

Research Article

The Role of Physician Associate in Primary Care in England: A Systematic Literature Review

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Abstract

Background: The NHS system is primary care led in the delivery of health care but there is a shortage of qualified healthcare professionals, especially doctors. The problem of the healthcare professional shortage in the NHS is more acute in primary care. The increasing demand and workload on the healthcare system have led to the introduction of advanced clinical practitioners such as physician associates (PAs) (formerly known as physician assistants) in many countries. The UK has adopted this approach to help reduce the staffing crisis in the NHS system.

Aim: This systematic literature review aimed to evaluate the role of physician associates in primary care in England.

Method: Systematic literature review considering BMJ, BJGP, Web of Science, PubMed, and ASSIA databases were searched from the period of 2011 to 2020. The inclusion and exclusion criteria involved two independent phases. All relevant publications were assessed using the Mixed Methods Appraisal tool version 2011 (MMAT) to extract findings. Results were classified and synthesised narratively as factors related to the role and outcome care of PAs in primary care in England.

Results: A total of 73 publications were identified, of which 10 met the inclusion criteria, all from England. The evidence on the role showed that PAs play a significant role as part of the multidisciplinary team in the delivery of optimal patient care. However, the lack of a statutory regulatory body in the UK limits their current scope of practice. Regulatory bodies are also known as 'competent authorities' as they control access to regulated professions. The evidence concerning outcomes showed a mainly positive report on patient safety and satisfaction.

Implications: The contribution of PAs to primary care, and how the current lack of a statutory regulatory body for the profession in the UK affects their role.

Conclusion: The research evidence of the role of PAs in primary care in England shows the contribution of the profession to patients' safety care and the need for a professional regulatory body for qualified PAs. Further studies are needed to fill in the gaps on the role of PAs in primary care in the UK focusing on what motivates them to work in the general practice.

Background

The healthcare systems globally continue to be faced with shortages of qualified healthcare professionals, and restraints on financial resources due to the growing global population [1-3]. The National Health Service (NHS) in the UK is struggling due to the significant shortage of qualified healthcare and continues to be faced with fewer doctors and nurses than in other developed countries [1,4-8]. According to a 2021 news article in the Daily Mirror, the House of Commons reported approximately 130,000 NHS vacant job opportunities before the onset of the worldwide COVID-19 pandemic [9]. Oliver [8] stated that the NHS and Social care have more than 100 000 unfilled job opportunities. The issue of the healthcare professional shortage in the NHS is more acute in general practice (primary care) where many qualified medical staff will soon reach retirement age [10]. The term "primary care" used in this review refers to where the patient receives active, short-term treatment for a medical condition. And this covers a range of terms; general practice, walk-in-center, acute hospital, and primary health care are some of the terms used in

the studies included in this review. The NHS Digital data report that General Practitioners (GPs) in primary care are choosing to take early retirement, and the number is gradually increasing to about threefold over the past decade [11]. In 2007-08, it was reported that, "82% of doctors reached the retirement age, 17% took voluntary early pension, and 1% retired on ill-health grounds" [11]. However, in 2016-17, the number of GPs retired because they reached their retirement age, took voluntary early retirement, and for ill-health reasons were 33%, 62%, and 5% respectively [11]. A survey in 2020 found that 40% of GPs were planning earlier retirement [12]. The survey of more than 800 GPs across the UK, reports that almost half (47%) said they intend to retire at or before 60 years [10].

An approach adopted by the UK government is the development of advanced clinical practitioner roles to undertake some of the activities of physicians [1]. The term "physician" used in this review refers to medical doctors who usually focus on treating or managing non-surgical conditions [13]. Advanced clinical practitioners are educated and trained in the medical model, and work within a multidisciplinary team [14]. They are not doctors but can diagnose, treat, and refer medical conditions independently within their organisational policies and procedures [11,14]. One of the advanced practitioner roles is the physician associates (previously known as physician assistant) [11,15].

The Physician Associates (PAs) role developed in the United States of America (USA) in the 1960s and has since been adopted by countries such as Germany, Australia, India, and Canada [14,16]. Upon graduation from the 2-year programme in the USA, there is a statutory one-year internship following which they were eligible to

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sit for National Licensing Exams to enable them to practice medicine in interdependent roles within a multidisciplinary team [17]. Larson, Hart, and Ballweg [18] reported that the task productivity of PAs' in practice is between 50% to 80% of a medical doctor. A 2-year pilot project evaluating 12 PAs trained in the USA but were employed in the NHS, shows that PAs worked carefully within their roles and the organisational guidelines [19]. A similar study was also carried out in Scotland to evaluate 15 PAs trained in the USA but employed in the UK healthcare settings also reported similar findings [19,20]. In an observational study comparing PAs and GPs consultation records (n=932 and n=1,154 respectively) in England, PAs used longer consultation time and attended to less complex patient cases than the GPs, hence the accompanying patient satisfaction survey (n=490 and n=590 respectively) shows that most of the feedback was "very satisfied" or "satisfied", and small number report confidence and trust in the PAs or GPs. Only 4.1% representing 11 patients reported they would prefer a GP in future consultation [14]. This study shows that PAs provide satisfactory patient care.

The UK employed PAs from the USA in the healthcare system including primary care from 2005 [20], until 2009 when the first UK-trained PAs graduated from a post-graduate diploma program [11]. PAs undertake patient history, physical examinations, investigations, diagnosis, and treatment [20]. PAs currently working in primary and secondary care in the UK are not able to request ionised radiation and prescribe medication due to the absence of statutory regulation and prescribing regulation [3,21].

The NHS system in the UK is primary care led, and GPs in primary care are the first point of contact for all health issues except emergencies that are referred to secondary care [14]. Primary care employs about 25% of PAs [14,20], and they are primarily deployed to provide consultations to patients demanding same-day or urgent appointments [19]. Concerns about the shortages in the primary care workforce, and strategies to provide greater healthcare delivery outside the hospital led to the recommendation for more PAs to be employed in primary care [1,22,23]. Although, the PAs' role is considered dependent on GPs, but can work autonomously within the multi-disciplinary team, diagnosing, treating, and referring patients when necessary [1].

Studies report that the role of PAs in primary care is well received by the patient and considered efficient by their supervising doctors [4,14]. Other studies reported that although patients did not understand the role of PAs in primary care, many consider them to provide good quality care [4,19]. Sitzia and Wood, Carr-Hill and Crow et al [24-26] reported that theoretical concerns and limitations of patient satisfaction surveys are well documented. Patient satisfaction is considered a relative concept, based on evaluative judgment [25] especially for role innovation as PAs substituting for general practitioners; it requires a more in-depth understanding of the patient [1]. Physicians find the role of PAs to be safe with no serious incidents or patient complaints [4]. Furthermore, several studies show that PAs provide safe patient care [27], and some PAs increase senior clinicians' productivity reported by consultants and managers [4]. PAs work independently and are supervised by a physician [28]. PAs works effectively under the supervision of physicians [29]. The supervising physician understands the scope of practice and level of competence of PAs [29]. In the UK, the Department of Health, and the Royal College of Physicians and General Practitioners have agreed on a competency and curriculum framework for PAs [19,30].

Several systematic literature reviews in secondary care report that consultants, registrars, and managers consider the role of PAs as safe, and well received by the patient. Many qualitative, quantitative, and mixed-method studies have reported on the role of PAs in primary care. But no recent study has attempted to systematically review the role of PAs on patient safety and satisfaction, PAs' scope of practice, and level of competence in general practice in England. In this systematic literature review, I considered evidence from a variety of studies that report on the role of PAs in primary care in England to better understand the contribution of PAs to patient safety and satisfaction, the scope of practice, and the level of competence in patient care.

