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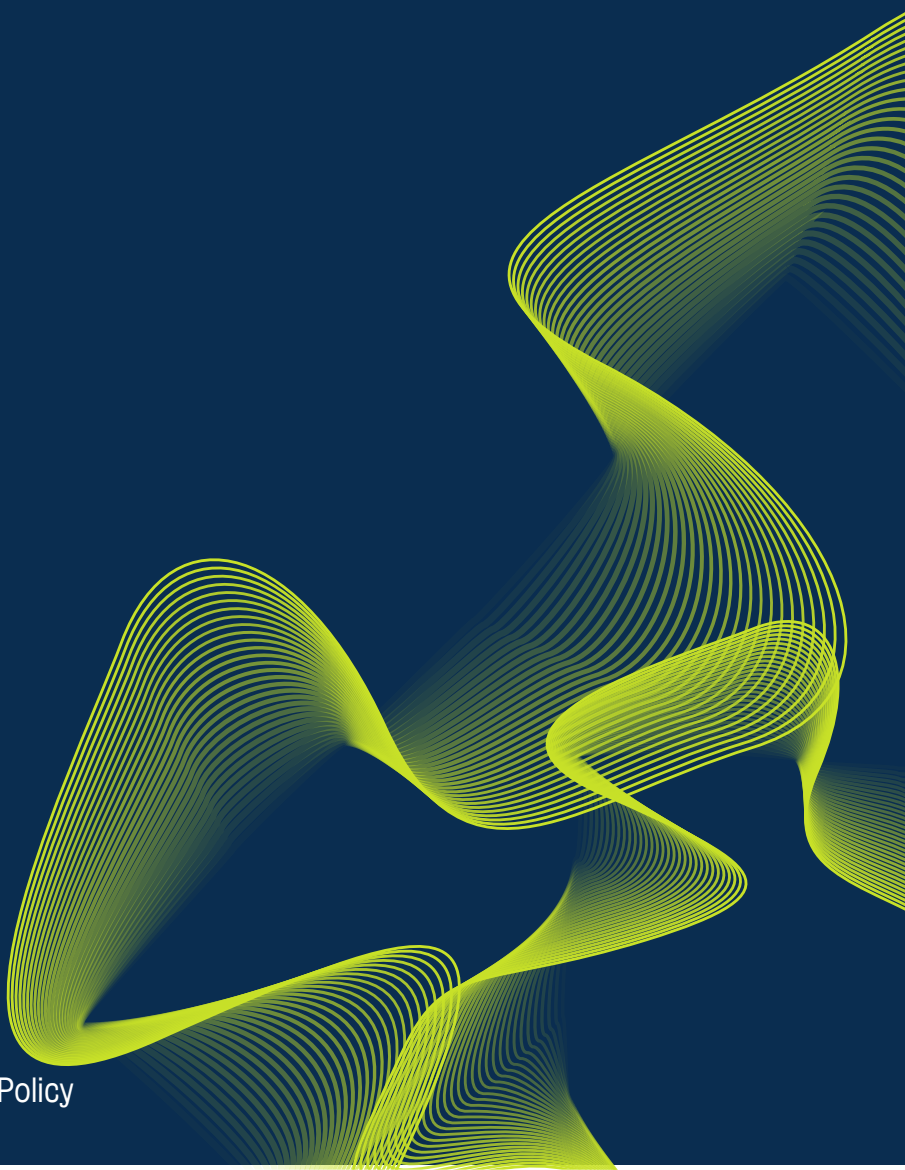
The National and International Research Literature on Physician Associates and Anaesthesia Associates

Safety, Effectiveness and Patient Perspective

Annette Boaz, Ian Kessler & Antonina Semkina



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Contents

Background

The Secretary of State for Health and Social Care has established an independent review of the physician associate (PA) and anaesthesia associate (AA) roles, to agree recommendations for the future. Under its terms of reference, the review will consider the safety and effectiveness of the roles and their contribution to multidisciplinary healthcare teams. It will also look at secondary questions relating to postholders' day to day working, education and training and regulation and governance. The conclusions of the review will inform the refreshed Workforce Plan for healthcare that the government has committed to publish in summer 2025. In addressing safety and effectiveness the review will draw together evidence from a wide range of sources. The National Institute of Health Research (NIHR) Health and Social Care Workforce Research Unit (HSCWRU) at King's College London completed a literature review on PAs and AAs for the Department of Health and Social Care (DHSC) in 2020 (Samsi et al 2020). It has been asked to contribute to the current independent review by revisiting and drawing together published national and international research.

Aims

The HSCWRU project supported the independent review by addressing the following questions:

- What does the national and international research literature tell us about whether the roles of Physician Associate and Anaesthesia Associate are safe and effective as members of multi-disciplinary teams, across all tasks, roles and settings, and as perceived by patients?

In doing so the Unit gathered and synthesised national and international research publications relating to these review questions. In the time available, it was not possible to conduct a suite of new systematic reviews. Given the differences between PA and AA roles and the research streams on their evaluation, these sources were considered separately with a rapid synthesis of relevant literatures. Moreover, in processing the literature on the PA role we were keen to distinguish studies by care setting, examining those focusing on PAs in primary and PAs in secondary care.

Methods

The project employed three different approaches to identifying the respective literatures.

A. **A search of the NIHR portfolio.** This was achieved through searches of the NIHR funding and awards website, NIHR open data, and by contacting NIHR key investigators who had undertaken work identified through the NIHR portfolio. Our interest in the NIHR projects as a discrete set of studies was prompted by their focus on the use, management and consequences of the PA and AA roles in the NHS England context. Much of the wider evidence base on these issues has been centred on the USA where the medical workforce structure and regulatory regimes underpinning the roles are very different. Indeed, in the US the roles are typically subject to forms of mandatory registration, which (despite consultation on the issue) as yet does not underpin their use in NHS England. In England, registration is being introduced and will be mandatory from December 2026.

   We conducted a search of the NIHR open database listing all funded studies, using the job titles, PA and AA, as search terms. In the case of the PAs, the terms 'physician associate' and 'physician assistant' were used (the latter yielding one additional study). The search revealed 7 studies. Two studies covered PAs in primary care. Another of these studies, McDermott et al (2022), examined skill mix in primary care, which included PAs as part of this mix, but without distinguishing the particular contribution or impact of PAs in this care setting. The second study by Drennan et al (2014) was specifically focused on PAs in primary care and provides insights into issues relevant to our review.

   The five other NIHR studies covered PAs in secondary care. Two of these studies engaged only indirectly with the PA role, in one case, Halter et al, focusing on skill mix in emergency care in a secondary care (Halter et al), and in the other, Wu et al., on the care experiences of women with high blood pressure in pregnancy. Neither studies is yet complete and again includes PAs as part of team limiting their relevance to our review. The study by Leckcivilize et al does have a dedicated PA focus but remains in progress with any substantive findings yet to be published. It is also the only

NIHR study to mention AAs, but its principal focus remains PAs, with AAs taken as a point of comparison in one element of the research. As noted, it is a study yet to be completed and will tell us very little about AAs. The findings from Parker (2022) do not seem to be publicly accessible, although judging by the size of the grant (£3K) this is likely not a major substantive piece of work. With these four NIHR studies of limited value to our piece of work, this leaves only one NIHR study with a dedicated focus on PAs in secondary care- Drennan et al. (2018).

B. **Previous systematic reviews.** We were keen to examine the canon of research literature on PAs. Previous published systematic reviews allowed us to compile an overview of the UK and international literature on the safety and effectiveness of and patient satisfaction with PAs, the peer review status of these reviews assuring their academic quality. In exploring the reviews, we were seeking to map the contours of the literature on PAs: the precise issues and contexts explored, their theorisation (if any), the methods and measures used and the substantive findings.

   We identified two studies in progress registered on the PROSPERO database of systematic reviews. We contacted the review teams led by Nicola Cooper and Dmytro Babelyuk. Both teams had completed recent (2024) systematic literature searches to identify UK and international literature on PAs. Both reviews identified 5 reviews, one identified a further review (due to scope both PAs and AAs). Our own searches (conducted in January 2025) identified the same set of reviews. Three of these systematic reviews covered PAs in secondary care settings: Doan et al. (2011); King et al. (2023); and Halter et al. (2018). Two covered studies of PAs in primary care settings: Sheringham et al. (2021) and Halter et al. (2013). One related to PAs across both primary and secondary care: van den Brink et al (2021).

C. **Recent literature.** We also worked with the authors highlighted above to pick up the most recent studies on PAs and AAs. More specifically:

- Nicola Cooper and her team at the University of Nottingham have conducted an enhanced rapid review of PAs. This rapid review aims to answer the question: 'What is the impact of physician associates on quality of care in advanced healthcare systems?'. The team completed the review at the end of February 2025. The

Nottingham team shared their full results prior to publication, and we extracted the ten most recent studies (2020-2025) for discussion in this report, all covering PAs in secondary care settings. A paper reporting on their review in full is now published (Cooper et al 2025).

