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Title

Barriers and facilitators to implementation of non-medical independent prescribing in primary care: a qualitative systematic review.

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Abstract

Objectives

In order to support global workforce deficits and the rising demand for medicines, advanced practice including independent prescribing by nurses, pharmacists and allied health professionals is increasingly integral to service delivery. To guide future development and planning strategies in primary care it is important to understand factors influencing implementation. The objective of this qualitative systematic review was to identify barriers and facilitators to non-medical independent prescribing in UK primary care and explore their influence on adoption, implementation and sustainability.

Methods

Informed by Diffusion of Innovations and the Consolidated Framework for Implementation Research a systematic review of UK qualitative studies (2010-2020) using a thematic meta-synthesis approach was conducted to explore stakeholders' views on independent prescribing in primary care.

Results

Twenty-two articles fulfilled selection criteria and were of moderate to good quality. Themes illuminated core stages in implementation including 1) initial organisational preparation, 2) selection and support of practitioners during training, 3) transition of prescribing into practice and 4) long-term development and sustainability. A need for greater managerial support to ameliorate barriers across the entire implementation trajectory was identified.

Conclusions

In order to address global deficits, there is increasing need for the healthcare workforce to optimise use of independent prescribing capability. However, a more coordinated approach to overcome barriers identified in the four key stages of implementation is required. Given predicted workforce shortfalls in the UK and around the world this will become increasingly important.

Article Summary

Strengths and limitations of this study

- This is first qualitative systematic review using a meta-synthesis approach to explore barriers and facilitators to independent prescribing by nurses, pharmacists and allied health professionals in UK primary care.
- Use of Diffusion of Innovation theory and the Consolidated Framework for Implementation Research supported identification of barriers and facilitators at organisational, team and individual practitioner level.

- Four key stages of implementation including 1) initial organisational preparation, 2) selection and support of practitioners during training, 3) transition of prescribing into practice and 4) long-term development and sustainability were identified.
- As the focus was on primary care barriers and facilitators in acute care and other care settings were excluded.
- In order to develop in-depth understanding of barriers and facilitators at contextual level, quantitative and grey literature was excluded.

Key words

Implementation, barriers, facilitators, non-medical prescribing, independent prescribing, primary care, meta-synthesis

Introduction

Equitable access primary care improves health outcomes, lowers costs and enhances patient experience(1, 2). Global workforce deficits(3-5) and the rising prevalence of long term conditions,(6, 7) frailty,(8) multimorbidity(9-11) and long Covid-19(12) are severely threatening primary care sustainability(12-15). Medicines use in global priorities including diabetes and cardiovascular diseases are increasing, with worldwide drug therapy days rising to 1.8 trillion and an average of 234 days per person(16). With one in four adults in primary care taking five or more medicines daily(17), the workforce implications for meeting prescribing needs are profound.

To address workforce and service sustainability, UK primary care reconfiguration(18) has amalgamated GP practices into primary care networks (PCN), covering populations of 30-50,000(19). Pooling resources to achieve government targets(20), PCN will offer additional hours within broader service options(21). By 2024 an additional 20,000 non-medical staff including advanced/specialist clinical pharmacists, dieticians, paramedic and physiotherapy first-contact practitioners will bolster PCN, bringing workforce skill diversity(22). Integral to advanced practice(23), prescribing capability is likely to be important in this workforce for addressing prescribing and medicines optimisation needs(24-26).

There are over 90,000 UK nurses, pharmacists, optometrists, radiographers, physiotherapists, podiatrists and paramedics(27) who under serial legislative changes(28-31) and with accredited training qualification(32-34) are authorised to prescribe using supplementary and/or independent forms. The former requires initial diagnosis by a doctor and a clinical management plan pre-stipulating medicines that can be prescribed,(35) whilst independent prescribing (IP) permits autonomous diagnostic responsibility and prescribing

without medical input(28). Supplementary prescribing retaining medical dependence is unworkable in many UK non-doctor led community services,(36, 37) and has largely been superseded by IP(38-40).

IP increases practitioner autonomy and expertise,(24, 41-43) enhances clinical outcomes compared to doctor-led care(24) and results in high service-user satisfaction(44). Despite these benefits UK adoption rates vary,(45, 46) with training course drop-out,(42) delayed prescribing onset(47, 48) and role underuse reported(49-52). Difficulties with implementation of IP are frequently cited(39, 42, 47, 53-55). Several UK(56, 57) and international(58-61) systematic and literature reviews,(62, 63) have focused on implementation barriers and/or facilitators. However, these have been profession-specific,(58-61, 63) have addressed heterogenous care settings,(56, 57, 59, 63) or have included international models with varying legislative/jurisdictional levels of prescribing autonomy(58-61) and none have synthesised qualitative studies to better understand challenges of implementing IP within UK primary care. Given demand for IP training has increased following PCN introduction(64, 65) identifying and understanding the challenges of implementation is ever pressing.

Aim

This qualitative meta-synthesis aimed to identify barriers and facilitators to NMIP in UK primary care and explore their influence on adoption, implementation and sustainability.

Theoretical perspective

Rogers' Diffusion of Innovations theory(66, 67) and the Consolidated Framework for Implementation Research(68, 69) were theoretical anchors for interpretive synthesis(70, 71). Diffusion of Innovations focuses on adoption, explaining how innovation attributes,(72-74) adopter characteristics(73) and implementing social systems facilitate innovation diffusion. It emphasises adopter traits and implementation self-efficacy within wider socio-political contexts and has resonance for the complex skill of prescribing(75, 76) which has been under historical medical monopoly(77). The Consolidated Framework for Implementation Research draws on Rogers' theory(68, 69, 78) and provides a framework of 39 constructs representing contextual factors(79) at organisational, provider and process levels most likely to influence implementation(80-82).

Methods

This qualitative meta-synthesis is reported following enhancing transparency in reporting the synthesis of qualitative research (ENTREQ) guidelines(83). Qualitative review(84, 85) was

adopted to synthesise evidence that provides in-depth, contextual understanding of IP implementation, from perspectives of stakeholders key to its delivery(86). Meta-synthesis, theoretically and epistemologically agnostic(87), is a suitable method for identifying and interpreting barriers and facilitators(87, 88). The review was registered in PROSPERO (CRD42019124400).

Search strategy

A systematic search of UK primary and community IP studies was undertaken in June 2020, using search terms developed according to the Sample, Phenomenon of Interest, Design, Evaluation, Research Type (SPIDER) tool(89). These were tested based on truncations of words related to prescribing, nurses, pharmacists, optometrists, and relevant professional groups, primary and community care. Wild card and Boolean Search Operators were used. To avoid specificity and sensitivity limitations,(90, 91) qualitative search terms were not included and all citations were screened for qualitative methodology. Search strings (see supplementary file 1 examples) were adapted for different electronic databases including EBSCO (MEDLINE, CINAHL), OVID (EMBASE) and ProQuest (British Nursing Index, Nursing & Allied Health) and Web of Science. Publications were searched from January 2010 to June 2020 to ensure findings contemporary to policy influencing UK primary care commissioning and re-configuration,(92-94) and extended to December 2020 by re-running search strings in January 2021. Other limits applied to ensure relevance are shown in Table 1. Retrieved citations were downloaded to EndNote V.X9 and duplicates removed.

Table 1 Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
►Primary research	►Literature reviews, meta-analyses or meta-synthesis
►Studies employing participatory and/or non-participatory data collection methods within any qualitative or mixed methods design	►Quantitative studies
►Studies addressing NMIP by legislated non-doctor health care professionals	►Studies addressing supplementary and/or collaborative models of prescribing
►Studies addressing NMIP in primary/ community care	►Studies addressing NMIP in secondary care and/or mixed primary and secondary care settings
►Studies presenting empirical evidence of barriers and/or facilitators to NMIP implementation	
►Studies addressing non-context specific generic educational programmes for NMIP	

► Peer reviewed, full text articles published between 01 January 2010 and 31 December 2020 in the English language	►Abstracts, conference reports
►Studies undertaken in the UK	►International studies

Screening and eligibility

UK studies meeting Table 1 criteria were included. Two reviewers (JE, NC) independently assessed titles and abstracts for eligibility using a three-step screening process. Titles were initially reviewed to exclude non-IP literature, abstracts were screened, and full relevant texts were sought. Reasons for screening exclusion are shown in Figure 1. Reference list hand searching supplemented database searching.

Figure 1 goes here

Figure 1. Flow diagram of selection process and search results (adapted from Liberati et al., 2009)(95).

Quality assessment

Quality appraisal was undertaken using the Quality Assessment Tool for Studies with Diverse Designs (QATSDD), which accommodates qualitative and mixed method designs and includes trustworthiness constructs(96). A graded scoring system (1=very slightly, 2=moderately, 3=complete) for each criterion allows for less ambiguity in distinguishing strong or weak criteria coverage. Possible QATSDD scores range from 0-42 and 0-48 for qualitative and mixed method studies respectively(96). To aid interpretation, scores were converted to percentages and classified as low (<50%: serious methodological defects with poor scientific value), medium (50-70%: moderate methodological defects without serious scientific detriment) or high (>70%: robust scientific methods meeting most benchmarks) quality. In order to expose methodological weaknesses in the literature(97, 98). studies were not excluded on the basis of quality assessment(84, 99).

Data extraction and assessment of relevance

Following best practice(100) study data were extracted by one author (JE) to a bespoke table adapted from recommended templates(101). This collated contextual and methodological information and was piloted on 5 index studies to ensure consistency and

usability. To help contextualise barriers and facilitators, main findings were included. Data extraction was recursive and involved repeated review/update between ensuing analysis stages(102).

Data analysis and synthesis

Data analysis followed a four stage, iterative process described by Thomas and Harden (2008) (Table 2). Qualitative "data" referred to participant quotations, (sub)themes, explanations, hypotheses or new theory, observational excerpts and author interpretations(103). Barriers were defined as "any obstacle (material or immaterial) impeding adoption, implementation and/or sustainability of IP"(104, 105) and facilitators were defined as "any obstacle (material or immaterial) enhancing adoption, implementation and/or sustainability of IP"(104, 105).

Table 2 Stages of analysis

►Stage 1 - In-depth reading and familiarisation with individual papers, data extraction
►Stage 2 - Inductive line-by-line coding of highest quality, index papers (n=5) by two independent reviewers (JE, NC).
►Stage 3 - Codes agreed, grouped into descriptive themes using NVivo(106); codebook applied to all papers
►Stage 4 - Descriptive themes organised into analytical themes, matrix charted with corresponding quotes

Rigour within the analytical process

To ensure analytic rigour, two independent reviewers (JE, NC) initially performed inductive line-by-line data coding from 5 highest quality index papers (stage 2). Each reviewer produced sets of open data codes which were compared and discussed. If different codes and/or different interpretations were assigned to a concept, these were discussed and revised. Data codes were subsequently grouped into descriptive themes, creating a codebook for application to all papers (stage 3). To identify possible contradictory cases and clarify thematic commonalities within studies,(107) a matrix of participant quotes was charted to constituent themes(108).

Patient and public involvement

As part of a PhD exploring paramedic IP(109), a University service user/carers group was consulted about paramedic working and prescribing in primary care, the approach of preliminary systematic review and data collection tool design. Users ratified the concept and

potential benefits of paramedic IP to primary care and highlighted the importance of stakeholder perspective.

Results

Search outcome

Outcomes of database searches are reported in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow chart in figure 1. Twenty-two papers representing 19 unique datasets were included and underwent quality appraisal(110-132).

Study characteristics

Studies, summarised in Table 3 and detailed in on-line Supplementary file 2, were qualitative,(110, 113, 115, 117-122, 124, 126, 127, 129-132) mixed method (111, 112, 114, 116, 123, 124) and survey(125) designs. The majority addressed nurse IP,(110-112, 114-116, 118-122, 125, 128, 130, 132) with fewer studies including pharmacists(113, 117, 124, 126, 129, 131) or other professions(123). Ten studies conducted pre-2011 reflected an historical primary care context and nursing workforce in early national IP adoption,(111-113, 115, 119-121, 129-131) with recent pharmacist IP roles suggesting more contemporary, multi-disciplinary environments(124, 126). IP was researched in general practice,(118-120, 125) community(114, 121, 122, 124, 126, 128, 132) or mixed settings(110-113, 115-117, 123, 129, 130). Participants included prescribers,(113, 114, 116-119, 121, 122, 128, 129, 131, 132) non-prescribers,(123, 125) students and educational staff,(110-112) service-users(115, 116, 120, 130) and multi-disciplinary team members(124, 126, 131, 132). Studies explored training,(110-112) IP job roles,(113, 118, 119, 121, 128, 131) patient acceptance,(115, 120, 130) prescribing/medicines optimisation practices,(114, 116, 122, 123, 132) implementation feasibility(124) and barriers and/or facilitators(117, 125, 126, 129).

Table 3. Study characteristics (n=22)

Author(s), year	Country	Study focus	Participants	Setting(s)	QATSDD score	Quality rating
Afseth & Paterson (2017)	Scotland	Views on training	6 student nurses 6 DMPs	Higher education institute	67%	Moderate
Boreham et al (2013)	Scotland	Views on training	87 student nurses 10 programme leads	Higher education institute	67%	Moderate
Bowskill et al (2014)	England	Views on training	6 student nurses 3 mentors	Higher education institute	60%	Moderate
Brodie et al (2014)	Scotland	Views on prescribing role	4 nurse IPs 4 pharmacist IPs	General practice Community	38%	Low
Cole & Gillett (2015)	England	Prescribing practices	6 clinical nurse specialist IPs	Community palliative care	29%	Low
Courtenay et al (2010)	England	Patient views on nurse prescribing	41 patients	General practice Community clinic	50%	Moderate
Courtenay et al (2017)	England Scotland Wales	Patient views on nurse and pharmacist prescribing	16 nurse IPs 1 pharmacist IPs 22 patients	General practice Community clinic	67%	Moderate
Courtenay et al (2019)	Wales	Factors influencing antibiotic prescribing	17 nurse IPs 4 pharmacist IPs	General practice Out-of-hours Unscheduled care Intermediate care	78%	High
Cousins & Donnell (2012)	England	Views on prescribing role	6 nurse practitioner IPs	General practice	59%	Moderate
Daughtry & Hayter (2010)	England	Experiences of prescribing	8 practice nurse IPs	General practice	36%	Low
Dhalivaal (2011)	England	Patient views on nurse prescribing	15 patients	General practice	43%	Low
Downer & Shepherd (2010)	Scotland	Views on prescribing role	8 district nurse IPs	Community	48%	Low
Herklots et al (2015)	England	Experiences of prescribing	7 community matron IPs	Community	43%	Low
Holden et al (2019)	England	Medicines optimisation practices	21 physiotherapists	Unspecified NHS and non-NHS settings	75%	High

Inch et al (2019)	England	Feasibility of implementation	2 pharmacist non-IPs 4 pharmacist IPs 6 GPs 16 care home staff 2 patients 3 relatives 1 dietician	Elderly residential care	54%	Moderate
Kelly et al (2010)	England	Barriers to adoption	31 practice nurse IPs 120 nurse non-IPs	General practice	33%	Low
Lane et al (2020)	England Scotland Northern Ireland	Barriers and facilitators to prescribing	27 pharmacist non-IPs 29 GPs 12 care home staff 7 patients 7 relatives	Elderly residential care	78%	High
Latham & Nyatanga (2018a,b)	England	Views on prescribing role	6 nurse IPs	Community palliative care	71%	High
Maddox et al., (2016)	England	Barriers and facilitators to prescribing	25 nurse IPs 5 pharmacist IPs	GP practices Community Nursing Homes Community pharmacy	71%	High
Stenner et al (2011)	England	Patient views on nurse prescribing	41 patients	General practice Community clinics	55%	Moderate
Weiss et al (2016)	England Wales	Views on prescribing role	7 nurse IPs 7 pharmacist IPs 7 GPs	General practice	52%	Moderate
Williams et al (2018)	England	Factors influencing antibiotic prescribing	15 GPs 15 nurse IPs	Out-of-hours	76%	High

DMPs – designated medical practitioners, GPs – general practitioners, IPs – independent prescribers.

Implementation and identification of barriers and/or facilitators

Studies were undertaken in exploration,(123, 125, 126) adoption,(124) and post-implementation phases(110-122, 127-130, 132) of IP. None were sustainability focused. Five studies had primary aims of identifying barriers and/or facilitators(117, 125, 126, 129, 132), and 4 reported findings as factors influencing NMIP(113, 121, 123, 128). Synthesis identified barriers and/or facilitators within the remaining 13 studies(110-112, 114-116, 118-120, 122, 124, 130, 131). Earlier research centred on prescribers or service-users(112-115, 118-123, 125, 128-130) with more recent studies adopting wider organisational perspectives(110, 111, 124, 126, 131, 132) and/or featuring implementation,(117, 126) psycho-social(131) and behaviour change theory(117).