Research question and aims

A good research question is considered vital and makes it easier for the researcher to set clear aims and objectives for the study [31]. Doody and Bailey [32], and Aslam and Emmanuel (2010) [33] state that choosing and writing a clear research question is viewed as difficult. But research questions can be derived from existing studies [32]. In this systematic literature review, the SPIDER framework (sample, phenomenon of interest, design, evaluation, research type) [34] was used to derive the research question (Table 1), and to guide the search terms (Table 2). The SPIDER framework helps the principal researcher to identify relevant qualitative, quantitative, and mixed-methods articles on the role of PAs in primary care [12].

Table 1: SPIDER framework.

S	Sample	Physicians working with PAs.
PI	Phenomenon of Interest	The supervising doctors' perception of the role performed by PAs in general practice.
D	Design	Data collection for this study was an electronic data search.
E	Evaluation	Systematic analysis of data to determine if the role of PAs in general practice is well received by the patient.
R	Research type	A systematic literature review of qualitative, quantitative, and mixed-methods studies on the role of PAs.

Principal question

What is the role of physician associates (PAs) in primary care in England as perceived by their supervising doctors in general practice?

Aim of study

The main aim of the study is to evaluate the role of physician associates in primary care in England.

Objectives of study

- To determine PAs' scope of practice and level of competence in patient care.
- To identify the contribution of PAs in general practice to patients' safety and satisfaction.

Methods

Research paradigm

The research paradigm is viewed as the philosophical position of the key researcher's idea on how to carry out a study in a way that would allow them to examine and explore issues in line with their own beliefs, discipline, and relevance to their academic field [35]. Their training and experiences can therefore affect the study method [36]. A positivist paradigm would enable researchers to have more generalised findings. However, the interpretivist paradigm would enable researchers to gain an in-depth understanding of seeking experiences and perceptions of a particular social context [37]. An

Table 2: Key Concepts and Search terms.

Role	"Impact" OR "Contribution".
Primary care	"General practice" OR "walk-in-center" OR "primary health care" OR "Acute hospital".
Physician associates	"Physician associates" OR "Physician assistant" or "Medical assistant".
Patient Satisfaction	"Well received" OR "Quality of care"
Patient	"individual" OR "day patient" OR "outpatient".
Patient safety	"Acceptable practice" OR "Appropriate practice".
Physician	"Physicians supervising PAs" OR "Doctors working with PAs" OR "Doctors who have worked with PAs" OR "GPs" OR "Medical managers".
Scope of practice	"Knowledge" OR "Skills" OR "Challenge".
Level of competence	"Experience" OR "Expertise".

interpretivist research paradigm was considered for this systematic literature review, to provide the opportunity to understand how the supervising doctors view the role of PAs in primary care.

Theoretical framework

The Humanistic Approach was the chosen theoretical framework for this systematic literature review. Paterson and Zderad [38] describe the humanistic approach to healthcare practice as an action in which the patient or client's interests, values, and dignity are taken to be of fundamental significance. The Humanistic Approach was considered for this systematic literature review because it provides a better understanding of the role of PAs in primary care as perceived by their supervising doctor. A better understanding of a person's attitudes and behaviour can help healthcare professionals to incorporate humanism within the problems of the healthcare environment and identify methods for tackling inequalities in humanistic care [39]. This approach views the patient as a whole individual than as a sequence of problems to be solved [40]. Glassman and Hadad [41] state that the humanistic approach tries to understand the person producing the behaviour as well as their point of view. The humanistic approach is patient-focused, and the person may feel more comfortable. Clinician feels connected to their patient and relevant persons when the humanistic approach is applied in patient care [39]. Branch et al [42], and Wald et al. [43] states that the humanistic approach in clinical practice may reduce burnout and improve patient healthcare outcome because it helps healthcare professionals to identify meaningful ways in their work and foster resilience.

Design and search strategy

This systematic literature review was designed per the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) [44], and relevant studies were identified through an electronic database search. For this review, a systematic search was conducted in British Medical Journal (BMJ), British Journal of General Practice (BJGP), Web of Science, PubMed, and Applied Social Sciences Index and Abstract for studies (ASSIA) on the role of PAs in primary care. The database search for the review began on 9 May 2022, and up to 25 June 2022. Electronic databases from the British Medical Journal, British Journal of General Practice, Web of Science, PubMed, and Applied Social Sciences Index and Abstract were considered for the review as they report the recent trends on the increasing demand for PAs in primary care. The systematic search included the key concepts summarised in Table 2, and as part of the search, numerous keywords were used to widen and increase the sensitivity of the electronic databases. Additional studies were identified using the reference lists of the selected studies.

Inclusion and exclusion criteria

All the relevant studies considered for the systematic literature review were selected using two independent phases (Phase I & Phase

II). Phase I involves screening through the title and abstracts of the search results from the different electronic databases that report on the role of PAs in primary care in England. Although some of the studies in phase I were vague but still considered for in-depth text review.

In phase II, inclusion criteria were set for all the relevant studies considered in phase I of the review. The inclusion criteria include studies that were in full-text publication, published in the English language, reports on patient safety practice in primary care; the satisfaction of physicians with the role of PAs; safe or acceptable PAs practice; GPs and employers' viewpoint of PAs in primary care; PAs and GPs in primary care; patient experience with PAs in general practice; the impact of PAs in general practice; PAs and GPs consultation; PAs in primary health care; obstacles and challenges that affect the competence of PAs in primary care. Studies were excluded when is not published in the English Language, did not report practical findings, duplicated studies, and studies that focused only on the education of PAs as it fails to meet any of the suitability criteria.

Identifying relevant studies

In this systematic literature review, a total of 73 studies were identified (27 from BMJ, 14 from BJGP, 11 from Web of Science, 12 from PubMed, and 9 from ASSIA), from which 35 studies were relevant to the topic after removing duplicates. Twelve (12) out of the 35 studies were removed after screening through the title and abstract. The full-text screening of the 23 studies led to 13 being excluded with reason. A total of 10 studies met the inclusion criteria, and Figure 1 presents the PRISMA flow chart [1,3,14,16,19,29,45-48].

Data extraction, and methodology assessment

In this systematic literature review, all the results from the different electronic databases were imported into Tool for Semantic Indexing and Similarity Queries (TSISQ) to help save time in finding the basic literature. It also helps increase the comprehension of this review by identifying sources that would have been excluded [49]. All the selected studies were screened against the set inclusion and exclusion criteria, and any of the studies in which inclusion was unclear were still considered and rescreened using phase 1 and phase 2, and the issue was then rectified.

Quality appraisal

All 10 papers extracted included variables such as reference, aims of the study, study method, sample and analysis, and main results or findings (Table 3). All the data extraction for this study went through an independent check as part of the quality assessment process, and to also address any risk of bias in the selection process. Zeng et al. [50] state that although there is inherent subjectivity in the use of quality assessment tools because of the extensive range of study methods; this remains a significant step to raising the objective and systematic selection of relevant studies above the quality of standard

Table 3: Variable extraction for all the considered studies in the final analysis (n= 10).