- Dmytro Babelyuk and a team at the University of Bangor carried out a systematic review on Medical Associate Professionals which included AAs. The team shared a subset of papers identified as focusing on AA roles as part of this project.

Each of the three approaches- NIHR studies, systematic reviews and recent studies- had different advantages. The first brought together research undertaken within the NHS and conducted to rigorous NIHR standards. The second allowed us to capture the body of research evidence, quality appraised as part of the systematic review process and published in peer reviewed journals. Given time lags, the systematic reviews covered were unlikely to capture recent research, but they did provide insights into the nature of previous research on PAs and the evolving state of knowledge on the role. Finally, we drew on recent systematic searches conducted as noted as part of the two PROSPERO registered reviews by Cooper and Babelyuk to identify new national and international research. The timing of these recent reviews is particularly important given the impact of the pandemic and the service crisis faced by many healthcare systems, with possible implications for workforce structure and management, including whether and how PAs and AAs are used and deployed. We were also aware of wider recent literature, for instance, a review on PA and AAs by Greenhalgh and McKee (2025).

In this report we present the findings from our evaluation of the literature in three main sections:

- PAs in primary care.
- PAs in secondary care.
- AAs.

In case of each of the respective staff groups we draw upon our three sources to explore the methods and outcomes measures used in studies and the findings from these studies.

Physician Associates in Primary Care

As it related to PAs in primary care the material from our three sources is presented in:

- Table 1 NIHR studies: PAs in primary care
- Table 2 Systematic reviews- PAs in primary care: safety and patient satisfaction
- Table 3 Systematic reviews: PAs in primary care: effectiveness.

- ***Methodologies and Outcome Measures:***

From Tables 1-3 the following points can be noted:

- It is clear that there have been very few dedicated studies of PAs in primary care: as noted, one completed NIHR study covering England (Drennan et al. 2014) and two systematic reviews (Sheringham et al. (2021) and Halter et al. (2013)) both with an international coverage. Our review of recent studies found none on PAs in primary care.
- Conducted between 2010-13, so well before the Covid pandemic, the Drennan et al. (2014) NIHR study adopted a multi methods case study approach covering six general practices with PAs and six without PAs. The case studies used a range of research techniques-interviews, analysis of patient records, video observations of consultations, expert reviews of consultations. This allowed for a triangulated picture to emerge on the use and impact of the PA role.
- The studies covered in the two systematic reviews used various methods, including reviewing patients, interviews and malpractice claims.
- The quantitative element in Drennan et al. (2014) study and those studies covered by the systematic reviews used similar outcomes measures: the re-consultation rate (in the case of the NIHR study within two weeks) and referral for further treatment and care.

- ***Findings***

Tables 1-3 highlight the following key findings on the ***impact*** of PAs in primary care:

- In broad terms the findings from the NIHR study and the studies covered by the systematic reviews are very similar.
- PAs and GP/physicians do often see different types of patients by age, morbidity and condition.
- Some studies control for patient profile but where they do not comparisons of outcomes (where PAs are and not involved in care delivery) remain difficult.
- There are difficulties in conducting conclusive research on PAs in primary care roles (by controlling all influences on outcomes and differences in the management of PAs).
- Notwithstanding these difficulties, studies measuring high level outcomes typically report no differences or small differences (both positive and negative) in relation to selected safety and effectiveness measures.
- In the Drennan et al. (2014) NIHR study:
    - Overall, 32% of the patients attended the surgery again within 2 week but there was no difference in the rate of re-consultation for the same problem, between those consulting PAs or GPs.
    - The review of patients reconsulting judged the documented activities in the initial consultation to be appropriate in 80% of PA records and 50% of GP records.
    - GP reviewers could not easily identify whether the clinician was a GP or a PA from the records, correctly classifying 40% of PA consultations and 76% of GP consultations.
    - In the video observations PA consultations were judged competent, with scores between 40% and 60% for the dimensions of interview/history taking, physical examination, patient management, problem solving, behaviour/relationship with patients and anticipatory care.

- More generally across the source studies, patient satisfaction was typically high, albeit with patients not always aware they were seeing a PA. In the Drennan et al. (2014) study there were no significant difference in patient satisfaction between those

consulting PAs or GPs: a majority who had consulted a PA being very satisfied (62%) or satisfied (28.3%) and willing to consult a PA again.

- With more serious conditions, some patients did express a preference to see a GP/physician.
- In the Drennan et al. (2014) study PA consultations were significantly longer than those conducted by GPs. However, there was no difference between PAs and GPs in the procedures undertaken or referrals to secondary care.
- Supervision, regulation and effective team working were highlighted in many studies as critical to the deployment of PAs in primary care. But there were few attempts to examine whether and how these contingencies impacted the use, management and impact of the roles.

Physician Associates in Secondary Care

As it related to PAs in secondary care the material from our three sources is presented in:

- Table 4 NIHR studies: PAs secondary care
- Table 5 Systematic reviews: PAs secondary: safety and patient satisfaction
- Table 6 Systematic: PAs secondary care effectiveness
- Table 7 Recent studies: PAs in secondary care
- Table 8: Measures and findings from recent studies (an in-text Table).

- ***Methodologies and Outcome Measures:***

From Tables 4-8 the following points can be noted:

- There is a more substantial research literature on PAs in secondary care than PAs in primary care. Certainly, there was again only 1 dedicated and completed NIHR study -Drennan et al. (2018)- covering PAs in secondary care (with another ongoing and to be completed by Leckcivilize et al.). However as noted above, three of the systematic reviews and all of ten of the recent studies covered PAs in this setting.
- Conducted between 2015-18, so also pre-pandemic, the Drennan et al. (2018) NIHR study on PAs in secondary care adopted a multi-methods approach in six case study hospitals. Senior trust managers and clinicians from a range of clinical specialisms were interviewed on the safety and efficacy of the PA role. Patients completed a survey and were interviewed on their relative levels of satisfaction with their treatment from PAs.
- Drennan et al. (2018) carried out more detailed work on PAs in Emergency Departments (ED): Comparing re-attendance within 7 days between PAs and Foundation Year (FY) 2 doctors and, with an expert panel (blind) reviewing a subsample of 40 of the ED consultation records (20 PA and 20 FY2).
- The three systematic reviews and the ten recent studies on PAs in secondary care were international in the coverage, but with the overwhelming majority based in the US.
- Two (Doan et al. 2011 and Halter et al. 2018) of the three systematic review covered studies undertaken well before Covid.

- The systematic reviews and recent studies covered PAs in a range of secondary care settings, but there was a concentration on the role in ED and in trauma and orthopaedics (T&O) departments.
- The systematic reviews used a variety of outcome measures to evaluate the safety and efficacy of PAs. Certain measures were dependent on the specific secondary care setting: in EDs for example, some studies used waiting-times and in the T & O and surgical departments, some studies used infection rates following surgery. However, other, generic measures were used in the different studies including length of stay and follow up treatments. Indicative of the US-centric nature of many studies, rates of prescription were sometime used as an outcome measures (PAs in the NHS are prohibited from prescribing medication).

- Complementing Tables 4-7, Table 8 below pulls out the measures used in the ten recent studies. It can be seen that the most commonly used measures were: patients returning for further treatment, operative and post operative complications and length of stay. Other measures were used more sporadically: for instance, mortality, patients seen per hour and hospital admission (from ED).

Table 8: Measures and Findings from the Recent Studies

	Kurtzman et al, 2023, USA	Moore et al, 2021, USA	King et al, 2024, UK	Divi et al, 2021a, USA	Divi et al, 2021b, USA	Hazzard et al, 2023, USA	Malloy et al, 2021, USA	Quanbeck et al, 2025, USA	Lui et al, 2023, USA	Griffith et al, 2023, USA
ED										
Surgical										
Other										
Length of stay	PA shorter	PA longer	PA longer	Comparable						
Likelihood of hospital admission	PA lower	PA lower								
Waiting Time	No difference									
Patients seen per hour		PA higher								
Patients returning		Similar	No difference	No difference					No difference	
Leaving against medical advice		Similar								
Patient satisfaction		PA higher								No difference
Death rates		Similar								
Leaving without being seen			No difference							
Operative time				Similar	No difference		PA shorter	PA shorter	No difference	
Tourniquet time average autografts						PA shorter				
Skin to skin average autografts						PA shorter				
Post-operative complications					Similar		Similar	No difference	No difference	

- **Findings**

The following emerged from the ***Drennan et al. (2018) NIHR study*** (see (Table 4):

- The qualitative interview data did not identify any perceived safety concerns or adverse incidents in the use of PAs.
- PA effectiveness was seen in the contribution the role made to continuity of care. PAs were reported to contribute to service efficiency through supporting doctors and nurses. Specific examples included: PAs working shift patterns to complement the junior doctors that enabled an outpatient clinic to extend its hours with greater patient throughput; and freeing up consultants' time
- In relation to the quantitative data from the EDs, re-attendance within 7 days of the ED visit, the principal outcome measure used, was found following 8% (n = 48) of the 610 visits for which these data were available. Logistic regression was used to model the likelihood of re-attendance. After adjustment for confounding variables this revealed no statistically significant difference in the rate of re-attendance between PAs and Foundation Year (FY) 2 doctors.
- The expert panel review was carried out on a subsample of 40 of the ED consultation records (20 PA and 20 FY2) and found that documentation in the consultation record was appropriate in the majority of both PA and FY2 doctor cases, with no component errors. Moreover, blind reviewers were unable to judge whether the consultation record was that of a PA or FY2 doctor.
- Overall, the evidence suggests that both PAs and FY2 doctors practice equally safely and appropriately in the ED, with no differences in re-attendance rates.
- The patient/relative interviews revealed uncertainty about the nature of the PA role but a positive experience of engaging with it and a willingness to do so in the future.
- All of the patients and relatives were positive about the treatment and care they had received from their health-care team.
- Some patients were not able to distinguish the PAs' contribution to their care from the care provided by the rest of the team.
- The participants in the ED reported that the contribution the PA made was to conduct a satisfactory assessment, plan and treat the presenting problem.