Relevance of studies to the review

Studies with highest relevance to review questions covered multiple primary care contexts,(117, 126, 129) included mixed stakeholder groups,(124, 126, 131) addressed specialist/non-specialist NMIP(117, 129) and targeted barriers and/or facilitators within aims/objectives(117, 125, 126, 129). Other studies based on the relative representation of the latter, as shown in Table 3 were indirectly or partially relevant to review questions.

Methodological quality

Full methodological quality assessment details are provided in on-line supplementary file 3 (see Table 3 for summary). Six studies were high quality,(117, 123, 126, 128, 129, 132) 9 were moderate quality(110-112, 115, 116, 118, 124, 130, 131) and 7 were low quality(113, 114, 119-122, 125). High quality studies adhered more closely to technical aspects of qualitative(117, 126, 128, 129, 132) or mixed methods research,(123) had larger samples sizes,(117, 123, 126, 129, 132) explored perspectives from different professional/non-professional groups,(117, 126, 129, 132) provided richer contextual descriptions(117, 126, 128, 129, 132) and/or used implementation theory(117, 126). Barriers and/or facilitators were explored in greater depth in these studies.

Thematic synthesis findings

The following presents findings on barriers and facilitators in 4 major analytical themes, representing synthesis of 11 descriptive sub-themes. Table 4 shows their relationship and provides a matrix of participant quotes exemplifying constituent themes. Study contribution to thematic barriers and facilitators is further detailed in on-line supplementary file 4.

Table 4. Themes, corresponding studies and indicative quotes

Descriptive Theme	(N) Studies	Indicative quotes
Analytical theme 1: Optimising organisational readiness		
Theme 1.1 Clinical need and remit	N=18 (110, 113, 115-119, 121-126, 128-132)	• *"It's about framing your service so that actually people understand what benefit it's going to be for them."*(126) • *"Because I have to write, send it to the GP, it has to land on the GP's desk, then the patient has gotta make an appointment to see that GP, then the prescription comes from the GP, and then they go and fulfil that prescription, and then make an appointment to come back and see me."*(123) • *"You're not waiting for medics to come and do your prescribing; you can do it as an autonomous practitioner, right from seeing the patient and, if they've got an instant need, you can prescribe and administer…the most crucial aspect of it—continuity of care."*(128)
Theme 1.2 Managerial leadership	N=18 (111-115, 118-126, 128-131)	• *"GPs do not understand the benefits of nurse prescribing."*(125) • *"It's just like having another partner who can deal with certain conditions, and who also works as a nurse within the practice."*(131) • *"I phoned up for advice...but she (manager) really didn't know… if I could prescribe for other practices out of hours or at the weekends. Anything I knew, I knew myself."*(121) • *"I wanted to do the nurse prescribing course for two years – until the BNF was opened fully, it was not worth my while. Now it is, my employing GPs will not support me, even though all my work is in extended or advanced role. There is a large medical mountain of negativity to overcome."*(125)
Theme 1.3 Inter-professional environment	N=11 (110, 111, 119, 121, 122, 124-126, 128, 129, 131)	• *"I'd ask the question why. Why? I mean if you want to be a doctor, be a doctor, if you want to be a nurse, be a nurse, but if you're a nurse you can't do nice bits of doctoring that you feel… I find it odd that other professions want to grab bits of medicine that's out.. with their own training."*(131) • *"t was building that trust that you could do it, and you were careful, and you were competent and you observed safety aspects."*(122) • *"I've had nothing but support. They created a consulting room for me, put all the systems in place, the diagnostics, even putting notices in the notice-board for the first year or two so the patients were aware. And the staff were all made aware of it, we have practice meetings, the practice nurse was consulted…."*(131)
Analytical theme 2: Optimising practitioner readiness		
Theme 2.1: Selecting the right practitioners	N=14 (111, 113-118, 120, 123, 125, 126, 128, 130, 132)	• *"I don't think we get paid enough to make those decisions. For me prescribing right does carry a lot of accountability and responsibility…at my level I'm not sure that's something I'd want to take on board."*(123) • *"You have to be competent, not only with your history taking… but, examination skills; you have to be able to examine… you have to be able to relate those findings… to the patient in a language that they can understand."*(117) • *''She explained a lot of things that to be quite honest I didn't really realize. Then she showed me a pattern of what*

		the insulin was doing and what the new insulin would do and how it would be beneficial to me. She went through it step-by-step and she explained a lot, and she drew little diagrams you know, an idiot proof kind of thing so you understand it."(130) •*"[I tell patients]. . .'this is normal; this is normal. That's really good. Your temperature's normal,'. . .this is what they've got and what the normal duration of that illness is. . .there's no need for antibiotics. . .I try and present that as a positive so, 'Oh, the good news is you don't need any antibiotics. You can manage this yourself at home.' It's about how you give that message really."*(132) •*"If you give a very good physical assessment, and then go through your findings with them, they are quite happy to not have a prescription, most of the time."*(116)
Theme 2.2 Preparing for training	N=5 (110-112, 123, 125)	•*"Reassurance that I could do [the course] with present qualifications or what I need to do to obtain these before I do the prescriber's course."*(125) •*"It was right at the beginning of the course when we started going through all the work and stuff and you think god how am I going to do this?."*(112)
Theme 2.3: Optimising and supporting training	N=5 (110-112, 114, 125)	•*"I think when we did our prescribing training … some of us had a lot of very active, proactive support from the medical mentors and some of us had less than that."*(114) •*"I have had to spend some time with my DMP to become familiar with the structure [of the course] and the competencies – that is not an assessment he has been really familiar with…I had to educate them … on how the course works."*(110) •*"As much as I would like but there be no-one doing my work while I am away. I just have to catch up."*(111)
Analytical theme 3: Focusing on early transition support		
Theme 3.1 Transition as a point of vulnerability	N=7 (112, 117, 119, 121, 122, 128, 129)	•*"I think as soon as they realize you can prescribe they expect you to be able to do exactly what doctors can do.* •*They don't understand your limitations …., and they expect you to sign repeat prescriptions, and send everybody through to you. So it can be quite difficult at times explaining to them."*(119) •*"I felt prepared, I felt excited, but I also felt petrified. Yes, the first prescription I sort of double checked, triple checked and I also rang the pharmacist afterwards to make sure I'd done it right."(128)* •*"When you've done the course, you lose a lot of confidence, because you learn a lot more about, you know the dilemmas and the ethics of prescribing, and that you've got to know a lot more about that drug before you prescribe it, so, then, it's actually harder to prescribe it independently."*(129)
Theme 3.2 Nurturing confidence and competence	N=9 (112, 114, 118, 119, 121, 122, 128, 129, 131)	•*"When I start working in a practice, I tend to try and agree ground rules, rules of engagement… about what it is they want me to do….so if I get people with musculoskeletal problems . I pass them over in that they expect me to just sort of stay within my boundaries."*(129) •*"I think once you start writing prescriptions, then that's when other problems come up don't they, that you have not come across until you actually start writing."*(112) •*"The first time I had to ask the GP if I was actually on the right lines, just for that support and that I was definitely doing the right thing. It's not as difficult the second and the third and the fourth time."*(121)
Theme 3.3	N=8	•*"If I am in any whatsoever doubt then I just buzz through to the GP (family physician)."*(129) •*"I suppose the bottom line is I don't get any formal support. I mean, I get support in an informal way from GPs*

Transition support needs	(113, 114, 117, 118, 121, 122, 128, 129)	*and the consultant and my colleagues."*(121) •*" think they [doctors] sort of assume sometimes that we know more than we do, and I think they assume we have huge confidence in our skills when we don't and what I would love is to sort of have a week or two a year when I was buddied up with a doctor, and he/she made me do all the prescribing. It would be terrifying but it would really make me learn, I think."*(122)
Analytical theme 4: Maximising and sustaining		
Theme 4.1 Service delivery	N=14 (113, 114, 116-119, 121, 122, 124, 126, 128, 129, 131, 132)	•*'"Non-medical prescribing consultations—the time tends to be much longer."*(113) •*"You've sometimes got limited information … their [GPs'] notes come through like a summary. They can be helpful at times. Other times, it's just lists going back years of medicines that have been prescribed."*(128) •*"I don't think all our colleagues are clear about non-medical prescribing. Also, patient expectations can cause problems. It can be hard to persuade them that they don't actually need a prescription. This causes pressure and takes up consultation time."*(118)
Theme 4.2 Developing and maximising roles	N=14 (113, 114, 116-119, 121, 122, 124, 126, 128, 129, 131, 132)	•*"It's altered my role quite in depth because in the post I am in now we have open access drop-in sessions for minor illness. We see anything from an ingrown toenail to somebody with chest pain. In the afternoon we work on an appointment basis, running chronic disease management clinics and weight management clinics."*(119) •*"Expanding your prescribing may be difficult, not because of your knowledge of the drugs, but because there's no training at a good enough level for the other stuff, you know, how do you become competent to treat osteoporosis, there are no courses."*(129) •*"I don't think I have increased my scope over the years; to be frank, I think I have quite a limited range that I feel confident doing, using and I haven't gone outside it. …But I certainly don't feel the need to suddenly become an expert in you know, Parkinson's meds or anything; I just wouldn't touch it."*(122) •*"I don't see how that could happen with the QOF (Quality and Outcomes Framework) targets ... there will be no money there for the practice and you need to money to pay for nursing time. For (MH) there's not a target ... so I genuinely don't think it's going to become part of the practice nurses remit."*(113)

Analytical theme 1: Organisational readiness

This analytical theme identified organisational readiness, managerial cooperation and conducive inter-professional climate requisite for successful implementation. IP service need to rectify medicines pathway gaps and team implementation intention clarity were key. Consultation promoted collective vision for IP and helped team members understand their role in implementation. Collegiate environments with good inter-professional relations created conducive climates.

Theme 1.1: Clinical need and remit

Identifying both clear need to manage patient prescribing and existing medicines pathway shortfalls were prerequisites for implementing IP. Studies described a highly qualified, specialist nursing and pharmacy workforce delivering unscheduled, scheduled and out-of-hours services(113-119, 121, 122, 124, 126, 128, 130-132) who routinely made autonomous clinical decisions necessitating prescribing and medicines optimisation skills(110, 115-117, 122, 128, 130, 132). IP held tangible advantage over former methods of GP referral and/or defacto prescribing for accessing medicines which, subject to GP workload(114, 124, 126) and constrained availability,(122, 124, 126, 128) were labour intensive,(122-124, 126, 128) inefficient,(118, 122, 123, 128) and burdened services and patients through additional healthcare contacts(115, 119, 121, 123, 124, 128, 130). By removing third party requirement, IP improved responsiveness with respect to medicines,(115, 117, 121, 122, 124, 126, 128, 130) enhanced care quality,(113, 124, 128) and helped prevent adverse outcomes(122).

Team clarity and transparency on IP implementation intentions was paramount(119, 121, 122, 124, 126, 128, 129, 131). Lack of IP role understanding could lead to poor integration,(131) role ambiguity(131) or misuse(113, 118, 122, 129). Consultative stakeholder processes helped clarify current medicines pathways bottle necks,(126) cemented clinical advantage of implementation(126) and encouraged collective understanding of IP(124, 126, 131). Conversely, if existing medicines pathways were perceived expedient and IP held limited advantage, adoption was less likely[123, 125].

Theme 1.2: Managerial leadership

Highly dependent on managerial cooperation, prescribers reported stage specific and on-going funding,(111, 123, 125) training(112-114, 118, 119, 121, 122, 129) and infrastructural needs(113, 114, 121, 122, 128, 129) extending across the IP implementation trajectory. Input was, however, frequently reported to diminish post-adoption(111-114, 118, 119, 121-

123, 125, 128, 129) and many practitioners believed managers undervalued IP(113, 118, 119, 123, 125) or misunderstood its service potential(113, 125). Prescribers ascribed high value to IP for improving service efficiency(117, 118, 121, 122, 128, 129) and skill utilisation,(113, 114, 118, 122) perceiving it extended clinical knowledge beyond prescribing,(113, 114, 122, 128) enhanced clinical confidence,(113, 119, 121, 122, 128) and job satisfaction,(118, 121, 128) and facilitated team education(113, 124, 131). Prescribers perceived themselves a unique workforce resource with potential for better mobilisation in under-resourced areas (e.g., mental health)(113). However, there was perception that management lacked appreciation of primary care workforce aspirations for IP(125) and overlooked its scope(113, 123, 125). Better recognition and commitment was considered essential for leveraging and driving IP services forward(113).

Ensuring teams understood IP and its role within care delivery mitigated subsequent barriers(118, 119, 122, 131). Understanding, particularly if IP reconfigured care(124, 126) was critical for implementation success(119, 121, 122, 124, 126, 128, 129, 131). Doctors, receptionists,(118, 119, 131) dispensing pharmacists,(128, 131) and peer colleagues(121, 128, 129, 131) all played supervisory and/or infrastructural roles in IP and understanding the need for this input was essential. Staff clarity on their roles in relation to IP positively influenced willingness to provide enabling supports such as clinic administration,(118, 131) record access,(126) and pharmacy advice(122, 128). Acceptance and positive attitudes towards IP as a shared skill was facilitative(124, 126, 131) and mitigated the likelihood of "turf wars" emerging if IP roles was perceived to encroach on professional territories(131).

Theme 1.3: Inter-professional environment

Trusting inter-professional relationships promoted different skill appreciation(131), helped ratify IP(110, 131) and built team confidence in the prescribing competence of nurses and pharmacists(110, 122). Good relationships facilitated information transfer(122), promoted supervision provision,(129, 131) shared learning(110) and team working(131). While many IPs reported positive relationships with doctors,(119, 121, 122, 128, 131) others described jurisdictional tensions(119, 125, 131). Building trust for IP where relationships were weak took time(124) and given the important supervisory role of doctors in IP,(113, 114, 118, 121, 122, 128, 129) consideration of their strength in adoption planning is pertinent. Good communication networks were more likely where established relationships and positive attitudes towards IP prevailed,(122, 131) and were important for imparting team IP knowledge,(118, 124, 126) for developing supervision and peer support(122, 128) and promoting teamwork(126, 131).

Analytical theme 2: Optimising practitioner readiness for training

This analytical theme identified skills compatible with NMIP that are relevant to workforce selection. It identified need to optimise practitioner expectation and knowledge of training and improve provision of support during training.

Theme 2.1: Selecting the right practitioners

Overall, strategic planning for IP workforce selection lacked scrutiny, and practitioner choice,(111, 113, 118) expectation of improved job satisfaction,(118, 125, 128) efficiency and patient benefit(111, 118) were primary drivers for uptake. Training course drop out(111) and failure to prescribe following training,(113, 114) suggest a need to ensure selection procedures match skills and capabilities to IP and increase chances of training investment. Synthesis identified essential skills(113, 115, 117, 118, 120, 128, 130, 132) and personal motivation(111, 113) as important considerations. Study demographic data indicated a clinically experienced workforce,(113, 118, 119, 128, 129) with degree/higher degree educational and/or specialist skills attainment(111, 115, 122, 130). Advanced physical assessment and clinical specialty skills not only suggested expertise and theoretical knowledge to underpin IP but were also recognised by patients as important contributors to care quality(115, 120, 130). Patients reported high levels of confidence in IP led care, with the caveat that prescribers demonstrated knowledge and expertise(115, 120, 130). Good interpersonal, communication, examination, history taking and diagnostic skills were key. These were mandatory for differential diagnosis(115-117, 130, 132) and holistic management,(118, 128, 132) for conferring prescribing decisions,(116, 117, 132) managing patient expectations for prescribing,(116, 117, 132) and promoting treatment concordance(113, 115, 117, 120, 126, 130, 132). Motivational deterrents to IP uptake identified by non-prescribing nurses(125) and physiotherapists(123) included being near retirement,(125) reticence for further training,(123, 125) concerns about training rigor,(123) and perception of effort/remuneration imbalance(123, 125). Although IP job satisfaction and professional benefits were considered future adoption drivers(125) lack of financial remuneration in particular disincentivised practice nurse(125) and physiotherapy adoption(123).

Theme 2.2: Preparing for training

Using a generic, inter-professional model UK IP training programmes deliver 26 days equivalent fulltime education alongside a supervised learning in practice period(110). Given the onus for safe prescribing, programmes were reported by students and prescribers to be academically rigorous(112, 128). There was evidence however that students lacked key knowledge about the generic training model,(125) learning expectations of different

pedagogies,(110) as well as course assessment and portfolio requirements(111). Expecting narrower, speciality specific rather than generic training was common(111, 128). Students found academic demands of training whilst continuing usual clinical duties challenging indicating a need to better balance work, personal and academic commitments(110, 112).