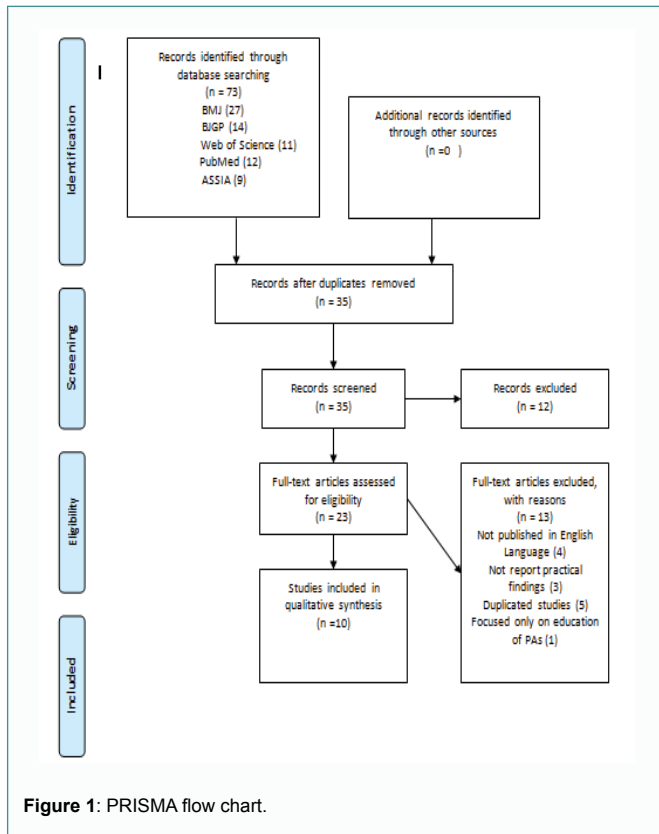
References	Aim of study	Study Method(s)	Sample & Analysis	Main Results/findings
Drennan et al., 2015.	To compare the cost and outcome of consultation between PAs and GPs in primary care.	A quantitative observational design was used in this study.	A total of 2086 patient records, and data were analysed using SPSS software (Version 21), and Stata software (Version 11.2).	A total of 932 (44.7%) of the consultation was with a PAs, and 1154 (55.3%) was with a GP. The study concludes that consultation with PAs in primary care has similar outcomes compared with GPs, and even at a much lower cost.
Halter et al., 2017.	To investigate patients' viewpoints on consulting with PAs in general practice.	A qualitative study using semi-structured interviews with thematic analysis.	A total of 430 adult patients took part in a satisfactory survey, but only 30 volunteered for the interview. Thematic analysis was used in this study.	The study concludes that patients saw PAs as an appropriate substitute for general practitioners.
Drennan et al., 2014.	To investigate the contribution of PAs to the provision of patient care in primary care.	A mixed-methods design was used in this study.	The study review found 49 studies published that show an increased number of PAs in primary care.	The study concludes that the role of PAs in primary care was found to be acceptable, effective, and efficient in supplementing the work of physicians.
De Lusignan et al., 2016.	To investigate the quality of patient consultation of PAs compared to that of general practitioners.	A comparative observational study using video recording consultation.	A total of 62 consultations (41 general practitioners and 21 PAs) were gathered from 4 PAs, and 5 general practitioners.	The study concludes that PAs provides competent and safe medical care, but general practitioners were rated more competent, but PAs offers complementary support to the workforce.
Drennan et al., 2017.	To explore the perceived effects on professional boundaries and relationships of introducing PAs role.	A mixed qualitative method was used in this study.	A total of 55 healthcare professionals were involved in this study. Analysis was both inductive and from a framed existing theory.	The study concludes that the introduction of PAs in primary care in the UK has been accepted but there is also evidence of hostility in the face of this relatively new role due to potential competing occupational groups.
Jackson, Marshall & Schofield, 2017.	To investigate the barriers and facilitators to the incorporation of PAs into primary care.	A qualitative approach was used in their study.	A total of 51 participants were involved in the study, and data were analysed using thematic analysis.	The study highlights that some of the factors that impede the integration of PAs include managing medical complexity, supervision burden, and not being able to prescribe medication, but suggested that the help of regulators and educationalist support can help with the integration of this relatively new role.
Halter et al., 2020.	To compare the contribution of PAs to the processes and outcomes of emergency medicine consultation with foundation year two physician-in-training.	A mixed method was used for this study.	A total of 8816 patients were seen by 6 PAs, and 40 foundation year two-physicians-in-training.	The study concludes that PAs treat patients safely at a similar level to the physician-in-training, providing clinical operational efficiencies.
Taylor, Halter & Drennan, 2019.	To understand patients' satisfaction through PAs-patient communication experiences.	A qualitative approach.	A total of fifteen patients and patient representatives who had experienced a PAs encounter.	The study concludes that PAs offer a constructive example of successful clinician-patient communication from the patient's perspective although they were naïve to the PAs role.
Drennan et al., 2011.	To understand the factors that sustain the employment of PAs perceived by practice managers and general practitioners.	A qualitative approach using a semi-structured interview, and data analysed thematically.	The study comprised 13 general practitioners, 3 practice managers from 15 general practices employing PAs.	The study concludes that PAs role is considered a positive addition to meeting patient needs but recommends the need for strong governance and regulatory framework for this relatively new role in the UK.
Williams & Ritsema (2014).	To identify the perceived benefits and challenges of the role of PAs from doctors' and patient perspectives.	A quantitative approach used for this study.	A total of sixty-one respondents completed the survey.	The study report that respondents were found to be generally satisfied with the role of PAs and believed that their role benefits doctors and patients.

literature review. The Mixed Methods Appraisal Tool version 2011 (MMAT) was used in this systematic literature review. Pluye et al. [51] state that the MMAT is designed to appraise the methodological quality of publications retained for a systematic mixed studies review. The MMAT appraisal is one of the commonly used literature appraisal tools recommended by the Sheffield Hallam University. The Hawker Qualitative appraisal tool and the McMaster Quantitative Appraisal tool may be used to assess the quality of publications for either a qualitative or quantitative literature review respectively. But the MMAT is designed for the appraisal of systematic review studies which include qualitative, quantitative, and mixed method studies [52]. The quality assessment tool used was an idea adapted

from a study that focus on modifying an existing tool and evidence to assess the risk of bias in previous studies [53]. This can also be used to appraise the quality of empirical studies that are based on experiments, observation, or stimulation [52,54]. All 10 papers were subjected to the quality appraisal tool to establish if the research was systematically good, flaws in the study design and analysis restrict the effectiveness of the results and would limit the quality of the review. The MMAT version 2011 tool for the systematic literature review is summarised in appendix 1.

Ethical consideration

According to the National Health Service Foundation Trust [55],



ethical approval is important in any research study to ensure the safety, dignity, and rights of the participants. It is relevant because of the frequently read and quoted evidence that impacts educational policies and practices. Ethical approval is linked to how and what systematic literature reviews are designed, applied, and have a significant implication. Although the best standard in a secondary research study is to carry out a systematic literature review. The time limit for a Master's level dissertation makes this unachievable hence a detailed outline of a systematic search approach with a clear selection process, and validated quality assessment tool to reduce bias in this systematic review [56]. As part of the ethical consideration for this review, all identifiable information of participants had been excluded from the ten studies.

Results

Ten studies from England were included in the systematic literature review, as summarised in the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flow chart. Out of the ten studies, four reports from qualitative studies, three reports from quantitative studies, and three from mixed method studies as presented in Table 3. The diverse content in the study type, populations, and outcome measures prevented any meta-analysis and a sequence of events review was undertaken. The synthesis of the results is organised into evidence related to the role and outcome of PAs in primary care in England. The evidence concerning the role of PAs in primary care was in two groups: the scope of practice of PAs, and the level of competence of PAs. The evidence concerning the outcome of PAs role in primary care also comprised of; contribution to patient safety, and patient level of satisfaction with PAs reported by the supervising doctor. The term "supervising doctors" covers a range of terms including GPs, physicians, and medical managers who are currently working or have worked with PAs, as used to refer to the

medical officers in the papers included in the systematic literature review.