- Inpatients and relatives particularly valued the contribution of the PAs to keeping them informed, in explaining their condition and the care plan, in a way that they could comprehend, as well as the responsiveness and accessibility of the PAs.
- All patients and relatives were content to be attended by a PA in the future based on their experience in their episode of care.

Given the significant swathe of studies covered (Tables 5-6), summarizing the findings from the ***three systematic reviews*** on PAs in secondary is difficult but patterns do emerge.

- In the case of the efficiency measures:
    - Studies covered by the reviews suggest that the involvements of PAs reduced wait times, particularly in EDs.
    - In T&O settings wait times were similar or no different
- In the case of safety, there were studies noting negative outcomes with the use of PAs: for example, one study in the Halter et al (2018) review noted inpatient mortality was statistically higher in pneumonia care where PAs were used in place of interns.
- In the main, however, studies covered by the systematic reviews suggested that in terms both of safety and effectiveness there were slight or no differences where PAs were involved, and this was found in EDs and T&O settings.
- In relation to patient satisfaction, some studies covered by the systematic reviews did suggest patient views were contingent on the acuity of their condition: thus, in one study patient satisfaction with PAs was higher where acuity was low, and in another study, patients were keen to be seen by a physician than PA where seriously ill. However, in general the systematic reviews again found patient satisfaction was typically high and similar or no different to levels of satisfaction with physicians or other care professions.

An overview of the findings from the **most recent studies** (see Tables 7 and 8), which as noted exclusively covered PAs in secondary care, indicates:

- There were certain measures against which PA outcomes differed from comparator physicians. In some instances, evidence on the same measure was inconsistent, in other words pointed in different directions (positive and negative). For example, there were studies which found that PAs lengthened and shortened length of stay,

as well as making no difference. In some studies, there was no difference in patient satisfaction with PAs relative to other healthcare professions, while others suggested satisfaction was higher (few suggested it was lower).

- With hospital admission from EDs, a couple of studies found these were lower with the involvement of PAs.
- On the most commonly used outcome measures, the recent studies found patient returns for further treatment similar or no different for PAs when compared to physicians.
- This was also the cases with other widely used measures, such as operating times and post operative complications in surgical departments.

Studies of the Anaesthesia Associate role

The Leng review is looking at both PA and AA roles, so we did some additional work to locate published research evidence on AAs. However, there is a considerably smaller literature on AA roles.

As noted above we identified two relevant reviews in progress registered on the PROSPERO database of systematic reviews, one of the teams including AAs. This was a systematic review focusing on the impact of Medical Associate Professions (MAPs) on healthcare. The systematic review was international in scope, and included literature on PAs, AAs, and surgical care practitioner (SCP) roles and their influence in various healthcare settings. Papers written in English and published over the last 20 years were evaluated in this study. The review only identified one dedicated study of AAs (Sellers et al., 2022). Given the limited evidence available we conducted a further online search and found three additional papers: an economic modelling study and two systematic reviews.

The four studies are summarised in Table 9, with the key point to emerge as follows:

- There is a very small literature on AAs.
- Sellers et al. (2022) was conducted in the UK and is a qualitative study looking at professionals experiences of working with AAs. The study found that all staff groups interviewed held a largely positive view, noting that the inclusion of AAs reduced cancelled lists, increased flexibility in rotas, and improved management of staggered admissions and emergency lists. Additionally, interviewees strongly supported statutory regulation of AA roles and the collection of robust data on their safety and effectiveness.
- The economic modelling study (Hanmer et al., 2024) provides an analysis of the economic viability of the proposed staffing model (one physician supervises two AAs across two lists) and argues that the model is only economically viable if the AAs are paid less, the supervisors are paid more, or the AAs undertake more clinical workload.

- Drawing on largely poor quality US studies, the two systematic reviews do not explicitly look at AAs, but at other non-physician anaesthesia roles and

conclude that there were either no, small or insignificant differences between the different roles, but observe that there are issues with the quality of the evidence available.

Summary and Conclusion

Our review of the research literature on PAs and AAs has been rapid and drawn from three main sources:

- NIHR studies;
- Systematic reviews; and
- The most recent studies.

From these sources we have drawn out studies and findings which related to: PAs in primary care, PAs in secondary care and AAs. Looking across the material the following summary and concluding points can be made:

- The vast majority of the published research literature comes from the USA where there is a different context in terms of health care organisation and delivery and, in relation to PA roles, differences in regulation and supervision.
- Much of the research, especially that recently conducted, has centred on PAs in secondary care. There are only a limited number of studies on PAs in primary care, perhaps reflecting the lower take-up of the role in this setting, and even fewer on AAs.
- Most of the published research was conducted before the COVID-19 pandemic, so it is unable to pick up Covid's impact on healthcare delivery and work organisation.
- In exploring PAs in secondary care, research has been undertaken in a variety of clinical settings, but with a concentration on PA roles principally in emergency and trauma and orthopaedic departments.
- While there have been multi-methods studies, in the main research on PAs safety and effectiveness has been quantitative, drawing upon retrospective patients records, and comparing PA and doctor outcomes or outcomes by team with and without PAs as members. There have been:
    - Few controlled/experimental studies, for example exploring outcomes before and then after a PA has been introduced.
    - Few attempts to theorise or hypothesise the relationship between the use of PAs and AAs and outcomes, often making the interpretation of findings difficult.

- The literature typically reports on a diverse range of outcome measures relating to quality and safety (for example, length of stay, waiting times, reattendance, patient satisfaction and clinical outcomes) making comparison between studies difficult.
- Likely reflecting a triage process, PAs and physicians do often see different types of patients in terms of age, morbidity, etc. Some studies have sought to control for patient profile, but more typically they have not, again making comparisons difficult.
- In some studies, the PA role is assessed as part of or as an addition to a Multi-Disciplinary Team, and in comparison, to the use of other roles (e.g. a physician, a nurse practitioner). In the MDT studies, the impact of PAs is often difficult to distinguish from that of the whole team. In the comparator studies, PAs and physicians often see different patients in terms of age, morbidity, severity, complexity, etc. making comparisons difficult.
- With strong caveats about the difficulties of conducting definitive research on PA roles, studies typically report no differences or small differences (both positive and negative) in relation to the selected measure of safety and effectiveness.
- Patient satisfaction is typically high, although patients are not always aware that they have seen a PA and there is some evidence that, with more serious conditions, patients would prefer to see a doctor.
- Supervision, regulation and effective team working seem critical to the deployment of PAs and AAs in health care systems. But in the research literature covered in our review there is a relative dearth of studies examining whether and how these contingencies relate to the roles in terms of their impacts.

About this report and acknowledgements

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Table 1: NIHR Studies on Physician Assistants/Associates in Primary Care