Theme 2.3: Optimising and supporting training

The degree of allocated support time(111, 112) and the quality of mentoring during supervised practice learning(110) were key influences on student learning experiences. Adequate study leave, protected time and backfill respectively optimised study time, reduced personal time encroachment and negated need to absorb usual role duties while training(111). Despite organisational requirement to confirm study leave arrangements pre-training, primary care allocation was highly unstandardised, with some students entering training without confirmed agreement(111). Prepared practice mentors with clarity on role obligations in general provided higher levels of student input(110), and good mentor-student relationships that continued post-training facilitated transition(114). Additional training buddying schemes provided moral support for courses, although time constraints limited their uptake(112).

Analytical theme 3: Focusing on early transition support

This analytical theme identified the transition period post-qualification key to development of confidence and competence, with high need for supervision and provision of informal and formal support. Delineating competence boundaries supports early prescribing development.

Theme 3.1: Transition as a point of vulnerability

Many IPs held vivid memories of anxiety and fear during their first IP encounters,(119, 121, 122, 128, 129) reporting a diminution of self-confidence during early transition(117, 119, 121, 122, 128, 129). This finding traversed the review decade and was unrelated to how prepared prescribers felt by training(119, 128). Heightened awareness of the risks of error,(129) the cautionary approach instilled by training,(119, 129) and liability for personal accountability(121, 128) fuelled feelings. It was recognised that self-confidence and competence development were essential for prescribing(119, 129) and mitigated anxiety(128), but were highly dependent on exposure to prescribing opportunities,(128, 129) time(119, 129) and above all, available support levels(110, 114, 121, 128, 129). Without a channel for accessing supervision, prescribers could doubt competence, lose confidence and defer from prescribing(129). This led to lack of competence development and underutilisation of NMIP(129) and suggests greater acknowledgement of transitional developmental needs is necessary.

Theme 3.2: Nurturing competence and confidence

Establishing competence boundaries and recognising personal limitations was an important enabler in transition(119, 129). NMIPs defined competence as the immediate clinical areas in which they had the knowledge and confidence to prescribe(118, 119, 121, 122, 129, 131). Delineating its scope by self-restricted formula use within circumscribed clinical areas(118, 122, 128, 131) and adhering to clinical guidelines and protocols(119) encouraged early competence development,(129) whilst traversing its “comfort zones”,(119) as in cases of complex polypharmacy or comorbidity,(114, 122) was deemed risky, unsafe and unprofessional(118, 129, 131). Prescribers reported that teams often lacked acknowledgement of self-confidence issues related to competence,(122) and exerted inappropriate expectations for IP(114, 118, 119). Prescribers recognised that as a new skill, prescribing competence was time and opportunity dependent(119, 128, 129) and several expressed anxiety that prescribing skills would diminish during transition if not utilised(128).

Theme 3.3: Transition support needs

Reports of poor transition support pervaded the review decade(113, 114, 117, 118, 121, 122, 128, 129) with limited evidence of pre-emptive, formalised supervision provision(114). NMIPs reported this absence as immediately impactful,(121) especially in isolated roles and in services with few prescribers(113, 129). While prescribers desired structured and informal supervision,(122) in all 7 studies addressing this theme,(113, 114, 118, 121, 122, 128, 129) most could only access a variable level of informal support. “Open door” contemporaneous advice provided from GPs was the primary source, although specialist doctors, peers and pharmacists were consulted. Team receptiveness to providing this mentoring,(129) its reliability(117, 121) and accessibility(128, 129) were key facilitators. Informal opportunities for discussion provided security(129) and were valued(118, 121, 128, 129). Exemplifying barrier interdependence, lack of mentoring relationships with doctors limited opportunity for informal support, prevented prescribing and limited competence with specific medicines or clinical conditions(129). In turn this necessitated re-engagement of GP referral for prescribing and culminated in inequitable patient medicines management(122, 129). To address shortfalls in formal support provision, several prescribers set up local peer networks,(114, 118, 122) however strong desire for formalised mentorship was expressed(122).

Analytical theme 4: Maximising and developing

This analytical theme describes barriers and facilitators identified under the descriptive sub-themes *service delivery* and *role development* which relate to how IP is used and maximised in primary care.

Theme 4.1: Service delivery

Prescribers reached consensus that IP promoted efficient, streamlined services(118, 119, 121, 122, 124, 128). However, views on how it impacted individual practitioner workload were opposing(118, 119, 121, 122, 128, 129). NMIP reportedly lengthened consultations,(113, 118) added administrative tasks(121, 128) and increased job-related stress(118). Undertaking in-depth holistic assessment to inform prescribing needs imposed time constraints,(113, 132) which were exacerbated in strict ten-minute clinic allocation systems(117, 118). Additional time and experience could however be mitigating(117, 132). Community IPs reported their main workload barriers as administrative and related to absent or incompatible electronic record and prescription generation systems(114, 121, 122, 128, 129, 132). Seeking clinical information caused significant delays, in some cases causing IPs to revert to GP referral(114, 121, 128, 129). However, recent IT accessibility was suggested to mitigate retrieval problems(126).

Attitudes towards role change because of IP also influenced perceptions about workload (118, 119). Some prescribers perceived that prescribing skill acquisition inherently equated to GP responsibility abdication,(128) increased workload and job demand(118, 119). Prescribers negatively referred to these expectations as work offloading,(119) and were suspicious of underpinning financial motives(125). Alternatively, other prescribers viewed IP at broader service level benefit and opportunity to reduce GP colleague workforce pressures(114, 126, 128). While GPs in one study stressed their acceptance of pharmacist IP rested on whether it increased existing workload(124) limited team member involvement within studies precluded synthesis of wider primary care workload impact of IP.

Theme 4.2: Developing and maximising roles

Despite limited contextual detail on workforce planning and service arrangements for developing IP,(113, 126, 131) synthesis identified enhancement, substitution and role specific implementation “models”. These varied according to whether competence expansion changed client groups and/or whether service reconfiguration occurred. Role enhancement introduced IP to established practitioner roles (e.g., community matrons, nurse practitioners) within pre-existing service patterns and care arrangements(119, 121, 122, 128, 129, 131) and was associated with core minimum prescribing competence(122, 131). Substitution replaced GP services (e.g., out-of-hours GP services(116) and domiciliary palliative

care,(128) minor illness and triage services(119) or extended service referral criteria(121, 128). Service re-configuration accompanied this model, although change in competence was not always necessary(113, 121, 124, 126, 128). Role specific models, limited to pharmacist elderly residential care(124, 126) were implemented in IP naïve settings, and introduced specifically to utilise IP skills. Extension of core competence and major care reconfiguration were inherent. One study found that IP employment models influenced successful role integration,(131) with direct GP practice employment as opposed to commissioned IP services creating greater sense of permanence, better IP role use, and enhanced team involvement. More latterly, GP practice co-location for Clinical Commissioning Group employed clinical pharmacists was advocated to foster relationships, trust and team building(124, 126).

Personal advancement rather than organisational strategy appeared primary drivers of enhancement and substitution models,(131) although likelihood increased where skill mix was recognised,(126, 131) with CPD availability(131) and where doctors provided leadership(119, 131). Absent policy and national targets restrained IP resource allocation,(113) whilst policy and national guidance was facilitative(124, 126). Doctors also imposed constraints on IP by limiting clinical caseloads,(119, 129) restricting formularies(114, 131) or by retaining sole diagnostic prescribing responsibility for patients(113, 126). For some prescribers, competence expansion was synonymous with crossing job descriptions and mandated formal negotiation with employers(129).

Provision of CPD overall was inconsistent, untargeted to evolving learning needs(118, 129), and prescribers identified pharmacology,(121) statutory drug updates(118) as key topics. Lack of confidence with heart failure,(122) mental health conditions,(113) polypharmacy and off-label prescribing(129) suggested CPD in co-morbidities warranted further input. Trust provision included forums/meetings,(118, 122) commissioned training, national conference attendance(121, 131) and electronic journal resources(121). However, provision varied widely and with few prescribers reporting accessible CPD systems,(118, 122) there was agreement that improved implementation was necessary(113, 118, 121, 122, 129, 132).

With time and input to create support systems(122) and enhance communication concerning role boundaries(128) prescribers reported that IP integration improved. However, formal evaluation following implementation was rare(114), with only two studies(117, 132) identifying quality assurance activities beneficial to antibiotic stewardship evaluation including service outcome data audit and local/national data benchmarking.

Discussion

The future of UK primary care is reliant on non-medical workforce expansion and introduction of new first-contact roles(21, 94, 133-135). Ensuring practitioners have the right skills to enable sustainable service development, at scale and pace is key(136, 137). An increase in UK non-medical prescriber numbers following PCN introduction(25, 65, 138) suggests prescribing capability is important for workforce transformation. This is the first meta-synthesis underpinned with implementation theory to address barriers and facilitators influencing IP exclusively in UK primary care settings.

Important to evidence synthesis for informing policy and practice,(71, 87, 139) theory can help make sense of implementation complexity and identify pathways to innovation success or failure(140). Covering adoption, implementation and dissemination stages(141), Diffusion of Innovation theory and the Consolidated Framework for Implementation Research aided identification of known organisational, practitioner and service-user level determinants(73, 142) and facilitated temporal examination of IP from initial identification of need to development in practice; a dimension lacking in previous UK reviews(56, 57, 59, 63). In its infancy in UK non-medical prescribing research(55), implementation theory will become increasingly important for informing strategies to overcome barriers as governance arrangements with extended prescribing rights become more complex across a greater number of regulators(138) and the primary care socio-political landscape continues to change(143).

From stakeholders' experiences of implementing IP, we identified barriers characterising adoption and implementation stages relating to organisational readiness, practitioner selection and support, transition and subsequent role development. While IP enhanced workforce skill utilisation and held service improvement potential, prescribers were concerned that it lacked strategic prominence in primary care. In line with national reports of inconsistent implementation across Clinical Commissioning Groups,(39, 42, 45) the statutory UK bodies responsible for the planning and commissioning of health care services, response to the non-medical prescribing agenda has been sluggish in some areas of the UK,(47) with reforms decentralising primary care commissioning either marginalising(47) or fragmenting its funding(144, 145). Moreover, in common with national evaluations,(39, 47, 146, 147) this synthesis identified a continuing practitioner led implementation of IP with largely voluntary uptake. Contrary to secondary care,(50) there was limited evidence(124, 126) for policy driven service design or targeted strategy embedding IP within career or service pathways. This suggests a disjointed approach to implementation that may reflect the rapidly changing policy and service context of UK primary care(148-150). However, with a third of the non-medical general practice workforce near retirement age,(151) and

succession of Clinical Commissioning Group procured IP roles lacking guarantee,(131) sustainability of IP is a key concern for the primary care workforce and management of ongoing and future patient demand(152).

Transition was identified as a key stage in implementation that warrants greater scrutiny and has resonance for professions new to prescribing such as paramedics. While its affective nature(75, 153) and the need for bespoke support systems is previously recognised,(154, 155) few studies have specifically sampled novice prescribers(153, 156) to ascertain optimal supervisory requirements(75). Despite. extension of IP rights to optometrists, physiotherapists, radiographers, podiatrists and paramedics over the past thirteen years, focus on implementation issues during transition within each profession has been limited(39, 157, 158). This is likely to be especially important for paramedics who, awarded IP rights in 2018 have not been subject to a supplementary prescribing lead in period that has characterised other professions(159) and are historically less well established in the primary care workforce(160, 161). Early data suggesting challenges around role isolation, team expectations for paramedic IP roles and lack of parity in legislation for controlled drugs warrant further exploration to determine whether this profession too, faces other barriers identified in this review(158, 162).

In common with other UK reviews,(56, 57) we found limited overall focus on the strategic element of IP implementation at either local, regional or national level. This may reflect the multiple changes made to policy,(163) leadership(164) and commissioning following the 2012 Health and Social Care Act(165) and the on-going embedding of governance structures within PCN(166). Of note, despite finding a need for more cohesive managerial support that extends across the entire implementation trajectory, minimal reference was made to the championing and change agent functions of non-medical prescribing leads(154, 155). The Department of Health has long recommended implementation of non-medical prescribing under direction of a designated lead with strategic, operational and governance footholds(28). A lack of representation in recent regional research(138) supports the tenet that many of these roles were not replaced by Clinical Commissioning Groups following abolition of primary care trusts(155). Successful implementation is more likely when champions are fully organisationally supported(167) to provide sustained input to implementation activities(154, 168, 169). However, a lack of non-medical prescribing lead role infrastructure, clarity and designated time,(138, 155) along with the increasingly diverse non-medical prescribing workforce is challenging this important role. While other models of workforce mentoring show promise in primary care,(170) the repetition and frequency of

barriers exposed by this review indicate urgent need for a more cohesive approach to supporting IP.

Strengths and limitations

This review strengthens the UK IP implementation evidence base by identifying theory based barriers and facilitators in traditional and contemporary primary care contexts. Using comprehensive search strategies and robust analysis methods, it highlights factors during adoption, practitioner selection, training and transition time points which can be used by practitioners and policymakers to identify areas for improving implementation support.

Although limited to UK literature, the use of theory ensured common factors known to facilitate implementation (e.g., overarching policy, the need for leadership and championing) and which are generalisable to any implementation context, in the UK or internationally were identified. We did not however include grey literature and although our qualitative synthesis enabled rich description of elements perceived by stakeholders to influence implementation of IP in the UK, reviews that include quantitative literature in primary care are encouraged. Our focus on primary care excluded barriers and facilitators that may be unique to acute care and other settings. Moreover, as the non-medical prescribing agenda is disseminated across the NHS, it will be increasingly important to consider the theoretical basis for developing strategies to achieve more successful implementation of this complex innovation in different professions(55, 78, 171).

Conclusion

Globally, healthcare systems are implementing strategies to address workforce deficits that enhance the skills of nurses, pharmacists and other non-medical healthcare professionals. Integral to advanced scope of practice, it is imperative that independent prescribing capability use is optimised through successful implementation. This meta-synthesis has identified barriers at four key stages of implementation including initial organisational preparation, selection and support of practitioners during training, transition of prescribing into practice and long-term development and sustainability. Given predicted workforce shortfalls in the UK and around the world a more coordinated approach to implementation with greater managerial support to mitigate barriers across the entire implementation trajectory is urgently needed.

Author contributions

JE and NC conceived the study. JE obtained funding, oversaw all aspects of the project and contributed to all stages. JE drafted this paper. JE designed and executed all the searches,

data extraction, coding, and quality appraisal. NC contributed to all stages of the review, including data extraction and coding. MC and NC contributed to the evolving synthesis and formulation of conclusions.