The evidence concerning the role of PAs in primary care

Scope of practice of PAs: The term "scope of practice" in this review refers to the limitation of PAs knowledge, skills, and challenges faced in their practice. Three studies [16,45,47] investigate the knowledge, skills, or challenges of PAs in primary health care. One of the selected studies [45] attempted to compare the quality of the patient consultation of four PAs to that of five GPs in England. The study used a comparative observational video of 62 consultations (n=41 GPs and n=21 PAs) recruited from 12 general practices. De Lusignan et al. [45] report that GPs were considered to have performed better in all areas of the consultation than PAs. However, the GP assessor failed to identify two of four of the PAs. GPs saw a patient with two or more presenting complaints, and PAs largely attended to patients with a single presenting complaint [45]. The study reported that many GPs have substantially more year's training and experience than PAs. This suggests some level of limitation in knowledge and skills for PAs. De Lusignan et al., [45] considered the evidence and concluded that PAs can still provide complementary support to the multidisciplinary workforce in general practice. This study shows that, PAs are seen to be competent, and works within their scope of practice [45].

Drennan et al. [16] report on the perceived challenges to professional boundaries of introducing PAs in primary health care. The study used a mixed qualitative study approach to gather data at macro and meso as well as micro levels (data from policy documents, interviews, and clinical and professional meetings) from GPs, nurse practitioners, practice staff, and senior medical managers. Drennan et al. [16] present evidence from the macro and meso levels before turning to the micro level of primary health care. The reasons stated for challenges the PAs face in their practice include the lack of a statutory regulatory body that permits doctors and other healthcare professionals to prescribe medicines or order ionising radiation, and senior medical managers wanting more evidence that the PAs role was cost-effective. However, the PAs role was reported to be one of the workforce solutions to the problems within primary health care [16]. Jackson, Marshall, and Schofield [47] report that complex factors may impede the scope of practice of PAs in primary care but proposed a conceptual model that can support their role. There were 51 participants (30 general practitioners, 11 advanced nurse practitioners, and 10 patients) in eight focus groups. The model suggested allows the facilitators and barriers to the role of PAs in primary care to be simplified into three areas namely; reasonable response to the increasing demand with reduced resources in the NHS, concern about the competencies in managing healthcare presentations in general practice, and barriers created by external legal and regulatory requirements [47]. This study acknowledges that the PAs role is one of the potential solutions to the staffing crisis within primary care [47].

Level of competence of PAs

Two studies report on the level of competence of PAs compared to other healthcare professionals [14,46]. Halter et al. [46] used a mixed-method approach to compare the consultation of PAs and Foundation Year Two (FY2) doctors. A quantitative, observational retrospective chart review of patient consultations by FY2 doctors compared to PAs, semi-structured interviews with the multidisciplinary team, and qualitatively observed PAs' practice to compare the contribution of PAs in providing patients with a range of conditions safely. The study

used records of 8816 patients attended by six PAs (n=2890), and 40 foundation years two doctors-in-training (n=5926). Although this study was carried out in secondary care, PAs work is reported to be at a similar level of experience to foundation year two-doctors-in-training in providing patient care [46]. This study provides a well-powered quantitative comparative analysis of the documented processes and outcomes of patient care by PAs and FY2 doctors [46]. Drennan et al. [14] compared the consultation of PAs and GPs in primary care in England. This study used a comparative, observational design based on consultation records, linked medical record review, and a patient satisfaction survey to compare the consultations of PAs and GPs. The study aimed to compare the outcomes and cost of the same-day appointment or request consultations by PAs and with those of the GPs. A total of 2086 patient records were presented at same-day appointments in 12 general practices in England. A total of 1154 (55.3%) had the index consultation with a general practitioner, and 932 (44.7%) with a PAs [14]. Although the use of an observational study rather than a randomised control trial may be seen as a weakness. However, this approach was considered to capture the impact of the PAs role as a relatively new profession within the NHS system. There was a higher percentage of PAs records of re-consulting patients were concluded to be appropriate than GPs records by independent GP who were successfully blinded to the PAs profession [14]. The study acknowledged that the use of clinical records may be reviewed as less robust than a prospective study, however this approach reduced the data collection burden and minimised the extent of missing relevant data. The study reported that PAs offer a potentially acceptable and efficient consultation.

Summary of evidence concerning the role of PAs' in primary care

The impact over time in general practice suggests that PAs play a significant role as part of the multidisciplinary team in the delivery of optimal patient care. However, the lack of a statutory regulatory body in the UK limits their current scope of practice and level of competence. The lack of a statutory regulatory body for PAs in the UK prevents them from prescribing medicines and requesting ionising radiation for the patient. The studies that compared the consultation of PAs and GPs in primary care in England (Drennan et al., 2015) suggest that support for the role is quite significant [14]. Any future regulatory bodies for the PAs in the UK will play a vital role in their delivery of patient care. Although, some mixed or contradictory ideas are also reported, and there is a need for more proof of their knowledge, skills, and competence in patient care.

The evidence concerning the outcome of PAs' role in primary care

Contribution to patient safety: The contribution of PAs role to patient safety was reported in two studies [3,19]. Drennan et al. [3] investigates the contribution of PAs in the delivery of patient care in England. This study used a mixed-method approach including a rapid review (n=49), a survey of PAs(n=16) in primary care, and comparative case studies in 12 primary care practices (six employing PAs). The study reported that there was no significant difference between PAs and GPs in the primary outcome of patient consultation. Drennan et al., [3] report that, GPs blinded to the type of healthcare professional in the study, judged the documented activities in the initial consultation of patients who reconsulted for the same presenting complaint to be appropriate in 80% (n=223) PAs, and 50% (n=252) GPs records. PAs were judged to be competent, and safe from

observed consultation. PAs are seen to be effective, and efficient and provide a flexible addition to the primary care workforce.

Drennan et al. [19] in a qualitative study used the semi-structured interview to explore the motivation of GPs (n=13) and practice managers (n=3) who employ PAs in general practice (n=15) in five different areas in England. The study report that general practice employers consider the role of PAs as a positive contribution to meeting patient demands and support the need for stronger governance as well as a regulatory framework for this profession.

Patient level of satisfaction with PAs reported by the supervising doctor

Three of the studies report on patient satisfaction with the role of Pas [1,29,48]. William and Ritsema [29] used a survey to collect descriptive data on the response of doctors supervising PAs. In the study, sixty-one doctors from 14 medical settings completed the survey. More than 50% responded that PAs work well as part of a multidisciplinary team, and have good clinical and communication skills [29]. About half of the doctors felt that having PAs on the team improves the patient experience, and only two respondents (3.3%) felt that PAs did not work well in the team [29]. More than 90% of the respondents felt that the regulatory body for the profession was important, and less than 10% felt regulation will be useful, but not critical [29]. The supervising doctors reported that they obtained positive feedback from the patient about the role of PAs and believed that the lack of statutory regulation of the PAs profession affects their ability to use their PAs staff to their fullest potential.

Taylor, Halter & Drennan [48] in a qualitative study used a semi-structured interview that aimed to understand patients' satisfaction with PAs in acute hospital settings. The study interviewed 15 patients and patient relatives who had experience with a PAs. Participants were satisfied with the PAs encounter, they shared relevant and meaningful information with them because of the trust and confidence in the relationship. Patients and patient relatives were satisfied with their encounters with PAs. The study concludes that PAs offer a constructive good example of a positive clinician-patient communication experience in an acute hospital encounter from the participant's perspective.

Another study by Halter et al. [1] investigates the patient perspective on consulting with PAs in primary care in England. A qualitative approach using a semi-structured interview (n=30 volunteers) in six primary health care employing PAs in England. Patients were confused about the role of PAs, but were not worried about the GP's role being substituted by a PAs. However, the negative patient experiences described problems when the limits of the PAs role were reached for example unable to request ionising radiation or unable to prescribe medication. Halter et al. [1] state that trust can be built through the experience of positive consultations, that is, trust in the individual PAs. Participants described their experience with PAs as having good consultation communication skills, having time to listen, and responding appropriately. The study reported that participants were satisfied generally with consulting PAs and saw them as suitable GPs substitutes.