Title	Study Dates (published)	Setting/ Focus	Questions/Issues	Methods	Findings
1.Investigating the contribution of physician assistants to primary care in England: a mixed-methods study Drennan, V., Halter, M., Brearley, S., Carneiro, W., Gabe, J., Gage, H., Grant, R., Joly, L. and de Lusignan, S.	August 2010-February 2013 (June 2014)	PAs English primary care	-How are PAs deployed in general practice and what is the impact of including PAs in general practice teams on the patients' experiences and outcomes? -What is the impact of including PAs in general practice teams on the organisation of general practice, the working practices of other professionals, relationships with these professionals and the practice costs? -What factors support/inhibit the inclusion of PAs in general practice teams at the local and macro level?	**Phase 1: Macro and meso levels:** -Rapid review of empirical evidence of the contribution of PAs to primary care - Documentary analysis of published commentaries and of UK workforce policy. -Scoping survey, using semi-structured interviews, of key informants -Online anonymous survey to identify deployment of PAs in primary care. **Phase 2: Micro-level** -Case studies: six matched general practices employing PAs and six not. - GPs, PAs, nurses and administrative staff interviewed (N=45). -Adult patients attending for same-day appointments surveyed (N=539) - Work diaries (N=5) -In PA practice case studies patients invited for interviews. (N=34) -Anonymous patient record (N=2086), with a study ID extracted for all patients attending these surgeries together with any record of primary care attendance within the following 2 weeks. The primary outcome: rate of re-consultation within 2 weeks for the same problem. -Consultations videoed and blind GP-PA reviewed by panel. (N=475) -Economic analysis: practice team configurations and costs; and patient-level comparison of the contribution and costs of GP and PA consultations	**Phase 1** -Rapid review found 49 published studies, mainly US, showed growth in PA numbers in primary care settings over 40 years but weak evidence for their impact on the process of care, patient outcomes or costs. -Analysis of interviews in scoping survey found majority offered a positive or, at worst, neutral view of the contribution that PAs could make as mid-level professionals. - Similar finding emerged from the analysis of published commentaries. PAs were, however, absent from English health workforce and education planning documents at national and regional levels. -Online survey of PAs response rate: 64% from 16 PAs working in primary care. Majority of their time and effort deployed in providing same-day appointments with patients. Other activities reported: chronic disease management, home visits, cryotherapy, teaching, clinical audit and supervision of other staff such as health-care assistants. **Phase 2** -PAs deployed to complement the work of GPs. Flexible resource and could cover the work of the nurses during absences. -PAs mainly provided clinician time in same-day appointments, with the expectation that the PA would behave as a doctor for their patient case mix and within their competency as agreed by their supervising doctor. -Allocated longer appointment slots or the same length of time as GPs, with free appointment slots for conferring with a GP. Some work changed over time with the expertise of the PA and the requirements of the practice. -Some deployed to incentivised activities: more services closer to home and more preventative work. -Patient survey: majority reported high levels of satisfaction with no significant difference between those consulting PAs or GPs. Majority who had consulted a PA said that they were very satisfied (62%) or satisfied (28.3%) and would consult a PA again.

					-Patient interviewees: Most had high degree of satisfaction with and confidence in PAs. Some patients mistakenly thought they had consulted some type of junior doctor. There is a need for patients to fully understand the role, to have choice of whom to consult and to ensure continuity in their relationship with their clinician. -Patient records: PAs consulted a wide range of patients but compared to GPs, the patients were younger, fewer indicators of multiple chronic conditions and presenting that day with less acute/complex problems. -No difference between PAs and GPs in: rate of procedures undertaken, referrals to secondary care or prescriptions issued. PAs were significantly more likely to document general advice. -32% of the patients attended the surgery again within 2 weeks. No difference between those consulting PAs or GPs in the rate of re-consultation with the same problem or a linked problem -Blind review of patients reconsulting for the same problem judged the documented activities in the initial consultation to be appropriate in 80% of PA records and 50% of GP records. -GP reviewers could not easily identify whether the clinician was a GP or PA from the records, correctly classifying 40% of PA consultations and 76% of GP consultations. -Video observations of PA consultations judged competent, with scores between 40% and 60% for the dimensions of interview/history taking, physical examination, patient management, problem solving, behaviour/relationship with patients and anticipatory care. -Staffing configurations varied within and between the groups of practices. - Average cost per patient ranged from £146 to £176 in practices employing PAs and from £68 to £405 in those not employing PAs. -Proportion of salaried GPs was higher in practices employing PAs than in practices without PAs. -Average patient consultation with a PA was 5.8 minutes longer than with a GP.

2 .Scale, scope and impact of skill mix change in primary care in England: a mixed-methods study McDermott, I., Spooner, S., Goff, M., Gibson, J., Dalgarno, E., Francetic, I., Hann, M., Hodgson, D., McBride, A., Checkland K. and Sutton, M.	September 2018-December 2020 (May 2022)	Skills Mix (including but not limited to PAs) Primary Care England	-What is the scale and distribution of skill mix changes in primary care and how is skill mix change associated with outcomes and costs? -what motivations drive skill mix deployment at the practice level and what is delivered by the deployment of different practitioner types? -how do skill mix changes affect the experiences of employers, practitioners and patients?	Mixed-methods/ three work packages (WPs). **-WP1: quantitative analysis of national data sets (2015–19)** on workforce and other aspects of care quality and experience. Designed to capture the extent and impact of skill mix changes. **-WP2: online survey of practice managers (August–December 2019**) at 1261 general practices (17% of all practices in England) about their motivations for employing non-GPs. **-WP3: comparative case study (August–December 2019)** of five general practices in England to examine processes and working practices sensitive to differences in context (38 interviews , 27 observations (totalling 1620 minutes), focus groups with 29 members of the Patient Participation Groups and 125 patient surveys)	-Overall FTE of partner GPs declined, whereas the FTE of advanced nurses and newer roles, such as clinical pharmacists (CPs) and physician associates (PAs), increased. Workforce composition showed variation across the English regions. -GPs reported difficulty in recruiting GPs as a motivation for implementing skill mix change, Practice managers reported motivation to increase overall appointment availability, release GP time and provide a better match between what patients need and what the team could deliver. -Employment of newer non regulated roles, such as PAs, may require delegation of tasks. Decisions must now be made about which tasks to transfer from GPs to non-GPs, and consideration given to supervision and transfer of responsibility. -GPs willing to transfer tasks. Interprofessional competition and the protection of occupational jurisdiction not a feature of case study sites. Discussions were about the extra work involved in operationalising skill mix change. -Practices categorised practitioners according to a combination of qualifications, training, upskilling, specialisation and/or past experiences, rather than solely by job title. Receptionists used the matrix to match patients' problems with what practitioners could provide. The potential for imperfect matching required practices, patients and staff to operate flexibly in the short term to accommodate any mismatch. Patient education/communication and availability of GP supervision for newer roles were vital in ensuring patient acceptance of skill mix change. -Large majority of patients surveyed (82% of 125) believed appointments were useful and thought that they have seen the right practitioner to deal with their problem(s). -Focus groups: concerns about the burden of patient 'work' required to develop relationships with newer practitioners. Introduction of newer roles not communicated effectively. -Outcomes were analysed in relation to FTE Per 1000 Patients (PTP) for GPs, nurses and a 'direct patient care' (DPC) group that includes CPs, physiotherapists, paramedics and PAs. -A higher FTE of GPs PTP is associated with relatively higher overall satisfaction and patient satisfaction with their experience of making an appointment. A higher FTE of both nurses and other DPC practitioners was associated with a lower satisfaction with experience of making an appointment, whereas a higher FTE of other DPC professionals was associated with a relatively lower overall satisfaction. -A higher FTE PTP of GPs, nurses and other DPC practitioners were all associated with higher levels of total Quality and Outcomes Framework performance, with the highest level associated with a higher FTE of GPs PTP. -A higher FTE of GPs or nurses per 1000 population was associated with a relatively lower rate of accident and emergency

					(A&E) attendances, but a higher FTE of other DPC practitioners PTP was associated with a relatively higher rate of A&E attendances.

Table 2: Existing systematic review evidence - Safety and Patient Satisfaction: PAs in Primary Care

Review	Safety		Patient satisfaction
	Outcomes	**Process**	
Sheringham, King, Plackett, R. et al. **(2021)** Physician associate/assistant contributions to **cancer diagnosis in primary care**: a rapid systematic review. *BMC Health Serv Res* 21, 644	No studies reported on the timeliness of cancer diagnosis. *Drennan et al. (2015), Kurtzman et al. (2017)*: **No reported differences** in re-consultation rates. *Brock et al. (2017):* PAs **had fewer malpractice payments** than physicians, but greater proportion related to diagnosis.	4 studies- high risk of bias. PAs **more likely to recommend** breast screening than physicians PAs had **knowledge gaps** on risk-stratified screening and referral for genetic counselling in adults at increased risk for colorectal cancer. All studies had a high risk of bias due to very low response rates. There were **no reported differences** between PAs and primary care physicians in diagnostic test ordering (4 articles), referrals (4 of those) or screening practices (Tang). Where differences found (1/8 analyses), not possible to conclude differences indicated better or worse quality of care.	*Brock et al. (2017)*: compared rates of malpractice reports and adverse actions for physicians, physician assistants (PAs), and nurse practitioners (NPs). **No reported differences** in patient satisfaction between groups (but profile of patients differed).
Halter, M., Drennan, V., Chattopadhyay, K. et al. (2013) The contribution of Physician Assistants in **primary care**: a systematic review. *BMC Health Serv Res* 13, 223,	5 studies **positive outcomes for PAs** (all but one from the 1970s; two studies: statements judgement based on interviews) Other three are quantitative comparisons of the PAs' care against NPs and/or physicians and **report equivalence of care (**control of hypertension *(Frame et al., 1978)*; diagnostic and therapeutic appropriateness *(Duttera and Harlan, 1978)*; self-reported patient functional status outcomes (*Kane et al., 1978*). PAs **rated less favourably** on all measures to monitor patients with diabetes and their patients less likely to achieve targets for disease control (*Ohman-Strickland et al., 2008*).	*Miles and Rushing (1976):* Patient encounter data and patient health survey data from six practices in one USA County over three year period, PAs **increased tendency to hospitalise insured versus uninsured patients.**	10 studies *Henry et al. (2007)*: Patient satisfaction with the PA encounter was reported to be **very high** in a small interview study *Hill et al., 1979, Mainous et al., 1992, Kane et al., 1978, Henry, 1974*: **high** in medium sized survey studies. *Hooker et al., 2005, Cipher et al., 2006*: Large studies of Medicare recipients, **similar results** for NPs and physicians. *Henry and Hooker, 2007*: focus group study of community residents where the PA sole primary care provider for two years, residents would so**metimes prefer to see a doctor.** *Litman, 1972, Smith, 1981:* US studies - acceptability of the PA role posed as hypothetical - **positive findings. W**illingness to see a PA decreased for more complex conditions. *Hooker et al., 2010*: An Australian study reports that 99% of patients would see a PA, even when the scenario time delay to seeing a doctor was reduced.