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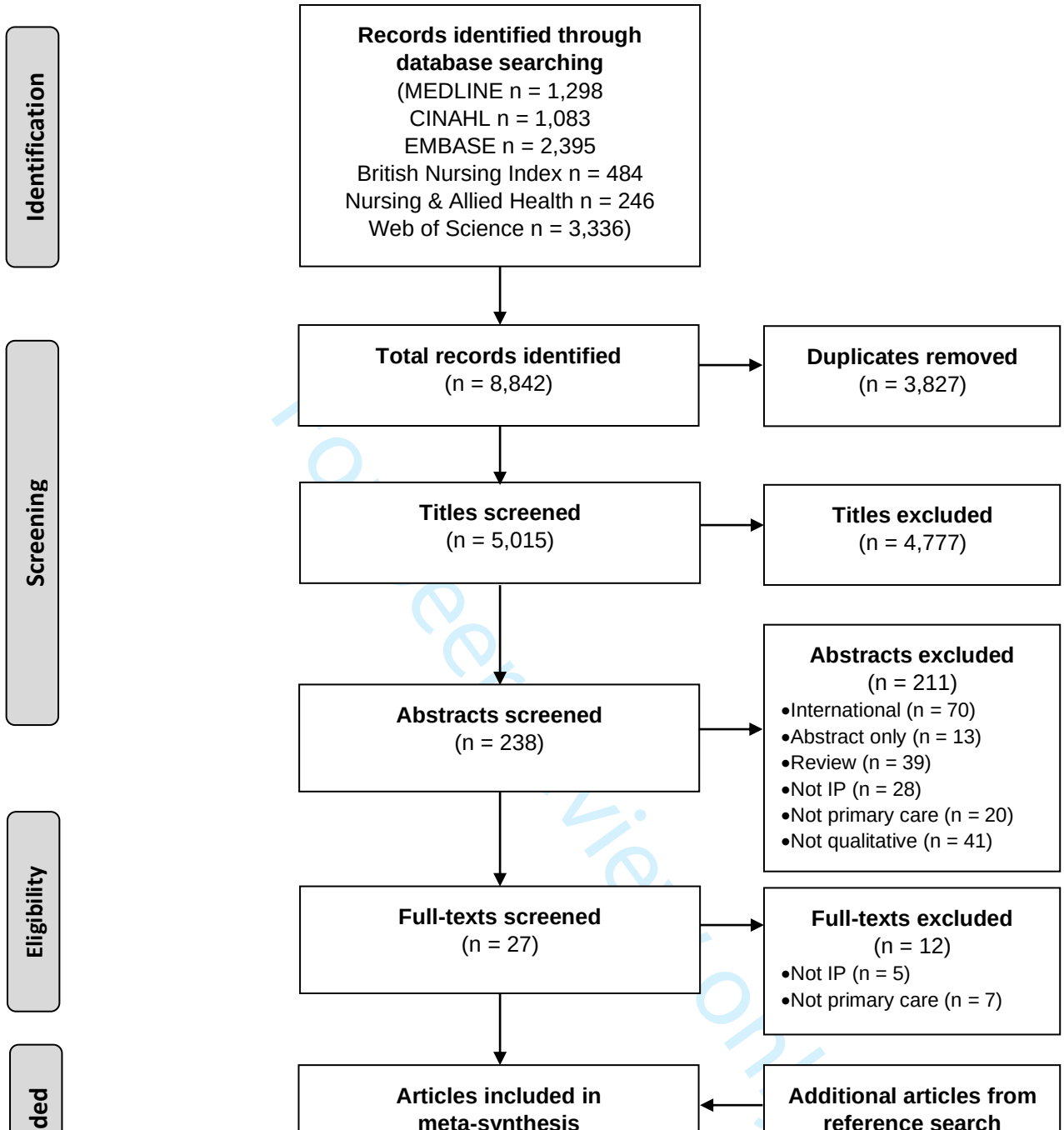
Identification
Screening
Eligibility
Included
Records identified through database searching
(MEDLINE n = 1,298
CINAHL n = 1,083
EMBASE n = 2,395
British Nursing Index n = 484
Nursing & Allied Health n = 246
Web of Science n = 3,336)
Total records identified
(n = 8,842)
Duplicates removed
(n = 3,827)
Titles screened
(n = 5,015)
Titles excluded
(n = 4,777)
Abstracts screened
(n = 238)
Abstracts excluded
(n = 211)
•International (n = 70)
•Abstract only (n = 13)
•Review (n = 39)
•Not IP (n = 28)
•Not primary care (n = 20)
•Not qualitative (n = 41)
Full-texts screened
(n = 27)
Full-texts excluded
(n = 12)
•Not IP (n = 5)
•Not primary care (n = 7)
Articles included in meta-synthesis
(n = 22)
Additional articles from reference search
(n = 7)

Supplementary_File_1_28.02.21

Supplementary File 1. MEDLINE search string

	EBSCO host; MEDLINE	
1	(MM "Family Practice")	42,149
2	(MM "Primary Health Care")	52,315
3	(MM "Physicians, Family")	11,183
4	(MH "Community Health Nursing")	19,640
5	(MH "Community Health Workers")	5,502
6	(MH "Community Health Services")	32, 035
7	(MH "Community Health Centres")	34,071
8	TI (community N1 health) OR AB (community N1 health)	41,477
9	TI (community N1 care) OR AB (community N1 care)	13,601
10	TI (primary N1 health) OR AB (primary N1 health)	28,349
11	TI (primary N1 care) OR AB (primary N1 care)	138,944
12	TI (general N1 practice*) OR (AB general N1 practice*)	45,549
13	TI (general N1 practitioner*) OR AB (general N1 practitioner*)	53,594
14	TI (family N1 practice*) OR AB (family N1 practice*)	10,921
15	TI (family N1 practitioner*) OR AB (family N1 practitioner*)	2,955
16	TI (gp N1 practice*) OR AB (gp N1 practice*)	2,067
17	TI (gp N1 service*) OR AB (gp N1 service*)	433
18	TI (gp N1 clinic*) OR AB (gp N1 clinic*)	341
19	OR/1-18	343,938
20	TI prescrib* OR AB prescrib*	153,174
21	TI independent prescrib* OR AB independent prescrib*	508
22	TI non-medical prescrib* OR AB non-medical prescrib*	208
23	OR/20-22	153,174
24	TI nurs* OR AB nurs*	460,786
25	TI physiotherap* OR AB physiotherap*	26,543
26	TI pharmacist* OR AB pharmacist*	34,354
27	TI (podiatr* OR chiropod*) OR AB (podiatr* OR chiropod*)	3,274
28	TI radiographer* OR AB radiographer*	1,746
29	TI (dietician* OR dietician*) OR AB (dietician* OR dietician*)	7,306
30	TI paramedic* OR AB paramedic*	7,958
31	TI optometr* OR AB optometr*	3,584
32	OR/24-31	533,864
33	23 AND 32	12,932
34	TI nurs* N1 prescrib* OR AB nurs* N1 prescrib*	1,054
35	TI pharmacist* N1 prescrib* OR AB pharmacist* N1 prescrib*	751
36	TI physiotherap* N1 prescrib* OR AB physiotherap* N1 prescrib*	105
37	TI paramedic* N1 prescrib* OR AB paramedic* N1 prescrib*	4
38	TI podiatr* N1 prescrib* OR AB podiatr* N1 prescrib*	15
39	TI chiropod* N1 prescrib* OR AB chiropod* N1 prescrib*	2
40	TI dietician* N1 prescrib* OR AB dietician* N1 prescrib*	18
41	TI dietitian* N1 prescrib* OR AB dietitian* N1 prescrib*	3
42	TI radiograph* N1 prescrib* OR AB radiograph* N1 prescrib*	61
43	TI optometr* N1 prescrib* OR AB optometr*N1 prescrib*	14
44	OR/34-43	1,985
45	33 OR 44	12,993
46	19 AND 45	2,417
47	LIMITS Full Text, Published 20100101-20201231, Peer-reviewed, English language	1,298

Supplementary_File_2

Supplementary File 2. Study characteristics (n=22)

Author(s), date	Study aims, focus and/or research question	Setting, country	Methodology and/or theoretical perspective	Methods, recruitment	Data analysis	Eligible participants	Sample	Main Findings
Afseth & Paterson (2017) [1]	To explore the views of NMP nursing students and DMPs on inter-professional competency assessment over course of training. To explore use of competency assessment as relates to development of prescribing competence.	1 HEI NMP programme provider, Edinburgh, Scotland.	Exploratory qualitative study.	Telephone semi-structured interviews (DMPs) and pre-post training focus group (NMP students). Convenience sampling of students and DMPs from one 2013 NMP training cohort.	Thematic analysis using Clarks theoretical Framework.	27 students (nurses) 27 DMP:	26 students 26 DMP.	Inter-professional training approach ratified role of NMP with DMP and within wider team. DMP lacked clarity on their role in training and use of competency assessments. Confidence in transition affected by the amount of time DMP engaged with and supported NMPs post qualification. .
Boreham et al (2013) [2]	How effective are NMP programmes in preparing nurses for prescribing roles? What do students feel are the most and least effective aspects of the programme? How could the provision be improved? What problems do programme leads encounter in bringing nurses up to the required standard?	7 HEIs delivering 7 NMP training programmes at 10 centres across Scotland.	Evaluative mixed methods. Survey, interviews and focus group.	Survey, semi-structured interviews (programme leads) and focus group (NMP students) using nominal group technique. Convenience sampling of students and programme leads from one 2011 training cohort.	Thematic analysis using nominal group technique.	192 students (nurses, midwives, health visitors), 10 programme leads.	Interviews n=10 programme leads Focus groups n=87 students	Generic training model helped contextualise NMP across services/settings for students; however, barriers including lack of study leave, protected time/backfill limited study time. DMP input often inadequate. Prior educational experiences influenced pedagogical preferences. Balance between professional duties, life and course commitments challenging. Unclear whether barriers specific to different care contexts.
Bowskill et al (2014) [3]	To describe uptake and use of a mentor scheme from	1 HEI NMP training provider,	Exploratory mixed methods.	Surveys, semi-structured interviews.	Content analysis.	74 students (professions unspecified)	6 students 3 mentors	NMP students found programme academically challenging with

Supplementary_File_2

	perspectives of student NMPs and mentors. To understand students' and mentors motivation for and experience of participating in the scheme.	Nottingham, England	Surveys and semi-structured interviews.	Convenience sampling of students from 2010 and 2011 training cohorts and former students from 2006-2010 cohorts.		49 mentors.		variable/no access to backfill arrangements. Academic challenges of courses detracted focus from integrating, or contextualising knowledge into practice. Transition highlighted as alternative/more optimal time point for mentoring.
Brodie et al (2014) [4]	To explore values and attitudes of NMPs to engagement in benzodiazepine prescribing.	General practices, community mental health and retail services in 1 health board, in semi-rural Scotland.	Exploratory qualitative interviews study.	Semi-structured interviews. Purposive sampling of IPs in PC roles; identified by NMP clinical nurse lead in health board.	Thematic analysis.	56 nurse and pharmacist IPs.	4 pharmacist IPs 4 nurse IPs (2 not prescribing).	NMP enhanced holistic care but practitioners concerned prescribing roles were underutilised. Role development impeded by barriers at service delivery and practitioner development/ support levels. Lack of targets for mental health considered to impede funding/ commissioning of NMP roles.
Cole & Gillett (2015) [5] .	To explore prescribing practices of palliative care clinical specialist nurse IPs and investigate why they are not prescribing.	1 hospice providing community palliative care, south east England.	Mixed methods service audit. Survey and focus group.	Survey and focus group. Convenience sampling of palliative care clinical specialist nurse IPs.	Thematic analysis.	10 nurse IPs.	6 nurse IPs	Audit identified underutilisation of NMP; focus groups identified barriers including lack of clarity on local policies, protocols and governance systems for INMP, poor awareness of NMP within teams and unclear clinical/service remit for NMP impeded prescribing. Low confidence in early transition highlighted and related to inconsistent DMP input and lack of medical and peer support.

Supplementary_File_2

Courtenay et al (2010) [6]	To explore views of diabetic patients on nurse prescribing and perceived advantages and disadvantages	7 community clinic and general practice sites across England.	Exploratory qualitative interview study.	Semi-structured interviews. Purposive sampling of diabetes nurse prescribers via diabetes prescriber network, purposive random sampling of patients receiving prescribed medicines.	Thematic analysis.	Size of target population unspecified.	7 nurse IP 41 patients	Patients were confident in nurse prescribing and reported improved service efficiency. Patients had clear expectations for specialist skills, knowledge and teamwork, but were divided on the level of autonomy nurses should enact.
Courtenay et al (2017) [7]	To explore patient expectations and experiences of nurse and pharmacist IP-led management of respiratory tract infections.	General practice and community clinics (number unspecified) in England, Scotland and Wales.	Mixed-methods: survey and interviews.	Survey, semi-structured interviews. Convenience sampling of patients presenting to nurse IP with respiratory tract infections in primary care.	Thematic analysis.	32 non-medical prescribers in one heath board, CCG and primary care based graduates of one HEI.	16 nurse IP 22 patients	Patients were confident in nurse antibiotic prescribing but had clear expectations for physical examination, specialist knowledge, information provision, good communication skills and unrestricted consultation time.
Courtenay et al (2019)	To use a theoretical framework to identify factors influencing management of respiratory tract infections. To identify behaviour change techniques for development of a theoretically informed intervention to support appropriate prescribing behaviour.	14 General practices, 14 out-of-hours/ unscheduled care services, 2 intermediate care services, 1 missing data.	Theory-driven explanatory interview study using Capability, Opportunity and Motivation for Behaviour and Theoretical Domains Frameworks.	Semi-structured interviews. Opportunistic sampling of primary care nurse and pharmacist IPs responsible for managing patients with respiratory tract infections recruited nationally.	Thematic analysis followed by mapping of themes to theoretical frameworks.	Size of target population unknown.	17 nurse IP 4 pharmacist IP	Antibiotic prescribing dependent on training, knowledge/skills, guideline provision, local peer benchmarked audit, consultation skills and role identity. Barriers included time pressures, lack of confidence, negative peer advice, fear of liability, patient pressure.

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Cousins & Donnell (2012) [8]	To investigate full impact of becoming an IP on nurse practitioner roles in general practice. To explore whether the IP increased work-related stress.	1 PCT, Liverpool, England.	Exploratory qualitative interview study.	Semi-structured interviews. Purposive sampling of nurse practitioner IPs in general practice ≥ 3 years IP experience.	Content analysis.	Size of target population unspecified.	6 nurse IP	NMP enhanced job satisfaction but service demand and work-related stress increased. Lack of remuneration perceived to disincentivise practitioners. Barriers at service delivery and practitioner development/ support levels impeded full development of NMP roles.
Daughtry & Hayter (2010) [9]	To explore impact of prescribing on the role of a practice nurse. To explore the experiences and feelings of practice nurses actively prescribing in general practice.	3 GP practices in 1 PCT in north west, England.	Descriptive qualitative interview study.	Semi-structured interviews. Purposive sampling of practice nurse IP in general practice. .	Thematic analysis (Colaizzi method).	Size of target population unspecified.	4 nurse practitioner IP, 3 practice nurse IP, 1 nurse manager IP. Median 3 (0.6–5.0) years' experience IP.	NMP expanded nurses' roles, but medical opposition impeded development in some practices (e.g., minor illness/triage), and skills were underutilised. Lack of role clarity led to misunderstanding amongst practice staff about NMP remit within services. Workload pressures increased from transfer of GP caseloads to nurses.
Dhalivaal (2011) [10]	To explore patients' attitudes to and experiences of nurse prescribing in inner-city general practices within different ethnic populations.	4 inner city general practices, Birmingham, England.	Descriptive qualitative interview study.	Semi-structured interviews using grand tour question. Convenience sampling of adult patients prescribed medication by a nurse prescriber; selected by nurse prescribers.	Thematic analysis.	Size of target population unspecified.	4 nurse IP 15 patients.	Patients satisfied with nurse NMP; clear expectations expressed for specialist knowledge and inter-personal and communication skills.
Downer & Shepherd (2010) [11]	To explore experiences of district nurses currently	Community services, 2	Heideggerian phenomenological	Conversational semi-structured interviews.	Thematic analysis	Size of target population unspecified.	8 nurse IP	NMP enhanced service access and increased job satisfaction. Challenges

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	prescribing as nurse IP.	health boards, west Scotland.	exploratory study.	Purposive sampling of district nurse IP with minimum 12 months IP experience and actively prescribing.	(Colaizzi method).		included lack of support, lack of record access, increased workload in maintaining competence, lack of remuneration/ recognition. Support lacking in transition and beyond.
Herklots et al (2015) [12]	To explore the prescribing experiences of community matron IP, including their prescribing practices and any influencing factors.	2 inner city, rural and suburban PCTs, south east England.	Exploratory qualitative interview study.	Semi-structured interviews. Purposive sampling of community matron IP managing long-term conditions.	Thematic analysis.	Size of target population unspecified.	7 nurse IP	Knowledge/skills from NMP training enhanced holistic care. However, nurses prescribed limited formulary and scope of prescribing practice did not develop. No consensus reached on whether local prescribing arrangements impeded NMP; nurses developed strategies to overcome potential barriers of lack of support/ supervision, CPD, GP confidence.
Holden et al (2017)[13]	To explore how UK physiotherapists address analgesic use among patients with hip osteoarthritis, and to explore their beliefs about the acceptability of prescribing for these individuals.	UK NHS and non-NHS primary care sites (settings unspecified).	Mixed methods, Survey and semi-structured interviews.	Telephone semi-structured interviews. Maximum variation purposive sampling based on gender, clinical experience, care setting, self-report analgesia approach..	Constant comparative method.	3126 physio-therapists	1646 survey, 20 non-IP physio-therapists, 1 physio-therapist IP.	Main (hypothetical) drivers for IP identified as patient convenience and reduction in GP workload; survey showed low adoption rate (1%, n=9). Barriers to uptake included lack of service advantage, remuneration and employer support, liability and burden of training concerns.
Inch et al (2019) [14]	To test feasibility of recruitment, data collection processes, suitability of outcome measures and retention rates in care	4 residential care homes with affiliated GP practices in Grampian	Mixed methods feasibility study. Semi-structured	Semi-structured interviews and focus group. Random and purposive	Thematic analysis.	346 GPs 14 pharmacist IP 86 residents 6 care homes	Interviews n=32 4 pharmacist IP 6 GPs 6 care home managers	NMP increased medicines access, safety and efficiency. Offloaded care home staff and GPs. Facilitated by GP practice computer access,