Summary of evidence concerning the outcome of PAs' role in primary care

These studies highlight the aspect of PAs' contribution to patient safety and satisfaction in general practice in England. There are some situations where participants felt PAs were limited or unable to provide

certain patient services such as prescribing rights, and requesting ionising radiation. This suggests that physicians or medical managers who have worked or worked with PAs' can determine the expectation of their patients based on their own experience working with PAs or the feedback they receive from patients. The evidence from the studies shows that there was a mainly positive report on patient safety and satisfaction with consulting PAs even the limitation in their role. This is considered relevant to the value of the NHS Constitution for England on the commitment to quality care. There is a need for more evidence about the lack of a statutory regulatory body for this new profession making it difficult for medical managers or patients unable to experience the full potential of PAs in the delivery of care.

Discussion

In this systematic literature review, many publications (n=73) that report on the role of PAs in general practice with few publications from secondary care settings in the UK, and the majority of the information from England were identified. However, after rigorous inclusion and exclusion criteria, some of the articles were excluded, and only 10 papers remained. Most of the included studies were from general practice in England and two from acute hospital care per the search term for this systematic literature review. Many of the papers were of high quality, providing reasonable data, and statistical evidence. Some of the papers reported that physicians who worked or are currently working with PAs were satisfied with the role of PAs in primary care. Hence, the following are summary of the key findings of the systematic literature review in the context of the research question.

The results of this systematic literature review were organised into evidence of the role, and outcome of PAs in primary care in England. In the USA, Physician Associate (PA) has a regulatory body, and about half of the qualified PAs working in primary care have adequate support, and a willingness to be employed by doctors [57]. This reflects the development of the PAs' role in the USA since the 1960s. The PAs' profession is a rapidly growing occupational group in the UK NHS system [58]. In the UK, PAs are trained to work with the medical model, with attitudes, skills, and the knowledge base to provide holistic care and treatment under a defined level of supervision by a doctor [59]. In general, healthcare professionals have shown support for the PAs role in primary care. The PAs profession is reported to be high, especially among those already employing them, however, few writers consider their role to be limited due to the current lack of a statutory regulatory body in the UK. Regulatory bodies are subject to national law governed by a Royal Charter in the UK. Regulatory bodies are also known as 'competent authorities' because they control access to regulated professions which require specific qualifications [60]. The Health and Safety Executive, which is the national independent regulator for health and safety in the workplace states that regulatory bodies play a key role in ensuring that professional standards are maintained [61], and protect patients from health risks. There are suggestions that some PAs roles increased senior clinicians' productivity [4]. Another key thing to remember is that, there is a sharp rise in voluntary retirement among GPs are also closed to record levels as a proportion of all retirements across the profession, making up 58.6% of all GP retirements in 2020/21, the second-highest figure recorded in more than a decade [62]. Some health care managers often arrange PAs' duty times to cover for the absences of physicians, for example, to attend workshops, and reduce the use of locum physicians. Drennan et al. [4] reported that senior clinicians considered locum physicians that were new to their care setting as less efficient, less safe, but also expensive than PAs.

The PAs' scope of practice means they can identify and treat certain medical conditions. Although with the limitations of this profession, there is still continual support and the increasing employment of PAs in primary care shows how they can support the multidisciplinary team in general practice. The evidence for this comes in the papers that describe the scope of practice of PAs in practice. However, De Lusignan et al [45] failed to offer an adequate explanation for using small data; this limits the generalisability of their study. Drennan et al. [16] provide empirical evidence of the response of health professionals in England to the introduction of PAs role in primary care. The study would have been more useful if the researchers were able to secure the macro level interview with GPs in training. However, the breadth of the sample across different parts of England, and the use of combined qualitative approaches mitigated the limitation to some extent. Jackson, Marshall, and Schofield [47] broke with tradition by including many GPs who were more familiar with the clinical supervision workforce. However, this adds to the credibility of the results as the researcher considers the question in a region unfamiliar with the role.

Studies report that PAs level of competence is considered efficient and safe [4,14]. The competence and curriculum framework for the PAs outline the core clinical conditions by category of the level of competence for the profession. PAs generally attend to less complex patients than the GPs aligned with their category of the level of competence, as this allows physician time to focus on more complicated patient cases [14]. There were high levels of patient satisfaction with PAs consultation. This relatively new profession has the capacity to be an asset to the general practice workforce in the NHS systems looking to support the primary healthcare provision in staffing crisis especially medical doctors, increasing population growth, and increasing demand for healthcare services. However, their current inability to prescribe medication and ionising radiation in the UK shows a potential increased workload to other clinicians and the need for a supervising doctor.

Campbell and Garner [63] state that patient safety is considered an intervention that has a demonstrated ability to prevent or reduce, harm to patients. In 2001, the NHS's National Patient Safety Agency was established with a mandate to identify patients' safety issues and find appropriate solutions [63]. The contribution of PAs role in primary care to patients' safety appears to be very high and supports the need for a regulatory body. Other studies on patient satisfaction reported by the medical managers or the supervising doctors were overall positive. When summarised against the NHS value on the commitment to quality of care based on safety, effectiveness, and patient experience [64], this suggests some relevant evidence for the PAs profession in primary care. Although patients and relatives were satisfied with the role of PAs, most of them did not understand what a PAs was [1] reported that the patient was confused about the role of PAs in the primary care setting. The negative patient experiences reported described issues when the limits of PAs role were reached which include prescription delay or additional GP consultations in primary care [1]. Patient experience is seen as a key part of this review, as this helped to provide an in-depth insight into the strength and limitations of the PAs role in general practice. And the patient experience of a new profession when substituting for another's role is important for understanding public acceptability and for embedding the new role (Halter et al., 2017) [1].

Most of the papers considered for the review were carried out

in primary care in England, reflecting the development of the PAs profession in the UK since 2002. These studies comprise qualitative, quantitative, and mixed methods with different analyses on the contribution of PAs to primary care. PAs provide that continuity of care for patients with chronic conditions, and they have an increasing role to play in general practice as part of the multidisciplinary team. The idea of maintaining continuity of care with a particular professional is considered equal if not more important than having a preferred type of healthcare professional; for example, choosing the PAs to provide that continuity of care, giving a positive justification of their ability to remember details such as past medical history and drug allergies, as well as the PAs, is seen as part of the multidisciplinary team. Considering the growing number of evidence on the role of PAs in England, this can be seen as acceptance of the contribution of PAs as a professional group [65-67].

Implications

The implications of the finding of this systematic literature review are threefold: the implications for the current scope of practice, level of competence, and patient safety of the PAs role in general practice in England. In England, PAs role in general practice is like the rest of the UK: for example, attending to patients needing same-day or urgent appointments. Literature suggests that PAs in general practice may enable GPs to deal with complex medical conditions while PAs provide care that might be considered less uncomplicated [57], but at a level that is appropriate to both the patient and the supervising doctors. This review provides some evidence about the contribution of PAs to general practice in England, and how the current lack of a statutory regulatory body for the profession in the UK affects their role.

Limitations

In this review are a few limitations. Firstly, the review focused on PAs role in general practice in England, hence limited available evidence. A broader focus on the role of PAs in the UK would have produced adequate evidence, and then analysis can be generalised on the results of PAs in the UK. However, findings from this review could serve as baseline data for future studies which review the role of PAs working in general practice in the UK. Secondly, two of the studies considered for the review were carried out in an acute hospital setting as defined in the search term. This potentially makes it difficult to narrow the findings of the review. Although, the reason for including such studies was the fact that, the patient received same-day or urgent treatment like general practice. Lastly, most of the studies for this review were from a particular group of authors who have conducted many studies about the role of PAs in England. These authors used different or similar research methods where data are presented in potentially confounding analyses or less detailed data analyses. However, this group of authors has carried out significant studies since the introduction of PAs in the UK.

