration the diverse roles within nursing and other clinical performance measures that might affect this relationship.

Apart from GPA, Terry et al conducted a systematic review to evaluate whether coursework summative assessments such as Objective Structured Clinical Examinations (OSCEs) predict the clinical performance of healthcare professionals, including medical doctors and pharmacists.⁵³ Despite evaluating a limited number of studies with heterogeneous outcomes, the review found that OSCEs and written assessments such as multiple-choice, extended matching, and short-answer questions significantly correlate with the clinical performance of healthcare professional students.⁵³ Additionally, Subih et al identified significant predictors of clinical performance among emergency nurses, including secondary traumatic stress, high body mass index, smoking, chronic diseases, and working overtime. The study highlighted a strong negative association between secondary traumatic stress and nursing performance, emphasizing the importance of a holistic approach to predicting clinical performance and implementing interventions to reduce stress levels.⁵⁴ Similarly, Lee et al found that personal factors, such as self-esteem and work-life balance satisfaction, along with the quality of the clinical learning environment, significantly influenced nursing students' readiness for practice.⁵⁵ These

findings suggest that other confounding factors should be considered when evaluating GPA as a predictor of work performance among healthcare professionals.

While this systematic review offers a well-structured response to an important and contentious issue, it has some limitations that need to be addressed. First, the methodological heterogeneity in the reported outcomes and study designs did not allow direct comparison or meta-analysis. Second, differences in the assessment tools, work performance metrics, and reported outcomes among the studies introduced additional challenges. Nevertheless, categorizing the studies by healthcare profession facilitated a more organized summary of the findings. Third, only three healthcare professions were identified within the included studies, which limits the ability to generalize the findings to all healthcare professionals.

Conclusion

Overall, this systematic review suggests that GPA may influence certain aspects of work performance in healthcare, but its impact may differ depending on the profession, career stage, and specific context. Therefore, GPA alone should not be used as a primary or definitive indicator of a healthcare professional's overall work performance. A more accurate evaluation requires a comprehensive assessment that includes clinical competencies, ethical behavior, communication skills, and job-specific responsibilities. For example, healthcare institutions could implement multifactorial hiring frameworks that combine GPA with assessments of clinical skills, professionalism, and communication abilities to better predict job performance.

The findings of this review also underscore that policymakers should avoid over-relying on GPA when hiring healthcare professionals and instead consider a holistic evaluation of candidates. However, the reviewed studies in this review were limited by small sample sizes, heterogeneous methodologies, focus on early career and entry-level professionals, inclusion of limited number of healthcare professions, and a lack of standardized performance metrics, which may affect the generalizability of findings. Future research should employ robust study designs to further explore the relationship between GPA and objective performance metrics, while also considering potential confounding factors, years of experience, and the multifaceted nature of each healthcare profession. This is particularly important as job performance can be affected by a range of factors, including personal beliefs, organizational culture, work environment, and career expectations. Longitudinal studies tracking professionals from their academic years through their careers would be particularly valuable in understanding the long-term relationship between GPA and work performance as well as provide more conclusive evidence.

Finally, the variability in GPA's impact on work performance across healthcare roles emphasizes the need for tailored approaches. For example, specific competencies like clinical reasoning may be more relevant for physicians, while pharmaceutical centered care and emotional intelligence may be critical for pharmacists and nurses, respectively. Recognizing this diversity is essential for improving workforce evaluation and ensuring high-quality healthcare delivery.

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