Table 3: Existing systematic review evidence – Effectiveness: PAs Primary Care

Review	Efficiency: administrative tasks	Impact on waiting time	Impact on length of stay (LOS)	Cost-effectiveness
Sheringham, King, Plackett, R. et al. **(2021)** Physician associate/assistant contributions to **cancer diagnosis in primary care**: a rapid systematic review. *BMC Health Serv Res* 21, 644				
Halter, M., Drennan, V., Chattopadhyay, K. et al. **(2013)** The contribution of Physician Assistants in **primary care**: a systematic review. *BMC Health Serv Res* 13, 223,	*Ekwo et al. (1980)*: Poor documentation of history and physical examination reported at a remote clinic.			8 Studies, mainly 1970s-early 1980s. Some suggest that PAs are expensive to employ or reduce profits. *Wright et al. (1977)*: PAs **accrued higher** medication and laboratory **costs** than other providers. *Larsen and Kirkwood (1982), Hill et al. (1979), Grzybicki et al. (2002), Kane et al. (1978*): **low revenue per patient encounter**. Interpretations include undercharging or the PA undertaking tasks that are time consuming yet simple and less remunerative. *Frame et al. (1978), Martin and Sophocles (1984); Grzybicki et al. (2002):* descriptive studies suggest that in most cases the **PA contributes positively to practice revenue/profit**.

Table 4: NIHR Studies on Physician Assistants/Associates in Secondary Care

Title	Study Dates (published)	Setting/ Focus	Questions/Issues	Methods	Findings
1. How might Physician Associates help (or not) address the workforce crisis in the NHS? Leckcivilize, A. English, M. Wong,G., Buckell, J., Shobhana, N. Patey, R.	May 2023-April 2026	PAs in UK hospitals	-Where are PAs working and in which roles? -How do PAs careers progress over time, and what factors influence their career choices? -Have PAs successfully have been integrated into hospital teams (or what went wrong) in other countries and if so, how? -What are PAs doing to learn from the experiences of managers, doctors, nurses and patients as well as themselves? - What are the experiences of PAs compared with other types of healthcare workers similar to PAs working in Anaesthesia and Surgery, as well as Advanced Nursing Practitioners.	-Use UK NHS Workforce databases to support national reporting on PAs' current roles and distribution in secondary care settings across the four UK Nations. -Cohort studies on career choices and retention for PAs -Examine the job preferences of PA graduates using discrete choice experiments. -Realist review of high and upper-middle income countries literature to understand how professionals equivalent to UK PAs have helped (or not) countries address hospital workforce challenges. -Examine in four NHS Hospital Trusts: a) the current roles and perceived value of PAs and other APPs b) the key conditions for success (or failure) of PAs using detailed narratives and generating realist logics, and c) whether developing exemplars of PA roles will help hospital Trusts and other professional stakeholders, patients and the public to understand PAs potential contribution to the UK NHS workforce.	Study Ongoing
2.Investigating the contribution of physician associates (PAs) to secondary care in England: the PA-SCER mixed-methods study Drennan, V., Halter, M, Wheeler, C., Nice, L ., Brearley, S., Ennis, J., Gabe, J., Gage, H., Levenson, R., de Lusignan, S ., Begg, P., and Parle, J.	October 2015 October 2018	PAs in English hospitals	-What factors influence the adoption and deployment of PAs within medical and surgical teams in secondary care? -What is the contribution of PAs, including their impact on patient experiences, organisation of services, working practices, professional relationships and service costs, in acute hospital care?	-Mixed-methods, multiphase -Systematic review -Policy review. -National surveys of medical directors and PAs. -6 hospital case studies including: *interviews with patients, managers and team and service members as well as requests for routine management data and observation of PAs at work. *Pragmatic retrospective record review of patients in emergency departments attended by PAs and Foundation Year 2 (FY2) doctors	-Surveys found small but growing number of hospitals employed PAs - Case studies found: *medical and surgical teams mainly used PAs to provide continuity to the inpatient wards. *Their continuous presence contributed to smoothing patient flow, accessibility for patients and nurses in communicating with doctors and releasing doctors' time for more complex patients and for attending to patients in clinic and theatre settings. * PAs undertook significant amounts of ward-based clinical administration related to patients' care. * Lack of authority to prescribe or order ionising radiation restricted PAs assistance with the doctors' workloads.

					*A few consultants in high-dependency specialties considered that junior doctors fitted their team better. -PAs reported to be safe, as was also identified from the review of ED patient records. Comparison of a random sample of patient records in the ED found no difference in the rate of unplanned return for the same problem between those seen by PAs and those seen by FY2 doctors' -Patients positive about the care PAs provided, but unable to identify PA. -PAs primarily discussed in terms of their contribution to patient safety and patient experience in contrast to utilising temporary staff. -PAs work within medical and surgical teams, such that their specific impact cannot be distinguished from that of the whole team.
3.A qualitative exploration of uncertainty tolerance amongst student physician associates whilst using eCREST (electronic Clinical Reasoning Educational Simulation Tool Parker, E.	April 2021-February 2022	Details unavailable	Details unavailable	Details unavailable	Details unavailable
4.Implementation of the non-medical practitioner workforce into the urgent and emergency care system skill-mix in England: a mixed methods study of configurations and impact. Halter, M. Drennan, V., Wang, C., Webb, J., Gabe, J., Taylor, F., Gage, H., Jarman, H.	March 2021 -April 2025	Non-medical practitioner workforce in the urgent and emergency care in NHSE	-What is the impact of different non-medical practitioner (NMP) skill-mix (including nurse practitioners and physician associates) in Emergency Departments (ED) and Urgent Treatment Centres (UTC) in acute hospitals on patient and service processes and outcomes? Impact on: patient experience, quality of care, clinical outcomes, activity, staff experience and costs in acute NHS trusts in England	**Phase 1 (months 1-12):** - Describe the rationale for, and configurations of, the NMP workforce in EDs/UTCs in England, and to develop analytical tools. -Publish a scoping literature and policy review on NMP development and skill-mix outcomes, informed by interviews with NHS clinicians, managers, commissioners and lay representatives. -Describe quantitatively the NMP and other clinical workforce (skill-mix) using NHS Digital and NHS Benchmarking national data, 2017-2021; and -Qualitatively the level of independence/supervision of NMPs and doctors, through observation. - Triangulate results to develop: a skill-mix ratio classification, a quantitative measure of independence and supervision, and a logic model for NMP skill-mix. **Phase two (months 13-18):**	Study Ongoing

				- Conduct a quasi-experimental study of association of skill-mix ratio classifications with primary outcome (rate of unplanned return to the ED/UTC in seven days, a proxy for clinical safety), secondary outcomes (national indicators of ED/UTC quality and performance), and cost-effectiveness. **Phase 3 (months 14-24)** -Explain the effectiveness and acceptability of skill-mix ratios through investigation in six local-level case study sites. -Add patient satisfaction as an outcome, collected via questionnaire. -Investigate the experience of including NMPs in the skill-mix through qualitative interviews with patients and staff. **Phase 4 (months 25-30)** -Synthesis of findings, using logic model, for structured discussion at a stakeholder event.	
5.Improving care for women with High blood pressure in pregnancy to reduce risk of heart disease developing in later life Wu, P., Chew-Graham, C., Hancock, A., Campbell, L., Knight, N,, Knight, Y., Dziedzic, K.	October 2024 - March 2026	Care of women with high blood pressure in pregnancy, especially women of Black African and Caribbean heritage	-What is the lived experience of women with Hypertensive Disorder of Pregnancy (HDP)? -What are the challenges faced by healthcare professionals providing care for them?	-Semi-structured interviews with 20 women with HDP to understand their experiences and their understanding of cardiovascular risk. -Interview approximately 20 healthcare professionals (e.g. midwives, health visitors, general practitioners, practice nurses, ***physician associates***, obstetricians, cardiologists) -Develop a Community of Practice which to meet 4 times to discuss key barriers, facilitators, and strategies for adopting and implementing NICE recommendations.	Study Ongoing

Table 5: Existing systematic review evidence - Safety and Patient Satisfaction: PAs on Secondary Care