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	homes and general practices. To assess service and research acceptability to care home residents, pharmacist IP, GPs and care home staff. To refine service specification.	(Scotland), Belfast (Northern Ireland), Norfolk and Yorkshire (England).	interviews and focus group.	sampling using multiple methods.			10 care home staff 2 residents 3 relatives 1 dietician Focus groups (n=2) 2 pharmacists	pharmacy knowledge, autonomy and ability to prescribe, good communication and knowledge transfer. Lack of established relationship with GP barrier.
Kelly et al (2010) [15]	To identify number of practice nurses in one county qualified as nurse IP and number intending adoption. To identify number of practice nurses providing first-contact care for minor illnesses, long term conditions. To identify barriers to adoption IP.	GP practices in 1 county in southern England.	Descriptive qualitative survey.	Questionnaire with free text questions. Convenience sampling of GP practice nurses managing long term conditions and/or minor illnesses.	Descriptive analysis.	251 practice nurses.	31 nurse IP 120 nurse non-IP	Barriers included lack of funding and/or backfill, lack of managerial support, poor knowledge/ information on training and application processes, reluctance to engage in further advanced training, education, lack of remuneration and concern over responsibility and liability.
Lane et al (2020) [16]	To explore stakeholder views on issues and barriers to pharmacist IP and inform service specification for a pharmacist IP intervention in older people's care homes.	4 residential care homes with affiliated GP practices in England, Scotland and Northern Ireland.	Theory-driven exploratory phenomenological study using Theoretical Domains Framework.	Semi-structured interviews and stakeholder specific focus groups. Topic guide informed by Theoretical Domains Framework. Purposive maximum variation sampling of stakeholders living or working in care homes via local professional networks, regulatory bodies, local primary care networks, Care	Framework analysis using Theoretical Domains Framework.	Size of target population unspecified.	Focus groups (n=72) 25 pharmacists 24 GPs 9 care home managers/staff 7 residents 7 relatives Interviews (n=13) 2 pharmacists 5 GPs 3 care home managers/staff	Consensus that pharmacist IP model appropriate to address limitations of GP workload and improve care-home prescribing efficiency. Hypothetical barriers identified in role remit and clarity, communication channels for integrated teamwork, team understanding of roles, pharmacist knowledge of LTC management/ care home systems/service pathways, resident preference for GP medicines consultations. GPs and pharmacists had reservations about

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				Quality Commission.			IP making independent diagnoses.
Latham & Nyatanga (2018a, 2018b).[17, 18]	To explore the lived experiences of clinical nurse specialists who work as IP with palliative care patients within community settings.	13 hospices across West Midlands, England.	Interpretive phenomenological interview study.	Semi-structured interviews. Maximum variation purposive sampling of clinical nurse specialist IP to limit geographical bias.	Constant comparative method.	Size of target population unspecified.	6 nurse IP NMP promoted timely access to medicines, but service improvements not realised for all patients because of unmet training needs and failure to develop scope of practice in non-cancer palliative care. Negative attitudes of stakeholders to NMP could impede prescribing. Transition highlighted as time of greater anxiety, and target for implementing support.
Maddox et al (2016) [19] .	To explore factors influencing how nurse and pharmacist IP working in community and primary care settings choose whether or not to take responsibility for making prescribing decisions.	11 general practices 11 community 3 nursing homes, 5 unspecified settings in England	Exploratory qualitative interview and focus group study.	In person/ telephone semistructured interviews focus groups using critical incident technique. Purposive and snowball sampling of nurse and pharmacist IP in primary care.	Thematic analysis.	Size of target population unspecified.	25 nurse IP 5 pharmacist IP Need for greater organisational clarity on remit for NMP within services identified. Transition post training highlighted as key point lacking supervision and support. Confidence and competence impeded by lack of NMP role clarity, organisational agreement for use of NMP and lack of inter-professional collaboration.
Stenner et al (2011) [20]	To explore nurse prescribing from perspective of patients with diabetes. Main objective to explore patients' views about consultations with a nurse prescriber and any impact on	7 community clinic and general practice sites across England.	Exploratory qualitative interview study.	Semi-structured interviews. Convenience sampling of diabetes nurse prescribers via diabetes prescriber network, patients	Thematic analysis.	Size of target population unspecified.	7 nurse IP 41 patients Patients were confident in nurse IP and identified benefits including improved disease management, service access, information provision and consultation time. Patients had clear expectations for specialist skills,

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	medications management.			recruited by nurse prescribers.			communication skills, knowledge and teamwork.
Weiss et al (2016) [21]	To explore group identities of GPs, nurses and pharmacists as IPs. To describe social identities of GPs, nurses and pharmacists as IPs, and extent to which identities are expressed and accepted.	General practices (n, unspecified) in PCTS in southern and central England and Wales; with and without employed nurse/ pharmacist IPs.	Exploratory qualitative interview study using social identity theory and social identity self-categorisation theory.	Semi-structured interviews. Maximum variation purposive sampling; surgery size, geographical location, practice area deprivation, gender and age.	Constant comparative method.	n=51 21 GP 19 nurse IP 12 pharmacist IP From 36 GP practices in 14 PCTs.	7 GP 7 nurse IP 7 pharmacist IP	Support, teamwork, social role identity and clarity facilitated integration of IP. Competence development impeded by lack of NMP role clarity, organisational agreement for use of NMP and lack of inter-professional collaboration.
Williams et al (2018)[22]	To identify GP and nurse IP experiences of prescribing antibiotics for respiratory tract infections in out-of-hours primary care, to explore facilitators and barriers to reducing antibiotic prescribing; and to identify similarities and differences between GP and nurse antibiotic prescribing.	Primary care out-of-hours services in England accessed by NHS 111 and walk-in-services (number unspecified)	Exploratory qualitative interview study.	Semi-structured interviews. Maximum variation purposive and snowball sampling for urban and rural settings, organisation type, clinical experience, cross-organisational role.	Constant comparative method.	n=1253 from professional associations, research network, NHS trust, mailout and snowballing.	n=30 15 GP 15 nurse IP	Nurse IP reported barriers to antibiotic prescribing including patient expectation, patient lack of trust in no prescribing decisions, lack of feedback on delayed prescriptions, inconsistent prescribing decisions between team members, lack of clinical record access, time constraints, staff turnover. Facilitators included peer discussion and education, patient information strategies.

CCG – Clinical Commissioner Group, DMP – designated medical practitioner, GP – general practitioner, HEI – higher education institute, IP – independent prescribing, LTC – long term conditions, NHS – National Health service, NMP – non-medical prescribing, PCT – Primary Care Trust

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Supplementary_File_3

Supplementary File 3. Quality Assessment Tool for Studies with Diverse Designs (QATSDD) quality scores

	Afseth & Paterson 2017 [1]	Boreham 2013 [2]	Bowskill 2014 [3]	Brodie 2014 [4]	Cole & Gillett 2015 [5]	Courtenay 2010 [6]	Courtenay 2017 [7]	Courtenay 2019 [8]	Cousins & Donnell 2012 [9]	Daughtry & Hayter 2010 [10]	Dhalivaal 2011 [11]	Downer & Shepherd 2010 [12]	Herklots 2015 [13]	Holden 2019 [14]	Inch 2019 [15]	Kelly 2010 [16]	Lane 2020 [17]	Latham & Nyatanga 2018a,b [18, 19]	Maddox 2016 [20]	Stenner 2011 [21]	Weiss 2016 [22]	Williams 2018 [23]
Explicit theoretical framework	3	1	0	0	0	1	0	3	1	0	0	3	0	3	0	0	3	3	0	0	0	3
Statement of aims/ objectives in main body of report	3	3	3	2	3	2	3	3	2	3	2	3	3	3	3	3	2	3	2	3	3	3
Clear description of research setting	3	3	3	2	2	3	2	3	3	3	2	1	2	2	3	2	3	3	2	3	3	2
Evidence of sample size considered in terms of analysis	0	0	0	0	0	0	0	2	3	0	3	0	1	3	3	1	1	2	3	0	0	0
Representative sample of target group of a reasonable size	2	3	3	2	3	3	3	2	3	1	2	0	1	3	3	3	3	1	3	3	3	3
Description of procedure for data collection	3	3	3	2	1	2	2	3	3	2	2	2	2	3	1	1	3	3	3	3	3	2
Rationale for choice of data collection tool(s)	2	2	0	0	0	0	2	3	1	0	2	3	0	2	0	0	3	3	2	0	0	0
Detailed recruitment data	2	2	3	1	2	3	2	3	2	2	3	1	2	3	3	2	3	3	3	3	3	3
Statistical assessment of reliability & validity of measurement tool(s) (Quan)	n/a	0	2	n/a	0	n/a	0	n/a	n/a	n/a	n/a	n/a	n/a	2	0	0	n/a	n/a	n/a	n/a	n/a	n/a
Fit between stated research question & method of data collection (Quan)	n/a	3	3	n/a	1	n/a	2	n/a	n/a	n/a	n/a	n/a	n/a	3	3	0	n/a	n/a	n/a	n/a	n/a	n/a
Fit between stated research question & format & content of data collection tool (Qual)	1	3	2	2	1	0	3	3	0	0	2	0	0	2	1	0	3	1	1	0	3	2
Fit between research question & method of analysis	3	3	3	2	1	3	3	3	3	3	0	3	3	3	1	2	3	3	3	3	3	3
Good justification for analytical method selected	1	2	0	1	0	0	2	2	0	0	0	3	2	2	0	0	2	3	1	0	0	2
Assessment of reliability of analytical process (Qual)	0	2	0	1	0	3	2	0	3	0	0	0	0	0	0	0	0	0	3	3	0	3
Evidence of user involvement in design	3	2	2	0	0	0	3	1	0	0	0	0	0	0	3	2	2	0	1	0	0	3
Strengths & limitations critically discussed	2	0	2	1	0	1	3	3	1	1	0	1	2	2	2	0	3	2	3	2	1	3
Total	28	32	29	16	14	21	32	33	25	15	18	20	18	36	26	16	33	30	30	23	22	32

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Max score possible	42	48	48	42	48	42	48	42	42	42	42	42	42	48	48	48	42	42	42	42	42	42
Score as %	67	67	60	38	29	50	67	78	59	36	43	48	43	75	54	33	78	71	71	55	52	76

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Supplementary_File_4

Supplementary File 4. Study contribution to theme barriers and facilitators

Analytical Theme	Descriptive Theme	Data theme	Barrier	Facilitator
Analytical theme 1: Optimising organisational readiness	Theme 1.1: Clinical need and remit	Established clinical need	(1, 2)	(3-16)
		Service gaps	(1, 2)	(1, 2, 5, 7, 9, 10, 12, 13, 17, 18)
		Role clarity	(4, 7, 9, 11, 12, 14, 19)	(8, 12, 14, 18, 19)
	Theme 1.2: Managerial leadership	Role of managers	(1, 2, 4, 7-9, 11, 12, 19-22)	(14)
		Recognising value	(1, 2, 4)	(4, 5, 7, 9, 11, 13, 17, 19, 22)
		Culture	(7, 14)	(8-12, 14, 18, 19)
	Theme 1.3: Inter-professional environment	Inter-professional relationships	(2, 8, 12, 14)	(3, 8, 9, 11, 14, 19)
		Communication & collaboration	(8, 14)	(9, 10, 14, 18, 20)
Analytical theme 2: Optimising practitioner readiness	Theme 2.1: Selecting the right practitioners	Selection	(20, 22)	(4, 7, 11, 20)
		Skills & aptitudes		(4-7, 11, 13, 15-18)
		Motivation & commitment	(1, 2, 7)	
	Theme 2.2: Preparing for training	Expectations of training	(1-3, 20, 21)	
	Theme 2.3: Optimising and supporting training	Study leave	(2, 20, 21)	
		Mentoring		(21)
		Designated Medical Practitioners	(3)	(3, 22)
Analytical theme 3: Focusing on early transition support	Theme 3.1: Transition as a point of vulnerability	Self-confidence	(6, 8, 9, 11, 12, 19, 21)	(8, 11, 12)
	Theme 3.2: Nurturing confidence and competence	Minimum competence	(8, 9, 12, 14, 21, 22)	(7-9, 12, 14, 19)
		Experience & exposure	(11)	(8, 11, 12, 14)
	Theme 3.3: Transition support needs	Informal & formal support systems	(4, 6, 7, 9, 11, 12, 19, 22)	(4, 7, 9, 11, 12, 19, 22)
Analytical theme 4: Maximising and developing IP	Theme 4.1: Service delivery	Impact on workload	(4, 6-9, 11, 12, 15, 16, 19, 22)	(4, 6-12, 18, 19, 22)
	Theme 4.2: Developing and maximising roles	Models of role development	(4, 9, 12, 14, 19, 22)	(8, 10, 11, 14-16, 18)
		Continued professional development	(4, 7, 9, 12, 15, 19)	(6, 14)
		Service evaluation	(22)	(6)

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Supplementary_File_4

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Reporting checklist for systematic review and meta-analysis.

Based on the PRISMA guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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		Reporting Item	Page Number
Title			
	#1	Identify the report as a systematic review, meta-analysis, or both.	1
Abstract			
Structured summary	#2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number	2
Introduction			
Rationale	#3	Describe the rationale for the review in the context of what is already known.	3

Objectives	#4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	3
Methods			
Protocol and registration	#5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address) and, if available, provide registration information including the registration number.	5
Eligibility criteria	#6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rational	5
Information sources	#7	Describe all information sources in the search (e.g., databases with dates of coverage, contact with study authors to identify additional studies) and date last searched.	5
Search	#8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplementary file 1
Study selection	#9	State the process for selecting studies (i.e., for screening, for determining eligibility, for inclusion in the systematic review, and, if applicable, for inclusion in the meta-analysis).	6
Data collection process	#10	Describe the method of data extraction from reports (e.g., piloted forms, independently by two reviewers) and any processes for obtaining and confirming data from investigators.	6
Data items	#11	List and define all variables for which data were sought (e.g., PICOS, funding sources), and any assumptions and simplifications made.	6
Risk of bias in individual studies	#12	Describe methods used for assessing risk of bias in individual studies (including specification of whether this was done at the study or outcome level, or both), and how this information is to be used in any data synthesis.	6

Summary measures	#13	State the principal summary measures (e.g., risk ratio, difference in means).	N/A
Planned methods of analyis	#14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I2) for each meta-analysis.	7
Risk of bias across studies	#15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	N/A
Additional analyses	#16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	N/A
Results			
Study selection	#17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	8, Figure 1 PRISMA
Study characteristics	#18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citation.	9, Supplementary file 2
Risk of bias within studies	#19	Present data on risk of bias of each study and, if available, any outcome-level assessment (see Item 12).	N/A
Results of individual studies	#20	For all outcomes considered (benefits and harms), present, for each study: (a) simple summary data for each intervention group and (b) effect estimates and confidence intervals, ideally with a forest plot.	N/A
Synthesis of results	#21	Present the main results of the review. If meta-analyses are done, include for each, confidence intervals and measures of consistency.	11-21
Risk of bias across studies	#22	Present results of any assessment of risk of bias across studies (see Item 15).	Supplementary file 3
Additional analysis	#23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	N/A

Discussion			
Summary of Evidence	#24	Summarize the main findings, including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., health care providers, users, and policy makers	22
Limitations	#25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review level (e.g., incomplete retrieval of identified research, reporting bias).	24
Conclusions	#26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	24
Funding			
Funding	#27	Describe sources of funding or other support (e.g., supply of data) for the systematic review; role of funders for the systematic review.	25

BMJ Open

Barriers and facilitators to implementation of non-medical independent prescribing in primary care: a qualitative systematic review.

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Title

Barriers and facilitators to implementation of non-medical independent prescribing in primary care in the United Kingdom: a qualitative systematic review.

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Abstract (296 words)

Objectives

To support workforce deficits and rising demand for medicines, independent prescribing (IP) by nurses, pharmacists and allied health professionals is a key component of workforce transformation in UK healthcare. This systematic review of qualitative research studies used a thematic synthesis approach to explore stakeholders' views on IP in primary care and identify barriers and facilitators influencing implementation.

Setting

UK primary/community care.

Participants:

Inclusion criteria were UK qualitative studies of any design, published in the English language. Six electronic databases were searched between January 2010 and September 2021, supplemented by reference list searching. Papers were screened, selected and quality-appraised using the Quality Assessment Tool for Studies with Diverse Designs. Study data was extracted to a bespoke table and two reviewers used NVivo software to code study findings. An inductive thematic synthesis was undertaken to identify descriptive themes and interpret these into higher order analytical themes. The Diffusion of Innovations and Consolidated Framework for Implementation Research were guiding theoretical anchors.

Primary and secondary outcome measures: N/A.

Results

Twenty-three articles addressing nurse, pharmacist and physiotherapist IP were included. Synthesis identified barriers and facilitators in four key stages of implementation: 1) "Preparation", 2) "Training", 3) "Transition" and 4) "Sustainment". Enhancement, substitution, and role specific implementation models reflected three main ways that the IP role was used in primary care.

Conclusions

In order to address global deficits, there is increasing need to optimise use of IP capability. Although the number of independent prescribers continues to grow, numerous barriers to implementation persist. A more coordinated and targeted approach is key to overcoming barriers identified in the four stages of implementation and would help ensure that IP is recognised as an effective approach to help alleviate workforce shortfalls in the UK, and around the world. PROSPERO registration number CRD42019124400.