Recommendation for Future Research

This systematic literature review makes it clear that several research questions remain, concerning the role of PAs in general practice in other parts of the UK. There is a growing body of evidence on the contribution of PAs to standard patient care in general practice. This review recommends investigating the role of PAs in general practice in the UK, and what motivates them to work in general practice. And I also suggest the researchers consider good quality articles with adequate comparative data with other relevant healthcare professional groups. Findings from such studies will provide many public and

private employers with the evidence to support their decision-making when recruiting staff for their company.

Conclusion

The research evidence of the role of PAs in primary care in England shows the contribution of the profession as part of the multidisciplinary team in the provision of safe and acceptable care for both patients and the supervising doctors. PAs could provide a flexible addition to the primary care workforce. The evidence concerning the role of PAs in primary care indicated that the current lack of a statutory regulatory body for the profession has contributed to some level of limitations in the delivery of patient care. However, with such limitations, PAs continue to play a vital role in safe and acceptable patient care. Any future regulation of this profession will make a significant positive impact and give the assurance that all qualified PAs are working to a similar framework and that they are protected. Professional regulation of PAs in the UK is important as it will provide the legal professional accountability and authority for the standards of behaviour, and competence for its members.

The evidence concerning the outcome of PAs' role in primary care showed positive patient satisfactory feedback obtained from the patient reported by the supervising doctors who have worked or currently working with PAs. The role since its introduction into the UK healthcare system in 2002 continues to make a significant impact in reducing the workload on the NHS system. Experienced clinicians valued this relatively new profession more highly than the service delivered by locum physicians who are unfamiliar with a particular health care setting [4]. However, PAs utility in general practice is unlikely to be fully realised in the absence of a professional regulatory body with qualified PAs to be able to prescribe medication, and request ionising radiation within their scope of practice [4].

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Appendix 1: Mixed Methods Appraisal Tool (MMAT)-version 2011

Paper 1: Drennan VM, Halter M, Wheeler C, Nice L, Brearley S, Ennis J, Gabe J, Gage H, Levenson R, de Lusignan S, Begg P, Parle J. (2015). Physician associates and GPs in primary care: a comparison. *British Journal General Practice*. 65: e344-50.

Study Design	Methodological Quality Criteria	Response			Comments
		Yes	No	Can't	
Screening Questions for all types	S1. Are there clear research questions?	<input type="checkbox"/>			To compare outcomes and costs of same-day appointments by PAs with those of GPs.
	S2. Do the collected data allow to address the research questions?	<input type="checkbox"/>			The study gathered data from a reasonable amount of patient records at same-day consultations in 12 general practices in England.
	A further appraisal may not be feasible or appropriate when the answer 'No' or 'Can't tell' to one or both screening questions				
Quantitative	4.1 Is the sampling strategy relevant to addressing the quantitative research question?	<input type="checkbox"/>			Yes, the source of the sample for this study is relevant for their study as it includes PAs and GPs working in primary care to increase external validity and generalisability of the data.
Descriptive	4.2 Is the sample representative of the population under study?	<input type="checkbox"/>			Yes, the study detailed the inclusion and exclusion criteria, and the reasons for the eligibility of the sample were explained.
	4.3 Are the measures appropriate?	<input type="checkbox"/>			The study clearly defined, justified and accurately measured all variables used to answer the research question.
	4.4 Is there an acceptable response rate (60% or above)?	<input type="checkbox"/>			Yes, out of 1020 patients aged > 16 years, about 539 (52.8%) returned a patient satisfactory survey: 220 consulted with a PA, and 319 consulted a GP representing 40.8% and 59.2% respectively. Most of the patients consulting a PA responded that they would accept a consultation from a PA (87.3%), and 9/220 of the patient would prefer a GP (4.1%) consultation in the future.

Paper 2: Halter, M., Drennan, V. M., Joly, L. M., Gabe, J., Gage, H., & De Lusignan, S. (2017). Patients' experiences of consultations with physician associates in primary care in England: A qualitative study. *Health Expectations*, 20(5), 1011–1019.

Study Design	Methodological Quality Criteria	Response			Comments
		Yes	No	Can't tell	
Screening Questions for all types	S1. Are there clear research questions?	<input type="checkbox"/>			To investigate the patients' perspective on consulting with PAs in general practice.
	S2. Do the collected data allow to address the research questions?	<input type="checkbox"/>			Yes, patients responded to semi-structured interviews to explore their experiences after attending a consultation with a PA.
	Further appraisal may not be feasible or appropriate when the answer 'No' or 'Can't tell' to one or both screening questions				
Qualitative	1.1 Are the source of qualitative data relevant to address the research question?	<input type="checkbox"/>			Yes, the study made clear the selection of process for the data obtained and provided relevant reasons for participants chose not to participate.
	1.2 Is the process of analyzing qualitative data relevant to addressing the research question?	<input type="checkbox"/>			Yes, the study explained the method of data collection (semi-structured interview), and how the data was collected. They also explained any changes in the method of data collection, and others to address the research question.
	1.3 Is appropriate consideration given to how findings relate to the context?	<input type="checkbox"/>			Yes, the researchers focused on studying patients' experiences of consultations with PAs in general practice, hence all the data were collected from a patient who has had a consultation with PAs in primary care to ensure the outcome is relevant to the study objective.
	1.4 Is appropriate consideration given to how findings relate to researchers' influences?	<input type="checkbox"/>			The researchers were able to critically explain how patients saw PAs as an appropriate general practitioner's alternative, during their interactions with the patient during the study.

Paper 3: Drennan VM, Halter M, Brearley S, et al. (2014) Investigating the contribution of physician assistants to primary care in England: a mixed-methods study. *Health Services and Delivery Research* 2:1-136

Study Design	Methodological Quality Criteria	Response			Comments
		Yes	No	Can't tell	
Screening Questions for all types	S1. Are there clear research questions?	<input type="checkbox"/>			To investigate the contribution of PAs to the delivery of patient care in general practice services in England.
	S2. Do the collected data allow to address the research questions?	<input type="checkbox"/>			The study gathered published studies (n= 49) that report on the increasing number of PAs in general practice, and a survey of PAs in primary care (n=16). The researcher also incorporated clinical record reviews of the patient satisfaction survey, video observations of consultations, and interviews with patients and professionals to help address their research question.
	Further appraisal may not be feasible or appropriate when the answer 'No' or 'Can't tell' to one or both screening questions				
Mixed Methods	5.1 Is the mixed methods research design relevant to addressing the qualitative and quantitative research question?	<input type="checkbox"/>			According to the researchers, the rationale for integrating qualitative and quantitative methods in their research was to allow for both description and the quantification of the influence of PAs in the context of primary care.
	5.2 Is the integration of qualitative and quantitative data relevant to addressing the research question?	<input type="checkbox"/>			Yes, the researcher provides evidence of how data was collected differently, and how each data was analyzed separately before then drawn together again in the outcomes section.
	5.3 Is appropriate consideration given to the limitations associated with this integration?	<input type="checkbox"/>			Yes, the authors report that there were limitations in the data collection tools. For example, the anonymised clinical records reduced the reliance on healthcare professionals, but this is open to the difficulty that there was a lack of study-prescribed uniformity in the data collection processes.

Paper 4: De Lusignan S, McGovern A P, Tahir MA, Hassan S, Jones S, Halter M, et al. (2016) Physician Associate and General Practitioner Consultations: A Comparative Observational Video Study. PLoS ONE 11(8): e0160902.