Review	Safety		Patient satisfaction
	Outcomes	**Process**	
Doan, Sabhaney, Kissoon, Sheps, Singer. **(2011)** A systematic review: The role and impact of the physician assistant in the **emergency department**. *Emerg Med Australas*. 23(1):7-15.	2 studies of trauma services: patients' **outcomes 'not negatively affected'** by inclusion of PA (but insufficiently powered to determine equivalence). *Rudy et al*. (1998): outcomes of patients treated by 14 NPs/PAs v. 16 resident physicians over a 1-month period from two academic centres: **no significant differences** (but did not control for patient age/level of acuity). *Mains et al.* (2009): retrospective chart review at a large hospital comparing patient outcomes treated by general surgery residents/staff surgeons v. trauma surgeons v. trauma surgeons with PAs. The patients treated by PA group: **lower adjusted odds ratio for mortality**. (But patient management variables or clinical practice guideline used not considered.)	6 studies- weak to moderate quality- found statistical **differences in the practice patterns** between physicians and PAs such as rate of investigations ordered. None of these addressed impact on patient outcome. 4 Studies- moderate to strong quality- compared PAs' skills in performing procedures. PAs appear **equally capable** of performing procedures **if adequately trained and supervised.**	*Rodi et al. (2006):* patient satisfaction **significantly higher** amongst those with **lower acuity** after PA implementation in a fast track unit. **Only 36%** of patients were willing to wait longer to see a physician. 2 studies: patient satisfaction with PA care in the ED- both found **high rates of satisfaction** with PA care (response rates low (11% and 25%)) .
King, Habeeb, Helps. **(2023)** The contribution of physician associates or assistants to the **emergency department**: A systematic scoping review. *J Am Coll Emerg Physicians Open*. 4(3)	*Sherwood et al. (2011):* outcomes - mortality, loss of vital signs, and missed fractures in patients seen by a PA compared to patients seen by a doctor. In 30-day follow-up, **no reported negative outcomes in patients seen by a PA.** Readmission rates within 72 hours were reported in 3 studies. **No difference was found in two studies** of PAs vs Foundation Year 2 doctors and PA vs Emergency physicians (Halter et al., 2020 and Pavlik et al., 2017). *Merdler (2020):* **reduction in the rate of readmission within 48 hours when seen by an Emergency doctors compared to PA**. *Merdler et al. and Pavlik et al.* studies are retrospective chart reviews which are subject to biases.	*Bloemhoff et al. (2016):* in the Netherlands EDs, PAs **ordered fewer investigations** and **consulted with other specialties more** than nursing practitioners (NPs), but were similar with NPs in imaging requested, diagnostic screening, procedures performed, medications ordered, and hospital admission rates.	7 Studies: Patients **generally satisfied** with the level of PA care and willing to see a PA rather than wait for an emergency physician. *Doan et al. (2012)*: 229 mothers in a Canadian paediatric hospital. If their child was severely ill, they **would wait longer** to see an emergency physician rather than a PA. In some studies, patients misconceived PAs to be doctors due to a lack of understanding of the role of a PA. Limitation: Surveys assess the service delivery and the patient's viewpoint of the organization and individual providing the service together, not separately.
Halter, Wheeler, Pelone et al. **(2018).** Contribution of physician assistants/associates to **secondary care**: a systematic review. *BMJ Open*.19(8)	**ED**: *Singer et al. (1995):* **no statistically significant difference** in wound infection rates in sample of patients with lacerations at the ED and seen by PAs compared with other medical staff providers. But, all wounds triaged.	**ED:** 3 studies. *Hooker et al. (2008):* Secondary analysis of national (USA) ED survey data (1995–2004): a statistically significant **higher proportion of PAs' cases receiving a prescription** compared with those of physicians and nurse practitioners.	**TO:** 2 prospective studies: addition of PAs to surgical teams, preoperatively, intraoperatively and postoperatively**. Positive results were presented from patient satisfaction** surveys.

	Pavlik et al. (2017): 72hours' reattendance rate to the ED for children aged 6 and under: **lower for patients treated only by a PA.** But rates unadjusted by children's characteristics **Trauma and Orthopaedics (TOs)**: *Althausen et al. (2013)*: Operating room complication rates/fracture malunion if the providers included a PA: **did not differ significantly** from other providers, but postoperative complications were reported **to have decreased** and antibiotic use and deep vein thrombosis prophylaxis i**ncreased** for cases with a PA present**.** *Oswanski et al. (2004):* mortality in two year-long periods reported: involvement of PAs in the clinical team had **no effect on overall mortality rates.** *Mains (2009):* **mortality decreased** by approximately 1% **with the introduction of PAs** to a trauma panel and 1.5% to general surgery residents' teams. Could not be directly attributable to the addition of the PA because contemporaneous improvements in efficiency of the trauma service occurred. **Acute internal medicine AIM (replacement**): *VanRhee et al. (2002):* **Inpatient mortality statistically higher** in pneumonia care where PAs in place of interns/ in pneumonia care. *Capstack (2016)*: **no significant differences** in mortality or 30-day readmission when retrospectively comparing outcomes where PAs made up a greater/lesser medics, in place of physicians.	*Ritsema et al. (2007)*: long bone fractures, secondary analysis of same US data for 1998–2003. Those seen by a PA having **adjusted odds** of 2.05 for receiving opiate analgesia. *Kozlowski et al. (2002):* Patients attended by an emergency physician had **adjusted odds** of 3.58 for receiving pain medication (29%) compared with those attended by PAs (10%). TO: *Althausen et al*: **minimal difference** for operation room set-up time in a direct comparison study. *Hepp et al*: **39% reduction in time at this stage**. *Bohm et al*: PAs **released time** for supervising physicians.	
van den Brink, Hooker, Van Vught, Vermeulen, Laurant. **(2021)** The **cost-effectiveness** of physician assistants/associates: A systematic review of international evidence. *PLoS One*.16(11)	Patient Outcome Evaluations: 30 studies assessed. In 13: care provided by PA **the same** as the physicians'. In 16 studies: **quality improved** when the PA replaced a physician or was added as a member of a medical or surgical team. In 2 studies: **mixed outcome**- 1 improved outcome and 1 remained the same. Types of PA improvement: reduction in complications, lower mortality, less hospitalization and readmissions.	5 studies: the process of care **remained the same.** In four studies, the **outcome improved** with the addition of a PA. Improvements were the use of thrombosis prophylaxis, beta-blockers, statins, or monitoring of blood pressure and blood glucose.	3 studies: Patient satisfaction of PAs did **not significantly differ** from the patient satisfaction of a physician, but patients did not always distinguish that the PA was not a physician *(Theunissen et al., 2014, Drennan 2014, Kuo et al., 2013)*.

Table 6: Existing systematic review evidence – Effectiveness: PAs in Secondary Care

Review	Efficiency: administrative tasks	Impact on waiting time	Impact on length of stay (LOS)	Cost-effectiveness
Doan, Sabhaney, Kissoon, Sheps, Singer. **(2011)** A systematic review: The role and impact of the physician assistant in the **emergency department**. *Emerg Med Australas*. 23(1):7-15.	*Schwartz et al. (1995):* History taking and working with documentation efficiency assessed where healthcare providers (physicians, PAs, nursing practitioners, residents and medical students) were working in ED. There was **significant loss of information among all healthcare providers, and no significant differences between provider types**.	1 study. Outcome of introducing PAs and NPs as additional providers in 5 EDs in Canada (over two weeks). Odds of achieving the waiting time benchmarks were **1.9** for patients visiting the ED after PA implementation, compared with those who visited the ED before PAs introduced.	2 Studies: *Ducharme et al. (2009*): Average ED LOS with PA present 30.3% **shorter** than before PAs were introduced. *Rodi et al. (2006):* found **reduction in** LOS from an average of 127 to 53 min after PA implementation.	*Arnopolin and Smithline (2000)*: A retrospective review of Urgent Care Clinics charts - PAs **took more time to assess and treat patients** than ED physicians. But the cost per visit was lower. *Newkirk (1980)*: One rural ED staffed by both ED physicians and PAs- net cost of using ED physicians was **higher** than that of using PAs.
King, Habeeb, Helps. **(2023)** The contribution of physician associates or assistants to the **emergency department**: A systematic scoping review. *J Am Coll Emerg Physicians Open*. 4(3)		7 studies. Majority of studies showed PA **reduced ED wait times**. PAs more effective in reducing wait times in lower acuity areas. *De la Roche et al. (2021)*: **reduction in the initial assessment time** for ED PAs compared to emergency doctors. *Merdler et al. (2020)*: If doctor saw a patient with the assistance of the PA, they **were attended to quicker** than without PA assistance.	11 Studies. In all studies the LOS of patients who had PAs involved in their care **reduced**. *Ducharme et al. (2009)*: LOS 30.3% **lower** when a PA was on duty. *Nestler et al. (2012)*: **decrease** from average 270 minutes to 229 minutes. *De La Roche et al. (2021):* **reduction** in LOS of an adult patient seen by an ED PA compared to those seen by an emergency doctor. *Kim et al. (2021)*: **reduction of** 18.43 minutes in LOS for low-acuity patients from triage over a 2-week period. *Doan et al (2012):* used a discrete event simulation model if a PA versus physician was working within a Canadian paediatric setting. PAs **benefitted the high-acuity** patients with a decreased LOS by 133.4 minutes **but an increase in LOS was found in low-acuity patients** by 169.1 minutes.	