Article Summary

Strengths and limitations of this study (122 words)

- This is first qualitative meta synthesis to explore barriers and facilitators to independent prescribing by nurses, pharmacists and allied health professionals in UK primary care.
- Use of Diffusion of Innovation theory and the Consolidated Framework for Implementation Research supported identification of barriers and facilitators at organisational, team and individual practitioner level.
- Four key stages of implementation were identified: 1) preparation, 2) training, 3) transition and 4) sustainment.
- Enhancement, substitution, and role specific implementation models reflected the three main ways that the independent prescribing role was used in primary care
- As the focus was on primary care barriers and facilitators in acute care and other care settings were excluded.
- In order to develop context-embodied knowledge of barriers and facilitators quantitative literature was excluded.

Key words

Implementation, barriers, facilitators, non-medical prescribing, independent prescribing, primary care, meta-synthesis

Introduction

Equitable access to primary care improves health outcomes, lowers costs and enhances patient experience[1, 2]. Global workforce deficits[3-5] and the rising prevalence of long-term conditions[6, 7], multimorbidity[8-10] and COVID-19[11] have severely threatened primary care sustainability[12-15]. Medicines use in global priorities including diabetes and cardiovascular diseases is increasing, with worldwide drug therapy days rising in 2019 to 1.8 trillion and an average of 234 days per person/year[16]. With one in four adults in United Kingdom (UK) primary care taking five or more medicines daily[17], the workforce implications for meeting prescribing needs are profound.

Mobilising primary care to improve workforce and service sustainability is a global challenge[5, 18]. As in other countries[19, 20], primary care in the four devolved UK nations (i.e., England, Scotland, Wales, Northern Ireland) has undergone significant restructuring and reorganisation[21-24]. In England, for example, the 2019 NHS long-term plan amalgamated GP practices into primary care networks (PCN), covering populations of 30-50,000[25]. Pooling resources to achieve government targets[26] with the promise of extra non-medical staff (e.g., advanced/specialist clinical pharmacists, dieticians, paramedics and physiotherapists), PCNs were expected to offer additional hours within broader service options[27]. While the impact of the new 2021/22 Health and Care Bill[28] on primary care workforce transformation in England remains uncertain, the diverse skills of the non-medical advanced practice workforce including prescribing capability are likely to remain important for addressing UK primary care prescribing and medicines optimisation needs[29-31].

In line with global movements to enhance the skills of non-medical healthcare professionals, over 90,000 UK nurses, pharmacists, optometrists, radiographers, physiotherapists, podiatrists, dieticians and paramedics[32] under serial legislative changes[33-36] and with accredited additional training[37-39] are authorised to prescribe using supplementary and/or independent forms. Although UK legislation restricts dieticians and diagnostic radiographers to supplementary prescribing, as reported by professions with dual supplementary/IP rights (e.g., nurses, pharmacists, physiotherapists, podiatrists) IP is more workable[40, 41] and has largely superseded supplementary prescribing in many UK non-doctor led primary and community care services[42-44]. Enabling the autonomous initial assessment and on-going management of patient prescribing and medicines optimisation needs, IP increases practitioner autonomy/expertise[29, 45-47], enhances clinical outcomes compared to doctor-led care[29] and results in high service-user satisfaction[48]. Across contemporary primary care

settings in the UK and internationally IP is an increasingly essential component of service re-design[45, 49-54].

Despite its many benefits, the UK adoption rates for IP vary[55, 56], with medical opposition to prescribing roles[57, 58], training course drop-out[46], delayed prescribing onset[59, 60] and role underuse reported[61-64]. Difficulties with implementation are frequently cited[43, 46, 59, 65-67]. Several UK[68, 69] and international systematic[54, 70-72] and literature reviews,[73, 74] have focused on implementation barriers and/or facilitators. However, these have been profession-specific[54, 70-72, 74], have included international models with varying legislative/jurisdictional levels of prescribing autonomy[54, 70-72] and/or have addressed prescribing in heterogenous care settings[54, 68, 69, 74]. None have synthesised qualitative studies in all IP eligible professions in UK primary care. Considering IP enhances workforce skills and builds capacity for service redesign and improved sustainability[42, 75-77], identifying and understanding the challenges to its implementation is ever pressing[78, 79].

Aim

This qualitative meta-synthesis aimed to identify barriers and facilitators that influence implementation of IP in UK primary care.

Theoretical perspective

This review is broadly informed by the Diffusion of Innovations theory[80, 81] and the Consolidated Framework for Implementation Research[82, 83] which provided theoretical anchors for identifying contextual factors likely to influence implementation[84-89].

Methods

This qualitative meta-synthesis is reported following the Enhancing transparency in reporting the synthesis of qualitative research (ENTREQ) guidelines[90] which incorporates elements of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement[91]. Thematic qualitative meta-synthesis[92, 93] permits synthesis of context-embodied research and is a suitable method for identifying factors influencing implementation[94-96]. The review was registered in PROSPERO (CRD42019124400)[97].

Search strategy

A systematic search of UK literature on primary and community care IP was undertaken in January 2021 and updated in September 2021. Barriers/facilitators to healthcare innovations are conceptually well established[98-102] and thus grey literature was excluded. Search terms were developed according to the Sample, Phenomenon of Interest, Design, Evaluation,

Research Type (SPIDER) tool[103] and tested based on truncations of words related to prescribing, community/primary care and UK non-medical healthcare professions with IP authority (e.g., nurses, pharmacists, optometrists, physiotherapists, podiatrists, paramedics and radiographers). Wild card and Boolean Search Operators were used. Qualitative search terms were not included[104, 105]; all citations were screened for qualitative methodology. Search strings (see supplementary file 1 examples) were adapted for 6 electronic databases (EBSCO - MEDLINE, CINAHL, OVID – EMBASE, ProQuest - British Nursing Index, Nursing & Allied Health, Web of Science). The 2010 inception search date reflected major UK coalition governmental change and the introduction of landmark legislative reforms[106-109] that decentralised UK primary/community care commissioning[110]. Inclusion criteria applied to study selection are shown in Table 1. Retrieved citations were downloaded to EndNote V.X9 and duplicates removed.

Table 1 Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
► Primary research conducted in the UK (England, Scotland, Northern Ireland and/or Wales)	► International/UK literature reviews, meta-analyses or meta-synthesis and/or grey literature
►Studies employing participatory and/or non-participatory data collection methods within any qualitative, quantitative or mixed methods design	►Quantitative studies not employing qualitative data collection methods
►Studies addressing IP by legislated non-doctor healthcare professionals	►Studies addressing supplementary, dependent and/or collaborative models of prescribing
►Studies addressing primary/ community care IP	►Studies addressing secondary care and/or mixed primary and secondary care IP
►Studies presenting empirical evidence of barriers and/or facilitators to IP implementation	
►Studies addressing non-context specific educational programmes for non-medical IP	
► Peer reviewed, full text articles published between 01 January 2010 and 30 September 2021 in the English language	

Screening and eligibility

Two reviewers (JE, NC) independently assessed all titles and abstracts against the inclusion criteria and the full-text versions of papers deemed potentially relevant were obtained and reviewed. Papers found not to meet the criteria during screening were excluded with

reasons recorded as shown in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) table (Figure 1). Reference list hand searching supplemented database searching.

Figure 1 goes here

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses depicting study selection, screening, eligibility for inclusion and synthesis (adapted from Page et al 2021)[91].

Quality assessment

In keeping with the scope of a qualitative meta-synthesis[111, 112], studies were not excluded on the basis of quality assessment[92, 113]. Methodological appraisal of individual papers was undertaken using the Quality Assessment Tool for Studies with Diverse Designs (QATSDD)[114], which has demonstrated validity and test-retest reliability for assessing the reporting and methodological transparency of diverse study designs[115]. The tool uses a 4-point scoring system for assessment of qualitative studies (14 questions) and mixed methods studies (16 questions), resulting in total possible scores of 42 and 48 respectively [114]. Scoring was undertaken by one reviewer (JE) and any uncertainties were discussed and resolved with a second reviewer (NC). Supplementary file 2 provides a detailed breakdown of questions and the grading of study manuscripts.

Data extraction

Study data were extracted by one author (JE) to a bespoke table adapted from recommended templates[116]. This collated contextual and methodological information, data on barriers and/or facilitators and main findings and was piloted on 5 index studies to ensure consistency and usability. Data extraction was recursive and involved repeated review/update between ensuing analysis stages[117].

Data analysis and synthesis

The aim of thematic analysis was to develop a coherent synthesis of barriers and facilitators that influenced IP across stages of the implementation continuum[118-120]. Data analysis followed a four stage, iterative process described by Thomas and Harden (2008)[121] (Table 2). Qualitative “data” referred to participant quotations, (sub)themes, explanations, hypotheses or new theory, observational excerpts and author interpretations[122]. Barriers were defined as “any obstacle (material or immaterial) impeding adoption, implementation

and/or sustainability of IP"[123, 124] and facilitators were defined as "any obstacle (material or immaterial) enhancing adoption, implementation and/or sustainability of IP"[123, 124].

Table 2 Stages of analysis

Stage 1	In-depth reading and familiarisation with individual papers, data extraction
Stage 2	Inductive line-by-line coding of highest quality, index papers (n=5) to develop a set of "open codes" by two independent reviewers (JE, NC).
Stage 3	Codes discussed/agreed, grouped into descriptive themes using NVivo[125]; codebook applied to all papers, and expanded/modified by identifying new codes/themes and/or merging/renaming existing codes/themes[126].
Stage 4	Descriptive themes organised into higher order analytical themes and matrix charted with corresponding indicative quotes

Rigour within the analytical process

To ensure analytic rigour, two independent reviewers (JE, NC) initially performed inductive line-by-line data coding from 5 highest quality index papers (stage 2). Each reviewer produced sets of open data codes which were compared and discussed. If different codes and/or different interpretations were assigned to a concept, these were discussed and revised. Disagreements were resolved by a third reviewer (MC). Data codes were subsequently grouped into descriptive themes, creating a codebook for application to all papers (stage 3). To identify possible contradictory cases and clarify thematic commonalities within studies[127], a matrix of participant quotes was charted to constituent themes (see Supplementary file 3)[128].

Patient and public involvement

The review was conducted as part of a PhD exploring paramedic IP in UK primary care, for which a University service user/carers group was instrumental in informing study design and methods. However, as the systematic review focused on implementation challenges and not patient-related outcomes, the group was not involved its design or conduct.

Results

Twenty-three of the 5,365 original articles identified met inclusion criteria[129-152] (see Figure 1. PRISMA table).

Study characteristics and quality assessment

Table 3 summaries the study characteristics and quality assessment scores of included articles. Studies were undertaken in in England[131, 134, 135, 138, 140, 142, 143, 145, 148-152], Scotland[129,

[130, 132, 141], or across devolved UK nations[133, 136, 137, 144, 146]. The representation of independent prescribers from Wales[133, 136] and Northern Ireland[144, 146] was limited.

Eighteen studies used qualitative methods[129, 132, 133, 135, 137-142, 144, 146, 147, 149-152], seven used mixed methods[130, 131, 134, 136, 143, 144] and one employed a qualitative survey[145]. Fifteen studies addressed nurse IP[129-131, 134-136, 138-142, 145, 148, 150, 152], seven included pharmacists[132, 133, 137, 144, 146, 149, 151] and one study focused on physiotherapists[143]. Where indicated, studies were conducted pre-2011[130, 131, 135, 139-141, 145, 149-151], between 2011-2015[129, 132, 134, 136, 147, 148, 152] or between 2016-2019[133, 137, 144, 146].

Table 3. Characteristics of included studies (n=23) and key barriers and facilitators

Author(s), year	Country, Setting	Study focus, Participants	Barriers	Facilitators	QATSDD score
Afseth et al (2017)	Scotland. HEI.	Views on prescribing training. 6 NIP trainees, 6 DMPs	1, 2, 3	4, 5, 6, 7, 8	67%
Boreham et al (2013)	Scotland. HEI.	Views on prescribing training. 87 NIP trainees, 10 HEI leads.	1, 2, 3, 8, 9	4, 5, 9, 10, 11	67%
Bowskill et al (2014)	England. HEI.	Views on prescribing training 6 IP trainees, 3 IPs (unspecified professions)	1, 3, 9	12	60%
Brodie et al (2014)	Scotland. Gen-P, Comm.	Views on prescribing role. 4 NIPs, 4 PIPs.	8, 13, 14, 15, 16, 17, 18, 19	9, 10, 20, 21, 22, 23, 24	38%
Carter et al (2021)	England, Scotland, Wales. Gen-P, Comm pharmacy.	Factors influencing prescribing and role of practice pharmacists on evidence based prescribing. 6 GPs, 6 NIPs, 6 PIPs, 12 key informants.	25, 26, 27	9, 11, 24, 28, 29, 30, 31, 32, 61	78%
Cole & Gillett (2015)	England. Comm pall care.	Prescribing practices. 6 NIPs.	2, 3, 15, 26, 27, 33, 34, 35, 36, 37, 38	21, 28, 30, 37, 61	29%
Courtenay et al (2010)	England. Gen-P, Comm clinics.	Patient experiences/views of nurse prescribing. 41 patients.		10, 11, 22, 39	50%
Courtenay et al (2017)	England, Scotland, Wales. Gen-P, Comm clinics.	Patient experiences/views of nurse and pharmacist antibiotic prescribing for respiratory tract infection. 16 NIPs, 1 PIP, 22 patients.	27	22, 23, 39, 40, 41	67%
Courtenay et al (2019)	UK (unspecified countries). Gen-P, OOH, IC.	Factors influencing antibiotic prescribing for respiratory tract infection. 17 NIPs, 4 PIPs.	18, 27, 38, 42, 43	6, 10, 11, 22, 23, 24, 28, 29, 32, 39, 40, 41, 44, 57	78%
Cousins & Donnell (2012)	England. Gen-P.	Views on prescribing role. 6 NIPs.	3, 16, 18, 27, 34, 35, 37, 42, 45,	6, 9, 10, 20, 24, 28, 61	59%
Daughtry et al (2010)	England. Gen-P.	Experiences of prescribing role. 8 practice NIPs.	3, 6, 18, 27, 29, 35, 62	5, 8, 9, 10, 11, 24, 28, 29, 30, 44, 46, 47, 57, 61	36%
Dhalivaal et al (2011)	England. Gen-P.	Patient views on nurse prescribing. 15 patients.		22, 39	43%
Downer & Shepherd (2010)	Scotland. Comm.	Views on prescribing role. 8 district NIPs.	3, 15, 17, 18, 35, 37, 38, 45, 48, 49, 62	3, 9, 10, 30, 44, 57, 61	48%
Herklots et al (2015)	England. Comm.	Experiences of prescribing. 7 community matron IPs.	3, 15, 16, 18, 35, 38, 48, 49, 62	6, 7, 10, 11, 12, 22, 29, 47, 57, 61	43%
Holden et al (2019)	England.	Medicines optimisation practices. 20 physio non-IPs, 1 physio-IP.	3, 13, 36, 42, 45, 50, 51	10, 21	75%
Inch et al (2019)	England, Scotland, Northern Ireland. Elderly residential care	Feasibility of implementation. 2 P non-IPs, 4 PIPs, 6 GPs, 16 care home staff, 2 patients, 3 relatives, 1 dietician non-IP.	3, 49	10, 21, 22, 23, 52	54%
Kelly et al (2010)	England. Gen-P.	Barriers to adoption of IP. 31 practice NIPs, 120 N non-IPs.	1, 2, 3, 9, 13, 35, 36, 42, 45, 50, 51, 53, 54, 55		33%

Author(s), year	Country, Setting	Study focus, Participants	Barriers	Facilitators	QATSDD score
Lane et al (2020)	England, Scotland, Northern Ireland. Elderly residential care	Barriers and facilitators to prescribing. 27 P non-IPs, 29 GPs, 12 care home staff, 7 patients, 7 relatives.	3, 35, 43, 48, 49	6, 7, 8, 10, 11, 21, 22, 39, 46, 52, 56	78%
Latham & Nyatanga (2018a,b)	England. Comm pall care.	Views on prescribing role. 6 NIPs.	3, 15, 18, 27, 35, 36, 38, 49, 50, 60	7, 8, 10, 11, 12, 20, 21, 22, 30, 44, 52, 57, 61	71%
Maddox et al (2016)	England. Gen-P. Comm, Nursing homes, Comm pharmacy.	Barriers and facilitators to prescribing. 25 NIPs, 5 PIPs.	3, 15, 16, 26, 27, 29, 35, 37, 42, 48, 62	6, 7, 10, 12, 24, 29, 30, 42, 47, 57, 61	71%
Stenner et al (2011)	England. Gen-P, Comm clinics.	Patient views on nurse prescribing. 41 patients.		11, 22, 23, 29, 39	55%
Weiss et al (2016)	England. Gen-P	Views on prescribing role. 7 NIPs, 7 PIPs, 7 GPs.	3, 6, 17, 25, 35, 45, 49, 51, 56, 58, 59, 63	3, 6, 8, 11, 12, 22, 24, 29, 39, 44, 46, 47, 63	52%
Williams et al (2018)	England. OOH/unscheduled care.	Factors influencing nurse and GP antibiotic prescribing for respiratory tract infection. 15 NIPs, 15 GPs.	15, 16, 18, 26, 27, 34, 49, 59	6, 12, 22, 23, 24, 28, 32, 41	76%

Comm – community, DMPs – designated medical practitioners, Gen-P – general practice, GPs – general practitioners, HEI – higher educational institute, IC – integrated care, NIP – nurse independent prescribers, N non-IPs – nurse non-prescribers, pall – palliative, physio-IP – physiotherapist independent prescriber, physio non-IPs – physiotherapist non-prescribers, PIPs – pharmacist independent prescribers, OOH – out of hours.