Study Design	Methodological Quality Criteria	Response			Comments
		Yes	No	Can't tell	
Screening Questions for all types	S1. Are there clear research questions?	<input type="checkbox"/>			To investigate the quality of patient consultation of PAs in comparison to that of GPs.
	S2. Do the collected data allow to address the research questions?	<input type="checkbox"/>			Yes, the researcher considered reasonable (n=62) video recordings of consultations by volunteer PAs and GPs.
	Further appraisal may not be feasible or appropriate when the answer 'No' or 'Can't tell' to one or both screening questions				
Quantitative	4.1 Is the sampling strategy relevant to addressing the quantitative research question?	<input type="checkbox"/>			Yes, they sampled staff (PAs and GPs) across 12 practices in the East, Southwest, and Southeast of England.
Descriptive	4.2 Is the sample representative of the population under study?	<input type="checkbox"/>			Yes, there were five GPs and four PAs, and each identified specific clinical sessions in same-day and urgent patient appointments for the video observation. The average number of years of experience for both GPs and PAs was also quantified.
	4.3 Are the measures appropriate?	<input type="checkbox"/>			Yes, the researchers clearly defined the variables used in their study that help to answer the research question. The Leicester Assessment Package was used to assess the validity and reliability of the consultation.
	4.4 Is there an acceptable response rate (60% or above)?	<input type="checkbox"/>			Yes, considering the video recording consultations there is no evidence that all patients presented with a similar condition.

Paper 5: Drennan, V.M., Gabe, J., Halter, M., de Lusignan, S., Levenson, R., (2017) Physician associates in primary health care in England: A challenge to professional boundaries? Social Science & Medicine (2017), DOI: 10.1016

Study Design	Methodological Quality Criteria	Response			Comments
		Yes	No	Can't tell	
Screening Questions for all types	S1. Are there clear research questions?	<input type="checkbox"/>			To explore the perceived effects on professional boundaries and relationships of introducing PAs into primary care.
	S2. Do the collected data allow to address the research questions?	<input type="checkbox"/>			Yes, there data gathered from civil servants, senior members of Organisations, NHS managers, GPs, nurse practitioners, and practice staff enable the researchers to address the research questions.
	Further appraisal may not be feasible or appropriate when the answer 'No' or 'Can't tell' to one or both screening questions				
Mixed Qualitative	1.1 Are the source of qualitative data relevant to address the research question?	<input type="checkbox"/>			Yes, the researchers explained that the mixed qualitative data for the study comprised of macro, meso, and micro levels within the health care system to help analyses data at different levels.
	1.2 Is the process of analyzing qualitative data relevant to addressing the research question?	<input type="checkbox"/>			Yes, analyses of the mixed qualitative data were both inductive and framed by the already existing theories of a dynamic system of professions.
	1.3 Is appropriate consideration given to how findings relate to the context?	<input type="checkbox"/>			Yes, the researcher focused on exploring professional boundaries within the healthcare system, hence data were obtained from managers, senior members, and relevant persons working within the healthcare settings.
	1.4 Is appropriate consideration given to how findings relate to researchers' influences?	<input type="checkbox"/>			Yes, the researcher critically explained their findings and explained their reaction to critical issues that occurs during the study.

Paper 6: Jackson B, Marshall M, Schofield S. (2017) Barriers and facilitators to integration of physician associates into the general practice workforce: a grounded theory approach. Br J Gen Practice 67(664): e785-e791.

Study Design	Methodological Quality Criteria	Response			Comments
		Yes	No	Can't tell	
Screening Questions for all types	S1. Are there clear research questions?	<input type="checkbox"/>			To investigate the obstacles and facilitators to the introduction of PAs into the general practice staff.
	S2. Do the collected data allow to address the research questions?	<input type="checkbox"/>			Yes, the authors used an emerging theme to develop an interview topic guide to obtain data from GPs, patients, and advanced nurse practitioners to understand the barriers and facilitators for the PA profession in primary care.
	Further appraisal may not be feasible or appropriate when the answer 'No' or 'Can't tell' to one or both screening questions				
Qualitative	1.1 Are the source of qualitative data relevant to address the research question?	<input type="checkbox"/>			Yes, the qualitative data was obtained from GP groups drawn from a postgraduate training community, patient groups from an established link with a medical school for teaching purposes, and advanced nurse practitioners from the general practice.
	1.2 Is the process of analyzing qualitative data relevant to addressing the research question?	<input type="checkbox"/>			Yes, qualitative data from all focus groups were audiotaped and transcribed verbatim by the authors. Data were analysed using thematic analysis to identify individual concepts using NVivo 10.2.2.
	1.3 Is appropriate consideration given to how findings relate to the context?	<input type="checkbox"/>			The study investigates the barriers and facilitators of the integration of PA in primary care teams within the region, hence considering data from focus groups relevant to the field of study.
	1.4 Is appropriate consideration given to how findings relate to researchers' influences?	<input type="checkbox"/>			Yes, the researchers were able to highlight the complex factors that impact the introduction of PAs into general practice in the UK.

Paper 7: Halter M, Drennan V, Wang C, *et al* (2020) Comparing physician associates and foundation year two doctors-in-training undertaking emergency medicine consultations in England: a mixed-methods study of processes and outcomes. *BMJ Open* 2020;10: e037557. DOI: 10.1136/bmjopen-2020-037557

Study Design	Methodological Quality Criteria	Response			Comments
		Yes	No	Can't tell	
Screening Questions for all types	S1. Are there clear research questions?	<input type="checkbox"/>			To compare the emergency medicine consultation outcome between PAs and foundation year two doctors-in-training.
	S2. Do the collected data allow to address the research questions?	<input type="checkbox"/>			Yes, the data collected allowed the researcher(s) to conclude that PAs can provide safe patient care like foundation year two doctors-in-training.
	Further appraisal may not be feasible or appropriate when the answer 'No' or 'Can't tell' to one or both screening questions				
Mixed Methods	5.1 Is the mixed methods research design relevant to addressing the qualitative and quantitative research question?	<input type="checkbox"/>			Yes, the researchers explained that mixed methods were used in their study because this helped them compare, contrast, and simultaneously interpret qualitative and quantitative data to be able to address the research question.
	5.2 Is the integration of qualitative and quantitative data relevant to addressing the research question?	<input type="checkbox"/>			Yes, the researchers considered a quantitative observational patient consultation by PAs compared to foundations year 2 doctors, and qualitative data from PA as well as a semi-structured interview from staff to be able to answer the research question.
	5.3 Is appropriate consideration given to the limitations associated with this integration?	<input type="checkbox"/>			Yes, the researchers highlighted that the patient view has not been previously reported for PAs in different healthcare settings, and impaired ability to describe cases in detail due to the low sensitivity of the triage system in the chosen department for the study.

Paper 8: Lovink, M.H., van Vught, A.J., Persoon, A. *et al.* (2018) Skill mix change between general practitioners, nurse practitioners, physician assistants and nurses in primary healthcare for older people: a qualitative study. *BMC Fam Pract* 19, 51 (2018). <https://doi.org/10.1186/s12875-018-0746-1>.
 *****Rejected***** because the study focuses on PA's role in the Netherlands instead of in UK or England. The current professional role of PAs in the UK differs from that of the Netherlands. The authors failed to justify why the qualitative method was used for their study. The current scope of practice of PA in the Netherlands is different from the UK.