Halter, Wheeler, Pelone et al. **(2018).** Contribution of physician assistants/associates to **secondary care**: a systematic review. *BMJ Open*.19(8)		**ED**: 1 study Canada *Ducharme et al. (2009)*: Odds of a patient being seen within their benchmark wait time was **1.6 times greater** when the PA involved. However, the PA was an additional resource rather than a substitute. **TO**: *Althausen et al. (2013)*: wait to be seen by the orthopaedic service **shortened** when PAs substituted for doctors (but authors attributed this to a combination of factors), *Bohm et al. (2010)*: median number of weeks to wait for surgical procedures was **reduced** from 44 to 30 weeks made possible by the PA preparing and finishing the case. *Hepp et al. (2017):* **30% increased throughput** in the number of new patients in the preoperative stage in the first year of PA position implementation.	**ED:** 2 Studies *Ducharme et al. (2009*): where PAs were an additional staff resource alternating with nurse practitioners, PAs **reduced patients LOS by 30%.** *Arnopolin and Smithline (2000*): setting where experienced ED PAs and physicians worked solo at different times of day. Patients of PAs **stayed longer.**Differences in LOS varied by diagnostic group, with PAs' patients between 5 and 32min longer. **TO**: 3 high-quality studies: *Mains et al. (2009)*: LOS reduction for all patients when PAs were an addition to either the resident physician team or reorganised trauma panel. *Oswanski et al. (2004)*: **no difference** when carrying out adjusted analyses of 1 year against another. *Althausen et al (2013)*: **no difference** when PAs were present or not. **Acute Internal Medicine (AIT):** 2 Studies. *Van Rhee et al. (2002):* impact of PAs in place of interns/residents. *Capstack et al. (2016)*: retrospectively compared outcomes where PAs made up a greater or lesser proportion of the medical team staff, in place of physicians. Both studies measured LOS for patients with diagnoses of cerebrovascular accident, pneumonia, acute myocardial infarction discharged alive, congestive heart failure and gastrointestinal haemorrhage. **Neither study reported any significant differences in LOS between groups,** with LOS considered to be a proxy for severity of illness.	**ED:** *Arnopolin and Smithline (2000)*: Small decrease per patient when patients treated by PA. **TO:** *Bohm et al. (2010):* employment costs for **PAs similar** to those of the GPs they replaced in the operating room and opportunity cost for others through released time for the supervising physicians. *Althausen et al. (2013)*: non-replacement model, **cost savings** and operating room savings based on time reduction and PA charges. **AIM:** *Van Rhee et al. (2002)*: Cost in terms of relative value units **similar** although laboratory RVUs were **lower for PAs** as they ordered fewer investigations. *Capstack et al (2016)*: **lower mean patient charge** for the expanded PA group (3 physicians and 3 PAs) vs for the conventional PA group (9 physicians and 2 PAs)

van den Brink, Hooker, Van Vught, Vermeulen, Laurant. **(2021)** The **cost-effectiveness** of physician assistants/associates: A systematic review of international evidence. *PLoS One*.16(11)		*Theunissen et al. (2014), Althausen et al. (2013)*: reported **decreased waiting time.**	In 2 ambulatory studies (*Drennan (2014), Arnopolin and Smithline (2000))* employment of the PA associated with a **slightly longer patient length of visit** (LoV). In *Arnopolin & Smithline (2000), Fung (2020), Singh et al. (2011)*: PAs led to increase in LoS. *Capsack (2016), de Lusignan et al. (2016), Kawar & DiGiovine (2011*): **no difference** was found in either LoV or LoS.	17 studies: use of the PA led to **a reduction in the overall cost of care**. 11 studies: cost of care, measured in monetary terms, **decreased with the introduction of a PA, or the results were equal** to that of a physician alone. *Singh et al. (2011)*: cost of care by a PA was '**slightly greater** than the physician's care'. *Grzybicki et al. (2002)*: PA provided **a financial benefit when the reimbursement was at least 80**% of an MD's charge. *Drennan (2014), Arnopolin and Smithline (2000)*: The cost of patient care when delivered by a physician **exceeded** the cost of care provided by PA. *Drennan (2014), Morgan et al. (2008), Hooker (2002)*: Three studies examined care outcomes by assessing cost-benefit and cost-utility. In the last 2 PAs **did not negate their cost-benefit of less expensive labour** by ordering more resources for an episode of care.

Table 7: Summary of recent studies PAs in Secondary Care 2021-2025

Author, year (lead author base profession)	**Setting**	**Comparators**	**Data**	**Outcome measures**	**Findings**
Kurtzman et al, 2023 (Nurse), USA ***Note this study did not isolate impact of PA but a team which included a PA along with RN compared to teams without PA in it*** ***Data 2009-2020***	Emergency Department	Practice patterns of teams in Emergency Departments. NPs vs PAs vs Physicians	Review of 95,718 records of patients who met the inclusion criteria – randomly sampled patient visits within a 12 year period from the National Hospital Ambulatory Medical Care Survey	Patient demographics Patient payment source Day of the week Patient clinical information Patient disposition (e.g. transferred, admitted, died in ED) Patient flow indicators (i.e. arrival time, time seen, time discharged) Process measures: diagnostic tests, procedures, prescriptions	PA team: **Patient demographic:** -**Fewer** 45+ years old patients seen by PA team -**Less severe** conditions. -**Shorter** visits =**Reduce**d likelihood of hospital admission. -**No influence** of waiting times **Patients triage classification**: -**More** semi-urgent or nonurgent (compared to immediate_: - received **fewe**r diagnostic services and procedure -had **longer** waiting times - **lower** odds of hospitalization **Older patients increased:** -incidence of diagnostic services and procedures -visit length - odds of hospital admission
Moore et al, 2021 (PA), USA ***Data 2016-2018***	Emergency Department	Emergency Department metrics. PAs vs Physicians	Review of 25,883 records of patients who attended between April 2016–December 2018.	Patient demographics Patient acuity Mean length of stay Door to provider time Re-attendance within 72 hours No. of patients seen per hour No. of CT scans requested Patient disposition Patient satisfaction	Patients cared for by **physicians**: - **older** than those cared for by PAs - **fewer** patients 65+ -PAs **slightly longer** LOS compared with physicians -PA **slightly longer** door-to-doctor times -But number of patients seen per hour **higher** on average for PAs than physicians. -Percentages of patients returning for re-evaluation within 72 hours **low and similar** between physicians (5.3%) and PAs (5.9%), --Percentage of returned patients subsequently requiring hospital admission i**dentical** between groups. -Physicians admitted **a slightly higher** percentage of patients (5.1%) compared with PAs (4.6%).

					-Transfer rates and patients leaving ED against medical advice **similar**, as were elopement and death rates in the ED =**No statistically significant difference** in the number of CT scans ordered by physicians compared with PAs. -Mean satisfaction score for PAs **significantly higher** than for physicians
King et al, 2024 (PA) UK ***Data 2018-2020***	Emergency Department	Outcomes of consultations. PAs vs FY1 doctors	Review of 7,405 records of adult patients who attended between August 2018–January 2020. Single Emergency Department.	Patient demographics Area seen Day and time of day Patient acuity Waiting time Length of stay in department Left without being seen Unplanned re-attendance within 72 hrs	-FY1s saw **significantly more** patients aged between 18 and 44 than PAs. -FY1s saw **significantly more** UTC patients comparison to PAs. -PAs saw **higher** acuity patients in the Majors or Resus areas compared to FY1s -PAs **lower level** of discharge and higher rate of admission. -FY1s saw **significantly higher** proportion of dermatology, ENT and generally unwell cases. -PAs saw a **significantly higher** proportion of cardiology, gastroenterology, gynaecology, haematology, mental health, musculoskeletal (MSK), neurology, respiratory, urology and vascular cases, -Unadjusted wait time for patients to see a PA **higher** than for FY1. When adjusted for various factors **difference disappeared** -LOS longer for PA even when adjusted -Unadjusted and adjusted, **low and no significant difference** in unplanned reattendance within 72 hours with the same complaint -Leave without being seen, **low and no difference.**
Divi et al, 2021a (Physician), USA ***Data 2014-2017***	Orthopaedic Institute	Surgical outcomes. PAs vs PGY2–5 (residents) and PGY6–7 (fellows) as assistants	Review of 171 records of patients undergoing lumbar decompression surgery	Patient demographics Total operative time Re-admission rates Need for revision surgery at 1 year Post-op PROMs	-*No baseline differences* in age, sex, BMI, smoking status, age-adjusted, or months followed-up between two groups. -**No differences** in rates of MIS surgery or in the number of levels decompressed. -Mean operative time **similar** in the F/R group and the PA group -Readmission within 30 and 90 days low and with no **statistically significant differences.** -Number of revisions low and **no difference.**