Barriers: 1=Lack of backfill/protected/study time, 2=Lack of DMP role clarity/supervision/availability, 3=Lack of medical/managerial support/leadership, 14=Lack of national IP incentives/policy initiatives, 15=Lack of clinical record/IT access, 16=Lack of CPD/supervision, 17=IP role isolation, 18=Time/workload constraints, 19=Lack of IP strategy, 25= Lack of inter-professional collaboration/communication networks, 26=Unclear/absent clinical protocols/guidelines, 27=Inappropriate patient/team pressure for prescribing, 33=Lack of local policies for IP, 34=Lack of governance/accountability structures, 35=Lack of team understanding of IP, 36=Lack of clinical/service advantage of IP, 37= Lack of peer support/mentoring, 38=Lack of prescribing confidence/competence, 42=Fear of responsibility/accountability/error, 43=Lack of practitioner specialist skills, 45=Lack of professional/personal adoption incentive, 48=Poor/absent physician relationships, 49=Lack of IP role clarity, 50=Expedient medicines pathways, 51= Prescribing considered outside professional practice scope, 53=Lack of course information, 54=Inconsistent selection policies, 55= Lack of workforce planning, 58=Formulary restrictions, 59=Lack of service user acceptance, 60=Delayed registration post qualification, 62=Lack of medical supervision, 63=Employment model

Facilitators: 4=DMP role clarity/good DMP supervision, 5=Inter-professional training model, 6= IP role clarity, 7=Established physician relationships, 8=Medical/managerial support/leadership, 9= Professional/personal adoption incentive, 10=Clinical/service advantage of IP, 11=Inter-professional collaboration/communication networks, 12=Peer support/mentoring, 13=Lack of course funding, 20=Prescribing integral to advanced practice, 21=Identified service pathways gaps, 22= Practitioner specialist skills, 23=Consultation time, 24=CPD/supervision, 28=Clinical/professional protocols/guidelines, 29= Prescribing confidence/competence, 30= Exposure to prescribing opportunity, 31=Adequate formulary, 32=National incentives/policy initiatives for prescribing, 39=Service user acceptance of IP, 40= Governance/accountability structures, 41=Audit/feedback on prescribing practice, 44=Good interprofessional relationships, 46=Stakeholder consultation, 47=Team understanding of IP, 52=Clinical record/IT access, 56= Employment model, 57=Medical supervision, 61=Delineated scope of prescribing competence

All studies reported results from primary care IP implementation; in general practice[138-140, 145], community domiciliary/residential care[134, 141, 142, 144, 146, 148, 152] or mixed general practice/community settings[129-133, 135-137, 143, 149, 150]. Participants included nurse/pharmacist prescribers[132, 134, 136-139, 141, 142, 148, 149, 151, 152], nurse/physiotherapist non-prescribers[143, 145], nurse non-medical prescriber trainees and educational staff[129-131], service-users[135, 136, 140, 150] and multi-disciplinary team members[144, 146, 151, 152]. Studies explored training[129-131], IP roles[132, 138, 139, 141, 148, 151], patient acceptance[135, 140, 150], prescribing/medicines optimisation practices[133, 134, 136, 142, 143, 152], implementation feasibility[144] and barriers and/or facilitators[137, 145, 146, 149].

The methodological quality of included studies (see Table 3 summary) was average, with a QATSDD mean score 25 (range 13-36), mainly due to seven low scoring studies[132, 134, 139-142, 145]. Common methodological weaknesses were: lack of explicit theoretical framework[132, 134, 139, 140, 142, 145], limited/absent rationale for choice of analytical methods[132, 134, 139-142, 145] and lack of reliability assessment for analytical processes[132, 134, 139-142, 145]. Methodological strengths of higher scoring studies were: statement of aims/objectives in main body of report[130, 133, 136, 137, 143, 147, 152], description of data collection procedures[130, 133, 137, 143, 146, 147, 149] and fit between research question and method of analysis[130, 136, 137, 143, 146, 147, 149, 152]. Notably studies providing richer contextual descriptions[133, 137, 146, 148, 149, 152], and/or using implementation theory[137, 146] explored barriers and/or facilitators in greater depth.

Identification of barriers and facilitators and key stages of implementation

Implementation of IP in primary care was found to be complex and influenced by a myriad of factors which were active at organisational, service/team and individual stakeholder levels. Informed by descriptive/data themes, these fell into four major analytical themes, each of which are presented as a key stage in the implementation process as follows:

1) Analytical theme 1: Preparation – organisational readiness for implementation
2) Analytical theme 2: Training – optimising practitioner readiness for IP
3) Analytical theme 3: Transition – ensuring early prescribing support
4) Analytical theme 4: Sustainment – maximising and developing IP

Table 4 provides an overview of analytical themes, associated descriptive/data themes and summative findings. Examples of indicative quotations making up these themes are presented in Supplementary file 3. Factors presented within themes acted as barriers and/or facilitators to implementation, e.g., poor managerial support was a barrier, while proactive managerial support and leadership facilitated implementation. It is acknowledged that

barriers and facilitators overlap some themes and in some cases are interdependent. For example, lack of mentoring relationships with doctors limited opportunity for informal support, which in turn prevented prescribing competence development and risked loss of prescriber confidence[142, 149]. Therefore, to avoid duplication of findings, barriers and facilitators are presented within the themes deemed most appropriate, yet their presence and influence is acknowledged elsewhere. The majority of data derived from studies conducted in England or mixed geographical settings, it was not possible deduce differences in barriers and facilitators across the devolved UK nations.

Table 4. Analytical themes and sub-themes from included studies, with summative findings

Analytical Theme	Descriptive Theme	Data theme	Summative findings
Analytical theme 1: Preparation – organisational readiness for implementation	Theme 1.1: Clarifying need & advantage of independent prescribing	Clarifying clinical/service need for independent prescribing	• Establishing a clear service/clinical need for IP[130, 135, 137-139, 141, 149] and identifying existing gaps in medicines pathways was a key requisite and facilitator for adoption[132, 134, 143, 144, 146, 148]. • Team clarity on the need for adoption cemented IP role intentions and avoided role dissonance following implementation[133, 142, 144, 146, 149, 151]. • Managerial leadership/support for IP was essential for ensuring initial and on-going infrastructural, funding and other implementation support needs[129-132, 134, 138, 139, 141-144, 146, 148, 151]. • Trusting interprofessional relationships, collaboration/team-working built confidence in IP and facilitated team support for implementation[129, 130, 133, 135, 137, 139, 141, 142, 146, 148, 149, 151].
		Establishing service pathway gaps	
		Role clarity	
	Theme 1.2: Managerial leadership and support	Role of managers	
		Recognising value	
		Culture	
	Theme 1.3: Inter-professional environment	Inter-professional relationships	
		Communication & collaboration	
Analytical theme 2: Training – optimising practitioner readiness for independent prescribing	Theme 2.1: Selecting the right practitioners	Selection	• Adoption was impeded by inconsistent candidate selection policies and lack of workforce planning[143, 145]. Individual practitioner expectation of professional/personal benefit remained a key driver for IP adoption[131, 132, 133, 138, 139, 141]. • Skills requisite to IP (e.g., physical assessment and communication skills) were important factors influencing service user and team acceptance of IP[135, 136, 140, 144, 146, 148, 150-152] • Motivational barriers (e.g., lack of remuneration, fear of litigation and competing professional or personal commitments) disincentivised training uptake[138, 143, 145].
		Skills & aptitudes	
		Motivation & commitment	
	Theme 2.2: Preparing and supporting practitioners during training	Expectations of training	• Lack of information on NMP training and support for managing competing work, personal/ academic commitments negatively influenced student learning experiences[129-131, 145, 148]. • Standardised allocation of study leave/backfill/protected time and prepared practice mentors were essential to support learning[129-131, 134]. • Additional training buddying schemes helped students better manage the competing demands of training whilst working[131].
		Study leave	
		Designated Medical Practitioners	
Analytical theme 3: Transition – ensuring early prescribing support	Theme 3.1: Transition as a point of vulnerability	Self-confidence	• Transition was a point of high vulnerability for new prescribers with an initial lack of confidence often under-recognised by teams[137, 139, 141, 142, 148, 149]. • Delineating a minimum scope of practice by restricting formulary and/or using guidelines/protocols facilitated early growth of competence and confidence[138, 139, 141, 142, 149, 151]. • Early exposure to prescribing opportunity, time and structured support systems with medical supervision were essential in transition[129, 132-134, 136-139, 141, 148, 149].
	Theme 3.2: Nurturing confidence & competence	Minimum competence	
		Experience & exposure	
	Theme 3.3: Transition support needs	Informal & formal support systems	
Analytical theme 4: Sustainment – maximising and developing independent prescribing	Theme 4.1: Service delivery	Impact on workload	• IP could increase workload and imposed time constraints[132, 137-139, 141, 142, 148, 152]. Role underuse was a risk in community settings if infrastructural requisites (e.g., electronic prescribing/IT clinical record access) failed to be implemented[132, 134, 141, 142, 148, 149]. • IP for service redesign and sustainability was facilitated by competence development, CPD opportunity and medical/managerial leadership[132, 133, 136, 139, 141, 142, 144, 146, 148, 149, 151, 152]. • CPD provision and formal evaluation of IP implementation was inconsistent and lacked
	Theme 4.2: Supporting role development	Role/service expansion	
		Continued professional development	
		Evaluation & Reflection	

			standardisation in primary care[132, 138, 142, 149, 152]. • 'Enhancement', 'substitution', and 'role specific' implementation models based on the maintenance or change in prescribing competence, service reconfiguration and/or substitution of services were identified[132, 139, 141, 142, 144, 146, 148, 149, 151].

CPD – continued professional development, DMPs – designated medical practitioners, GPs – general practitioners, IP – independent prescribing, IPs – independent prescribers, NMP – non-medical prescribing

Analytical theme 1: Preparation – organisational readiness for implementation

This analytical theme refers to barriers and facilitators influential to the planning phase of implementation which related to the service need and relative advantage of implementing IP, the need for consistent managerial leadership and an inter-professional environment that was conducive to team implementation.

Descriptive Theme 1.1: Clarifying need and advantage of implementing independent prescribing

Identifying shortfalls in existing medicines pathways and how IP could fill service gaps were key steps in this stage. Studies described a highly qualified, specialist nursing and pharmacy workforce delivering unscheduled, scheduled and out-of-hours services[132, 134-139, 141, 142, 144, 146, 148, 150-152] who routinely made autonomous clinical decisions necessitating prescribing and medicines optimisation skills[129, 135-137, 142, 148, 150, 152]. IP held tangible advantage over former methods of accessing prescribed medicines which involved request, referral and/or the counter-signing of prescriptions by doctors. Subject to GP workload[134, 144, 146] and constrained availability[142, 144, 146, 148], these methods were labour intensive[142-144, 146, 148], inefficient[138, 142, 143, 148], and burdened services and patients through the need for additional healthcare contacts[135, 139, 141, 143, 144, 148, 150]. By removing the need for doctor input, IP improved responsiveness with respect to medicines[135, 137, 141, 142, 144, 146, 148, 150], enhanced care quality[132, 144, 148], and helped prevent adverse outcomes[142].

Lack of team clarity and transparency on IP role intentions were persistent barriers to implementation[139, 141, 142, 144, 146, 148, 149, 151]. Poor team understanding of IP could limit integration[151] and promote role ambiguity[151] or misuse[132, 138, 142, 149]. Consultative team stakeholder processes facilitated clarification of current medicines pathways bottle necks[146], helped cement clinical advantage of IP[146] and encouraged a collective understanding of implementation[144, 146, 151]. Conversely, if existing medicines pathways were perceived to be expedient and IP held limited advantage, adoption was less likely[143, 145].

Descriptive Theme 1.2: Managerial leadership and support

Lack of managerial leadership and support were highly cited barriers to implementation that persisted across the review decade. Nurse/pharmacist prescribers reported stage specific and on-going funding[130, 143, 145], training[131, 132, 134, 138, 139, 141, 142, 149] and infrastructural needs[132, 134, 141, 142, 148, 149] that extended across the IP implementation trajectory. Managerial support was, however, frequently reported to diminish post-adoption[130-132, 134, 138, 139, 141-143, 145, 148, 149] and many practitioners believed managers lacked knowledge about IP[132, 138, 139, 143, 145] or misunderstood its potential for improving service quality[132, 145]. Nurses/pharmacists

ascribed high value to IP for improving service efficiency[137, 138, 141, 142, 148, 149] and skill utilisation[132, 134, 138, 142], perceiving it extended clinical knowledge beyond prescribing[132, 134, 142, 148], enhanced clinical confidence[132, 139, 141, 142, 148] and job satisfaction[138, 141, 148], and facilitated team education[132, 144, 151]. They perceived themselves a unique workforce resource with potential for better mobilisation in under-resourced areas (e.g., mental health)[132]. However, there was a perception that management lacked appreciation of primary care workforce aspirations for IP[145] and overlooked its scope[132, 143, 145]. Better recognition and commitment were considered essential for leveraging and driving IP services forward[132].

Ensuring teams understood IP and its role within care delivery mitigated subsequent barriers[138, 139, 142, 151] and was critical for implementation success[139, 141, 142, 144, 146, 148, 149, 151]. Doctors, receptionists[138, 139, 151], dispensing pharmacists[148, 151], and peer colleagues[141, 148, 149, 151] all played supervisory and/or infrastructural roles in IP implementation and understanding the need for this input was essential. While staff clarity on their roles in relation to IP positively influenced willingness to provide enabling supports such as clinic administration[138, 151], record access[146], and clinical supervision/pharmaceutical advice[142, 148] lack of team understanding of IP was a barrier that was cited repeatedly across the review decade[134, 138, 139, 141, 142, 145, 146, 148, 149, 151].

Descriptive Theme 1.3: Inter-professional environment

Respectful, trusting inter-professional relationships promoted an appreciation of different professional skill sets[151], helped ratify the purpose of IP[129, 151] and built team confidence in the prescribing competence of nurses and pharmacists[129, 142]. Good relationships facilitated information transfer[142], promoted supervision provision[149, 151], shared learning[129] and team working[151]. Acceptance and positive attitudes towards IP as a shared skill were facilitative to implementation[144, 146, 151] and mitigated the likelihood of “turf wars” emerging if IP roles was perceived to encroach on professional territories[151]. While many nurses/pharmacists reported positive relationships with doctors[139, 141, 142, 148, 151], others described jurisdictional tensions over prescribing authority[139, 145, 151]. Building trust for IP where relationships were weak took time[144] and given the important supervisory role of doctors in IP[132, 134, 138, 141, 142, 148, 149], consideration of their strength in adoption planning is pertinent. Good communication networks were more likely where established relationships and positive attitudes towards IP prevailed[142, 151], and were important for imparting information to teams about IP [138, 144, 146], for developing supervision and peer support[142, 148] and promoting teamwork[146, 151].

Analytical theme 2: Training – optimising practitioner readiness for independent prescribing

This analytical theme refers to the extent to which organisations select and prepare the right practitioners for IP training, as well as how they support and maximise students' learning experiences.