Study Design	Methodological Quality Criteria	Response			Comments
		Yes	No	Can't tell	
Screening Questions for all types	S1. Are there clear research questions?	<input type="checkbox"/>			To describe how skill mix change is organised in daily practice.
	S2. Do the collected data allow to address the research questions?		<input type="checkbox"/>		Qualitative data were collected from 34 different healthcare professionals who were considered for the study, but they were not processed in a way that allowed the researcher to answer the question.
	Further appraisal may not be feasible or appropriate when the answer 'No' or 'Can't tell' to one or both screening questions				
Qualitative	1.1 Are the source of qualitative data relevant to address the research question?	<input type="checkbox"/>			Yes, the researchers were able to obtain data from the relevant healthcare professionals to address the study's question.
	1.2 Is the process of analyzing qualitative data relevant to addressing the research question?			<input type="checkbox"/>	The authors did mention what the analysis involved but no details were given on how the qualitative data was processed.
	1.3 Is appropriate consideration given to how findings relate to the context?			<input type="checkbox"/>	It was too difficult to tell from the study whether appropriate consideration was given to the results obtained by the authors.
	1.4 Is appropriate consideration given to how findings relate to researchers' influences?	<input type="checkbox"/>			Yes, the authors were able to highlight a few limitations to the study. These include very small focus groups, no interaction made with PAs and GPs, and a lack of perspective of the patient and their family.

Paper 9: Drennan, V. Levenson, R., Halter, M., & Tye, C., (2011) Physician assistants in English general practice: a qualitative study of employers' viewpoints. *Journal of Health Services Research & Policy* Vol 16 No 2, 2.

Study Design	Methodological Quality Criteria	Response			Comments
		Yes	No	Can't tell	
Screening Questions for all types	S1. Are there clear research questions?	<input type="checkbox"/>			To study the motivation of GPs and practice managers who employed PAs, and to understand the factors that sustained their employment.
	S2. Do the collected data allow to address the research questions?	<input type="checkbox"/>			Yes, the authors were able to obtain qualitative data from 13 GPs and 3 practice managers from 15 general practices that have employed PAs. And findings from the study were discussed and resulted in a set of agreed terms.
	Further appraisal may not be feasible or appropriate when the answer 'No' or 'Can't tell' to one or both screening questions				

Qualitative	1.1 Are the source of qualitative data relevant to address the research question?	<input type="checkbox"/>			Yes, the authors were able to explain in detail how the selection of participants for the study, and the reasons why other relevant participants chose not to participate.
	1.2 Is the process of analyzing qualitative data relevant to addressing the research question?	<input type="checkbox"/>			Yes, the qualitative method of data collection was clear (semi-structured interviews), the form of data was explained by the authors, and the data were analysed thematically to address the study question.
	1.3 Is appropriate consideration given to how findings relate to the context?	<input type="checkbox"/>			Yes, the researchers considered how findings from their studies relate to the settings in which the data were collected.
	1.4 Is appropriate consideration given to how findings relate to researchers' influences?	<input type="checkbox"/>			Yes, the authors emphasized that results from their study were analysed independently of each other, and difference in opinion was discussed and resolved as a group.

Paper 10: Williams, L. E., & Ritsema, T. S. (2014). Satisfaction of doctors with the role of physician associates. *Clinical medicine (London, England)*, 14(2), 113–116. <https://doi.org/10.7861/clinmedicine.14-2-113>

Study Design	Methodological Quality Criteria	Response			Comments
		Yes	No	Can't tell	
Screening Questions for all types	S1. Are there clear research questions?	<input type="checkbox"/>			To identify some of the perceived benefits and challenges of the role of PAs from the doctors' and patients' perspectives.
	S2. Do the collected data allow to address the research questions?	<input type="checkbox"/>			The researcher collected a reasonable amount of data from doctors working in different specialties or medical settings.
	Further appraisal may not be feasible or appropriate when the answer 'No' or 'Can't tell' to one or both screening questions				
Quantitative	4.1 Is the sampling strategy relevant to addressing the quantitative research question?	<input type="checkbox"/>			Yes, the researcher sampled doctors from 14 specialties or medical settings to increase the external validity and generalisability of the data.
Descriptive	4.2 Is the sample representative of the population under study?	<input type="checkbox"/>			Yes, all the respondents were doctors working with PAs, and the researchers stated that doctors who did not work with PAs were excluded from their analysis.
	4.3 Are the measures appropriate?	<input type="checkbox"/>			Yes, the questionnaire for the survey was pre-tested with PA employers and subjected to an internal validity check based on their feedback.
	4.4 Is there an acceptable response rate (60% or above)?			<input type="checkbox"/>	The researchers for acknowledged that the response rate of 40.7% is reasonable, but not an optimal rate for the return of the survey. They also stated a few reasons for the low response rate to their survey.

Paper 11: Taylor, F., Halter, M., & Drennan, V. M. (2019). Understanding patients' satisfaction with physician assistant/associate encounters through communication experiences: a qualitative study in acute hospitals in England. *BMC health services research*, 19(1), 603. <https://doi.org/10.1186/s12913-019-4410-9>.

Study Design	Methodological Quality Criteria	Response			Comments
		Yes	No	Can't tell	
Screening Questions for all types	S1. Are there clear research questions?	<input type="checkbox"/>			To understand patients' satisfaction through PA-patient communication experiences.
	S2. Do the collected data allow to address the research questions?	<input type="checkbox"/>			Yes, a reasonable number of patients and patient representatives who have experienced a PA encounter were interviewed across different healthcare settings.
	Further appraisal may not be feasible or appropriate when the answer 'No' or 'Can't tell' to one or both screening questions				
Qualitative	1.1 Are the source of qualitative data relevant to address the research question?	<input type="checkbox"/>			Yes, the researchers explained that to minimize selection bias they were present all day during the recruiting of participants to maximise the number of opportunities for eligible participants to be initially identified by a PA and then approached by the researcher.
	1.2 Is the process of analyzing qualitative data relevant to addressing the research question?	<input type="checkbox"/>			According to the researchers, data were coded and analysed using thematic analysis. And their analysis was informed by the study topic guide and the theoretical framework of the study. The analysis processes resulted in the identification of appropriate themes for the study.
	1.3 Is appropriate consideration given to how findings relate to the context?	<input type="checkbox"/>			Yes, the researchers explained clearly how findings from their studies relate to the settings in which the data were collected.
	1.4 Is appropriate consideration given to how findings relate to researchers' influences?	<input type="checkbox"/>			Yes, the researchers explained that a theoretical approach based was adopted to examine the PA-patient communication encounter. They also acknowledged that this approach in medical encounters influences outcomes.

Paper 12: 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 (2013). <https://doi.org/10.1186/1472-6963-13-223>

*****Rejected**** because is a systematic review and major of the studies were from the USA where the current scope of practice of PAs differs from the UK

Study Design	Methodological Quality Criteria	Response			Comments
		Yes	No	Can't tell	
Screening Questions for all types	S1. Are there clear research questions?	<input type="checkbox"/>			To appraise the evidence of the contribution of PAs within general practice.
	S2. Do the collected data allow to address the research questions?	<input type="checkbox"/>			Yes, the data gathered allows the researchers to address the question for the systematic review
	Further appraisal may not be feasible or appropriate when the answer 'No' or 'Can't tell' to one or both screening questions				

Quantitative	4.1 Is the sampling strategy relevant to addressing the quantitative research question?			<input type="checkbox"/>	The study identified many significant publications for the review, but the authors acknowledged that the exclusion criteria of the studies may have limited the evidence available.
	4.2 Is the sample representative of the population under study?			<input type="checkbox"/>	No, the authors acknowledge that they considered a sample from countries with similar primary care systems.
	4.3 Are the measures appropriate?	<input type="checkbox"/>			Yes, the quality of the publications for the systematic review was assessed using the critical appraisal skills programme tools.
	4.4 Is there an acceptable response rate (60% or above)?			<input type="checkbox"/>	The study was a systematic literature review,