Hazzard et al, 2023 (PA), USA ***Data 2016 and 2020***	Department of Orthopaedic Surgery	Surgical outcomes. One experienced PA vs rotating Fellows as first assistants	Review of 264 records of patients undergoing ACL reconstruction	Patient demographics Skin–skin time Tourniquet time Month of surgery PROMs before and after surgery	=**No** overall preoperative statistical **difference** between fellow and PA groups in age, sex, or BMI -**Longer** surgical skin-to-skin (all grafts) times all 4 quarters with the fellow compared with the PA -Tourniquet (all grafts) times **longer times** with the fellow cases than the PA cases -Tourniquet time average for the PA-assisted BTB autografts **shorter** -Surgical skin-to-skin average for PA-assisted BTB autografts **shorte**r
Malloy et al, 2021 (Researcher), USA ***Data 2013-2019***	Department of Plastic Surgery	Surgical outcomes. PAs with 2+ years training vs PGY3+ residents as first assistants	Review of 49 records of paediatric patients undergoing reduction mammaplasty	Patient demographics Financial data Duration of surgery (“indirect cost”)	-Patients in PA and resident cohorts of **comparable** age, ethnicity, BMI, and similar amounts of breast tissue resected during reduction -All patients exhibited **similar rates** of post-operative complications, regardless of first-assistant type during their reduction -Cases performed with resident as first-assist **more expensive** and **too**k an average of 34 minutes **longe**r than those performed with a PA
Divi et al, 2021b (Physician), USA ***Data 2014-2017***	Department of Orthopaedic Surgery	Surgical outcomes. PA vs PGY5-6 resident/fellow as first assistants	Review of 350 records of patients undergoing lumbar fusion surgery	Patient demographics Type of surgery Total surgery time Length of stay Wound infection Need for revision surgery at 1 year PROMs	-**No significant difference** between PA and F/R groups in terms of age sex ,BMI. smoking status, months followed up ,or preoperative diagnosis. -A significant baseline difference existed with the F/R group having more comorbidities . -Regarding surgical variables, **no difference** existed in surgery type, number of levels fused, and number of levels decompressed. -**No significant difference** existed in total surgery time -Length of stay was **comparable.** - Rates of long-term complications between the groups **similar.**
Quanbeck et al, 2025 (Physician), USA ***Data 2006-2016*** Explores surgical outcomes where surgeon alone or with different types of assistant (resident, fellow and PA) Only 2.6% of cases involved PA.	Dept of Orthopaedic Surgery	Surgical outcomes. Surgeon alone vs PA, resident, or fellow as first assistant	Review of 888 cases of closed reduction and percutaneous pinning of paediatric supracondylar humerus fractures.	Operating time Complication rate	-**Statistically significant i**ncrease in operative times when a resident participated compared to the other categories. -Shortest mean surgery time when an attending surgeon and PA present -Complication rate **highest for PA groups** (8.7% compared to lowest for resident- 3.3%. -But Fisher’s Exact Test showed **no statistically significant** association between the type or absence of assistant and the complication rate

Lui et al, 2023 (Physician), USA ***Data 2015-2020***	Dept of Orthopaedic Surgery	Surgical outcomes. PA vs resident vs fellow vs resident+fellow as first assistants	Review of 274 records of patients with cubital tunnel syndrome who had primary cubital tunnel surgery	Patient demographics Operating time Complication rates	-Patients four cohorts based on primary surgical assistant: physician associates (PA, orthopaedic or plastic surgery residents , hand surgery fellows, or both residents and fellows. -Patients in all cohorts **similar** demographics and clinical characteristics. -**Significantly higher** rate of subcutaneous transposition in the PA cohort -Presence of surgical assistants and trainees had **no association** with length of surgery, complications and reoperation rates.
Griffith et al, 2023 (PA), USA ***Data 2019-2021***	Academic dermatology centre	PAs vs residents vs Dermatologists	Review of routinely collected patient satisfaction surveys following 12,386 outpatient visits. (PAs 2,479; residents 892; Dermatologists 8988).	Patient satisfaction measures: timeliness, patient centredness, time spent with patient, likelihood of recommending care provider.	-Patient satisfaction consistently **high** for all three groups (Dermatologist, resident and PAs) -Overall, **no statistically significant differences** between dermatologists and PAs, Scores slightly lower for residents.

Table 9: Summary of Anaesthesia Associate (AA) studies

Author, year	Country	Setting	Study design	Comparators	Data	Outcomes
Sellers et al., 2022	UK	Secondary care	Exploratory study looking at the deployment of AAs, the experience of working with them as part of the anaesthetic team, and their perceived impact on medical anaesthetic training in the United Kingdom.	8 included NHS trusts: four employing AAs, two employing and training AAs, and 2 neither employing nor training AAs	18 qualitative interviews undertaken in 2017 with AAs, trainee AAs, college tutors and clinical leads drawn from 8 NHS Trusts. Exploring the perceptions of the AA role, interactions and relationships with and impact of the role, benefits and limitations of AAs on medical anaesthetic training,and ideas about future development.	Found positive reactions to AAs and a perception of their beneficial contribution to the wider anaesthetic team. Need for more robust quantitative and qualitative data on teamwork and training, effectiveness, patient outcomes and safety, and to support career development and expansion of the role. Consideration of the potential for extended practices, but only in collaboration with the Royal College of Anaesthetists.
Hanmer et al., 2024	UK	Secondary care	Described as a narrative review, but actually economic modelling	None	Analysis of the economic viability of the most efficient staffing model, previously endorsed by the UK Royal College of Anaesthetists and the Association of Anaesthetists, according to which one physician supervises two AAs across two operating lists.	Economic modelling undertaken in the UK looking at the costs of AAs and supervising doctors and concluding the AAs could only be economically viable in terms of the staffing model if paid less (the employment cost of the two AAs should be equal to or less than that of a single supervisor doctor), if supervisors were paid more, or if AAs were undertaking increased relative clinical workload.
Smith et al., 2004	UK	Secondary care	A narrative international systematic review of the comparative effectiveness and safety of physician and nurse anaesthetists rather than AAs. Searched Medline, CINAHL, EMBASE, Health Management Information Consortium (a UK 'grey literature' database) Cochrane Library – 1990-April 2003	In the 4 included studies, the performance comparisons are between: nurse anaesthetists, attending anaesthesiologists, or residents; physician and nurse anaesthetists; solo anaesthesiologists, nurse anaesthetists working alone and anaesthesia care teams; and personally provided, or directed by, an anaesthesiologist, or	Identified four studies (US=3, DK=1) looking at safety, none on effectiveness, and none on patients' views on different anaesthesia providers.	Found no robust evidence that there are significant differences in safety between different anaesthesia providers, but observe the challenges in conducting research on this topic so need to treat the results with caution.

				performed nor directed by an anaesthesiologist. 'Undirected' means residents' cases, or supervised either by a physician or a staff nurse anaesthetist; or supervised, but not directed, by an anaesthesiologist or directed by a non-anaesthesiologist physician.		
Lewis et al., 2014	UK	Secondary care	International systematic review of studies comparing physician anaesthetists and non-physician anaesthetists (NPA) for surgical patients. These varied in the studies and included: Certified registered nurse anaesthetists; Nurse anaesthetists; Circulation nurses; PA(A) (physician assistants (anaesthesia)) Clinical officers (name in the developing world) Theatre practitioner (with extended role). Searched the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, EMBASE and CINAHL (February 2014) . Also carried out searches of clinical trials registers, forward and backward citation tracking and grey literature searching. Considered case-mix and type of surgical procedure, patient co-morbidity, type of anaesthetic given, and hospital characteristics as	Considered all randomized controlled trials (RCTs), non-randomized studies (NRS), non-randomized cluster trials and observational study designs which had a comparison group. Included studies which compared an anaesthetic administered by a NPA working independently with an anaesthetic administered by either a physician anaesthetist working independently or by a NPA working in a team supervised or directed by a physician anaesthetist.	Included six studies with 1,563,820 participants in total. Five were large retrospective cohort studies using routinely collected hospital or administrative data from the United States (US). The sixth was a smaller cohort study based on emergency medical care in Haiti. Two were restricted to obstetric patients whilst the others included a range of surgical procedures. 2 studies overlapped with Smith's review (Silber 2000, Pine 2003). The other two included in the Smith et al were excluded here (Hoffmann 2002, Maaløe 2000, because 'there were no NPA working independently')	The authors conclude that none of the data were of high quality and the studies presented only small differences and inconsistent findings. Most studies stated that there was no difference in mortality numbers when given anaesthetic by either a NPA or a medically qualified anaesthetist. One study stated that there was a lower rate of death for NPA compared to medically qualified anaesthetists. One study stated that the risk of death was lower for NPA compared to those being supervised by an anaesthetist or working within an anaesthetic team, whilst another stated the risk of death was higher compared to a supervised or team approach. Other study results also varied.

			possible confounders in the studies, and judged how well the authors had adjusted for these confounders.			

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Boaz, A., Kessler, I. & Semkina, A. (2025) *The National and International Research Literature on Physician Associates and Anaesthesia Associates: Safety, Effectiveness and Patient Perspective*, London: NIHR Policy Research Unit in Health and Social Care Workforce, The Policy Institute, King's College London.

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hscwru@kcl.ac.uk