Descriptive Theme 2.1: Selecting the right practitioners

Overall, strategic planning for IP workforce selection lacked scrutiny, and practitioner choice[130, 132, 138], expectation of improved job satisfaction[138, 145, 148], efficiency and patient benefit[130, 138] were the primary drivers for implementation across the review period. Training course drop out[130] and failure to prescribe following training[132, 134], suggest a need to ensure selection procedures match skills and capabilities to IP and increase the chances of organisational return on IP training investment. Synthesis identified essential skills[132, 135, 137, 138, 140, 148, 150, 152] and personal motivation[130, 132] as important considerations. Study demographic data indicated a clinically experienced workforce[132, 138, 139, 148, 149], with degree/higher degree educational and/or specialist skills attainment[130, 135, 142, 150]. Advanced physical assessment and clinical specialty skills not only suggested expertise and theoretical knowledge to underpin IP but were also recognised by patients as important contributors to care quality[135, 140, 150]. Patients reported high levels of confidence in IP led care, with the caveat that prescribers demonstrated knowledge and expertise[135, 140, 150]. Good interpersonal, communication, examination, history taking and diagnostic skills were key. These were mandatory for differential diagnosis[135-137, 150, 152] and holistic management[138, 148, 152], for conferring practitioner prescribing/non-prescribing decisions[136, 137, 152] and managing treatment concordance[132, 135, 137, 140, 146, 150, 152] and patient expectations for medicines[136, 137, 152]. Motivational deterrents to IP uptake that were identified by non-prescribing nurses[145] and physiotherapists[143] were being near retirement[145], a reluctance to undertake further advanced training[143, 145], concerns about training rigor[143], and a perception of effort/remuneration imbalance[143, 145]. Although IP job satisfaction and professional benefits were considered future adoption drivers[145] lack of financial remuneration in particular disincentivised practice nurse[145] and physiotherapy adoption[143].

Descriptive Theme 2.2: Preparing and supporting practitioners during training

UK non-medical prescribing training programmes employ profession-specific or inter-professional models, delivering 26 days equivalent fulltime education alongside a supervised learning in practice period[129]. Given the onus for safe prescribing, programmes were reported by students and nurse/pharmacist prescribers to be academically rigorous[131, 148]. There was evidence however that students lacked key knowledge about generic training

models[145], the learning expectations of different pedagogies[129], as well as course assessment and portfolio requirements[130]. Expecting narrower, speciality specific rather than generic training was common[130, 148]. Students found the academic demands of training whilst continuing their usual clinical duties challenging indicating a need to better balance work, personal and academic commitments[129, 131]. The degree of allocated support time[130, 131] and the quality of mentoring during supervised practice learning[129] were key influences on student learning experiences. Adequate study leave, protected time and backfill respectively optimised study time, reduced personal time encroachment and negated the need to absorb usual role duties whilst training[130]. Despite organisational requirement to confirm study leave arrangements pre-training, primary care allocation was highly unstandardised, with some students entering training without a confirmed agreement[130]. Prepared practice mentors with clarity on their role obligations in general provided a higher level of input to students[129], and good mentor-student relationships that continued post-training facilitated transition[134]. Additional training buddying schemes helped students better manage the competing demands of training whilst working, although time constraints limited their uptake[131].

Analytical theme 3: Transition – ensuring early prescribing support

This analytical theme highlighted the importance of the post-qualification transition period in the development of prescribing confidence/competence and identified a high need for supervision and informal and formal support. Delineating the scope of prescribing competence facilitated early implementation.

Descriptive Theme 3.1: Transition as a point of vulnerability

Many nurses/pharmacists held vivid memories of anxiety and fear during their first IP encounters[139, 141, 142, 148, 149], reporting a diminution of self-confidence during the early transition period[137, 139, 141, 142, 148, 149]. This finding traversed the review decade and was unrelated to how prepared prescribers felt by training[139, 148]. Heightened awareness of the risks of error[149], the cautionary approach instilled by training[139, 149], and liability for personal accountability[141, 148] fuelled feelings. It was recognised that self-confidence and competence development were essential for prescribing[139, 149] and mitigated anxiety[148], but were highly dependent on exposure to prescribing opportunities[148, 149], time[139, 149] and above all, the level of available support[129, 134, 141, 148, 149]. Without a channel for accessing supervision, nurses/pharmacists could doubt competence, lose confidence and defer from prescribing[149]. This led to a lack of competence development and underutilisation of IP[149] and suggests that greater acknowledgement of transitional developmental needs is necessary.

Descriptive Theme 3.2: Nurturing competence and confidence

Establishing competence boundaries and recognising personal limitations were important enablers in transition[139, 149]. Nurse/pharmacist prescribers defined competence as the immediate clinical areas in which they had the knowledge and confidence to prescribe[138, 139, 141, 142, 149, 151]. Delineating individual scope of prescribing practice by restricting the range of medicines prescribed to circumscribed clinical areas[138, 142, 148, 151] in line with clinical guidelines and protocols[139] encouraged the early development of competence[149]. Alternatively, prescribing outside these boundaries[139], as in complex polypharmacy or comorbidity[134, 142], was deemed risky, unsafe and unprofessional[138, 149, 151]. Nurses/pharmacists reported that teams often failed to recognise their self-confidence issues related to competence[142], and exerted inappropriate expectations for IP[134, 138, 139]. Recognising that as a new skill, development of prescribing competence was time and opportunity dependent[139, 148, 149] several nurses expressed anxiety that prescribing skills would diminish during transition if not utilised[148].

Descriptive Theme 3.3: Transition support needs

Reports of poor transition support pervaded the review decade[132, 134, 137, 138, 141, 142, 148, 149] and there was limited evidence of pre-emptive, formalised supervision provision[134]. Nurses reported this absence as immediately impactful[141], especially in isolated roles and in services with few prescribers[132, 149]. While nurses and pharmacists desired structured and informal supervision[142, 149], in all 7 studies addressing this theme[132, 134, 138, 141, 142, 148, 149], most could only access a variable level of informal support. “Open door” contemporaneous advice given by GPs was the primary source, although specialist doctors, peers and pharmacists were also consulted. Team receptiveness to providing this mentoring[149], its reliability[137, 141] and accessibility[148, 149] were key facilitators. Informal opportunities for discussion provided security[149] and were valued[138, 141, 148, 149]. Exemplifying barrier interdependence, lack of mentoring relationships with doctors limited opportunity for informal support, prevented prescribing and limited competence with specific medicines or clinical conditions[149]. In turn this necessitated re-engagement of GP referral for prescribing and culminated in inequitable patient medicines management[142, 149]. To address shortfalls in formal support provision, several prescribers set up local peer networks[134, 138, 142], however a strong desire for formalised mentorship was expressed[132, 138, 142, 149].

Analytical theme 4: Sustainment – maximising and developing independent prescribing

This analytical theme describes barriers and facilitators within the descriptive sub-themes of service delivery and supporting role development, which relate to how IP was used and maximised in primary care.

Descriptive Theme 4.1: Service delivery

Prescribers reported that IP promoted efficient, streamlined services[138, 139, 141, 142, 144, 148]. However, views on how it impacted individual practitioner workload differed[138, 139, 141, 142, 148, 149]. IP reportedly lengthened consultations[132, 138], added administrative tasks[141, 148] and increased job-related stress[138]. Undertaking in-depth holistic assessment to inform prescribing needs imposed time constraints[132, 152], which were exacerbated in strict ten-minute clinic allocation systems[137, 138]. Additional time and experience could however be mitigating[137, 152]. Community IPs reported their main workload barriers as administrative and related to absent or incompatible electronic record and prescription generation systems[134, 141, 142, 148, 149, 152]. Seeking clinical information caused significant delays, in some cases causing IPs to revert to GP referral for prescribing needs[134, 141, 148, 149]. However, recent IT accessibility was suggested to mitigate retrieval problems[146].

Attitudes towards role change because of IP also influenced perceptions about workload[138, 139]. Some prescribers perceived that GPs abdicated responsibility for prescribing following introduction of IP[148] which increased workload and job demand[138, 139]. Prescribers negatively referred to this as work offloading[139] and were suspicious of underpinning financial motives[145]. Alternatively, other prescribers viewed the benefits of IP at a broader service level and as an opportunity to reduce GP colleague workforce pressures[134, 146, 148]. While GPs in one study stressed that their acceptance of pharmacist IP rested on whether it increased existing workload[144] limited team member involvement within studies precluded synthesis of wider primary care workload impact of IP.

Descriptive Theme 4.2: Supporting role development

Despite limited contextual detail on workforce planning[132, 146, 151], three broadly categorised "models" of IP implementation were identified. The first "*Enhancement*" model introduced IP to enhance the efficiency of existing nurse/pharmacist roles without changing the pattern of service provision, client group or condition complexity[139, 141, 142, 149, 151]. The second "*Substitution*" model adapted existing IP roles to directly substitute or replace GP services, which required some level of structural re-organisation of care and/or a change in core prescribing competence[132, 141, 144, 146, 148], (e.g., substituting GPs in out-of-hours palliative care services and additionally managing non-cancer terminal illness[148]). The final, less

frequently evidenced "*Role specific*" model created new roles specifically for pharmacist prescribers, for which geriatric chronic disease and co-morbidity management were new areas of competence, and in which pharmacists assumed a transfer of responsibility from GPs for care home medicines management[144, 146]. One study found that the specific models of employment/funding influenced how well IP roles were integrated[151], with direct GP practice employment as opposed to commissioned PCT funded roles creating greater sense of permanence, better role use, and enhanced team involvement. This was assumed to result from improved relationships, trust and team building[144, 146].

A strategic top-down approach to implementation of IP was unclear from the reviewed studies, and overall an individual practitioner, bottom-up approach appeared to drive adoption. However, there was some evidence that where skill mix was recognised and valued within services[146, 151], CPD was readily available[151] and doctors provided leadership[139, 151] IP was used to greater extent for primary care redesign and service sustainability. Absent policy and national targets restrained IP resource allocation[132], whilst policy and national guidance was facilitative[144, 146]. Doctors also imposed constraints on IP by limiting clinical caseloads[139, 149], restricting formularies[134, 151] or by retaining sole diagnostic prescribing responsibility for patients[132, 146]. For some prescribers, competence expansion was synonymous with crossing job descriptions and mandated formal negotiation with employers[149].

Provision of CPD overall was inconsistent, untargeted to evolving learning needs[138, 149], and prescribers identified pharmacology[141], statutory drug updates[138] as key topics. Lack of confidence with heart failure[142], mental health conditions[132], polypharmacy and off-label prescribing[149] suggested CPD in co-morbidities warranted further input. Trust provision included forums/meetings[138, 142], commissioned training, national conference attendance[141, 151] and electronic journal resources[141]. However, provision varied widely and with few prescribers reporting accessible CPD systems[138, 142], there was agreement that improved implementation was necessary[132, 138, 141, 142, 149, 152].

With time and input to create support systems[142] and enhance communication concerning role boundaries[148] prescribers reported that IP integration improved. However, formal evaluation following implementation was rare[134], with only two studies[137, 152] identifying quality assurance activities such as audit and local/national data benchmarking in the context of antibiotic stewardship.

Discussion

The future of UK primary care is reliant on workforce expansion and introduction of new first-contact non-medical roles[27, 153-156]. Ensuring practitioners have the right skills to enable sustainable service development, at scale and pace is key[157, 158]. Recent reports of rising non-medical prescriber numbers in some regions of the UK[30, 79, 159] suggest healthcare providers are recognising the value of prescribing for skill-mix and workforce transformation. Ensuring implementation is optimised, sustained and IP roles are maximised for service and patient benefit is essential.

This is the first meta-synthesis evaluating barriers and facilitators to the implementation of IP by non-medical healthcare professionals in primary care. Guided by theory, synthesis of factors across a continuum of implementation provides a temporal dimension and insight into three primary '*enhancement*', '*substitution*', and '*role specific*' models of implementation that previous UK systematic reviews lack[54, 68, 69, 74]. In its infancy in UK primary care non-medical prescribing research[137, 146, 160, 161], implementation theory is likely to become increasingly important for informing implementation strategies as the governance arrangements for extended prescribing rights grow in complexity[159] and the socio-political primary care landscape continues to change[162].

From stakeholders' experiences of implementing IP, barriers and facilitators were identified in four key analytical themes: '*Preparation',* '*Training*', '*Transition*' and '*Sustainment'*. While some interdependence and overlap is acknowledged, these themes present a stage based road map of barriers and facilitators for consideration in future implementation.

In the theme '*Preparation',* the importance of organisational readiness for implementing IP was reflected by a need for consistent managerial leadership/support, improved team understanding of prescribing role intentions and an interprofessional environment that supports novice prescribers. While nurses and pharmacists considered IP integral to advanced practice and essential to enhance workforce skill utilisation there was concern that it lacked strategic prominence in primary care. Accordingly, the '*Training*' theme identified a need for improved managerial recognition of primary care workforce aspirations for IP along with a need to ensure skills and motivations matched those necessary for training. In line with national reports[43, 46, 55], the response to the non-medical prescribing agenda has been sluggish in some UK regions[59], with reforms to commissioning either marginalising[59] or fragmenting its funding[110, 163]. Moreover, in common with national evaluations[43, 59, 164, 165], this synthesis identified a continuing practitioner led implementation of IP with largely voluntary uptake. Contrary to secondary care[62], there was limited evidence[144, 146] for policy driven service design or targeted strategy embedding IP within career or service pathways. This suggests a disjointed approach to implementation that may reflect the rapidly changing

policy and service context of UK primary care[166-168]. However, with a third of the non-medical general practice workforce near retirement age[169], and succession of IP roles lacking guarantee[151], sustainability of non-medical prescribing capability is a key concern for future management of primary care patient medicines needs[170].

Transition was identified as a key stage in implementation that warrants greater scrutiny and has resonance for professions such as paramedics who are new to prescribing. While its affective nature[171, 172] and need for bespoke support systems has been previously recognised[173, 174], few studies have specifically sampled novice prescribers[172, 175] to ascertain optimal supervisory requirements[171]. Despite extension of IP rights to optometrists, physiotherapists, radiographers, podiatrists and paramedics over the past thirteen years, focus on implementation issues during transition within each profession has been limited[43, 176, 177]. This is likely to be especially important for paramedics who, awarded IP rights in 2018 have not been subject to the supplementary prescribing lead in period that characterises other professions[178] and who are historically less well established in the primary care workforce[179, 180]. Early data suggesting challenges around role isolation, team expectations of paramedic IP and lack of legislative parity for controlled drugs warrants further exploration to determine whether paramedics too, face similar barriers identified by this review[177, 181].

In common with other UK reviews[68, 69], limited overall focus on long-term sustainability or strategy for implementation at either local, regional or national level was found. This was echoed by the dominance of the '*enhancement*', as opposed to '*role specific*' implementation models identified and may reflect the multiple changes made to policy[182], leadership[183] and commissioning[184] and the on-going embedding of new governance structures within primary care[185]. Of note, despite finding a need for more cohesive managerial support that extends across the entire implementation trajectory, minimal reference was made to the championing and change agent functions of non-medical prescribing leads[173, 174]. The Department of Health has long recommended implementation of non-medical prescribing under direction of a designated lead with strategic, operational and governance footholds[33]. A lack of representation in recent regional research[159] supports the tenet that many of these roles were not replaced in England following the abolition of primary care trusts[174]. Successful implementation is more likely when champions are fully organisationally supported[186] and provide sustained input to implementation activities[173, 187, 188]. However, a lack of role infrastructure, clarity and designated time[159, 174], along with the increasingly diverse non-medical prescribing workforce is challenging this important role. While other models of primary care workforce mentoring show promise[189], the repetition and frequency of barriers

exposed by this synthesis over the review decade indicate urgent need for a more cohesive approach to supporting IP.

Strengths and limitations

This review strengthens the UK evidence base by identifying challenges to IP implementation in traditional and contemporary primary care contexts. Using comprehensive search strategies and robust analysis methods, it highlights factors during '*Preparation',* '*Training*', '*Transition*' and '*Sustainment'* stages which can be used by practitioners and policymakers to identify areas for improving implementation support.

Although limited to UK literature, the theoretical lens ensured focus on common factors known to facilitate implementation (e.g., the need for leadership and championing) which are generalisable to any implementation context, either in the UK or internationally. We did not however include grey literature and although qualitative synthesis enabled rich description of elements perceived by stakeholders to influence implementation of IP in the UK, reviews that include quantitative literature in primary care are encouraged. Our focus on primary care excluded barriers and facilitators that may be unique to acute care and other settings. Moreover, as the non-medical prescribing agenda is disseminated across the NHS, it will be increasingly important to consider the theoretical basis for developing strategies to achieve more successful implementation of this complex innovation in different professions[67, 119, 190].

Conclusion

Globally, healthcare systems are implementing strategies to address workforce deficits that enhance the skills of nurses, pharmacists and other non-medical healthcare professionals. Integral to advanced scope of practice, it is imperative that IP capability is optimised through successful implementation. This meta-synthesis has identified persistent barriers at the '*Preparation',* '*Training*', '*Transition*' and '*Sustainment'* stages of implementation. A more coordinated and targeted approach to overcome barriers identified in these stages is key to ensuring that IP is an effective approach to helping alleviate workforce shortfalls in the UK, and around the world.

Contributors

JE and NC conceived the study. JE obtained funding, oversaw all aspects of the project and contributed to all stages. JE drafted this paper. JE designed and executed all the searches, data extraction, coding, and quality appraisal. NC contributed to all stages of the review, including data extraction and coding. MC and NC contributed to the evolving synthesis and formulation of conclusions.

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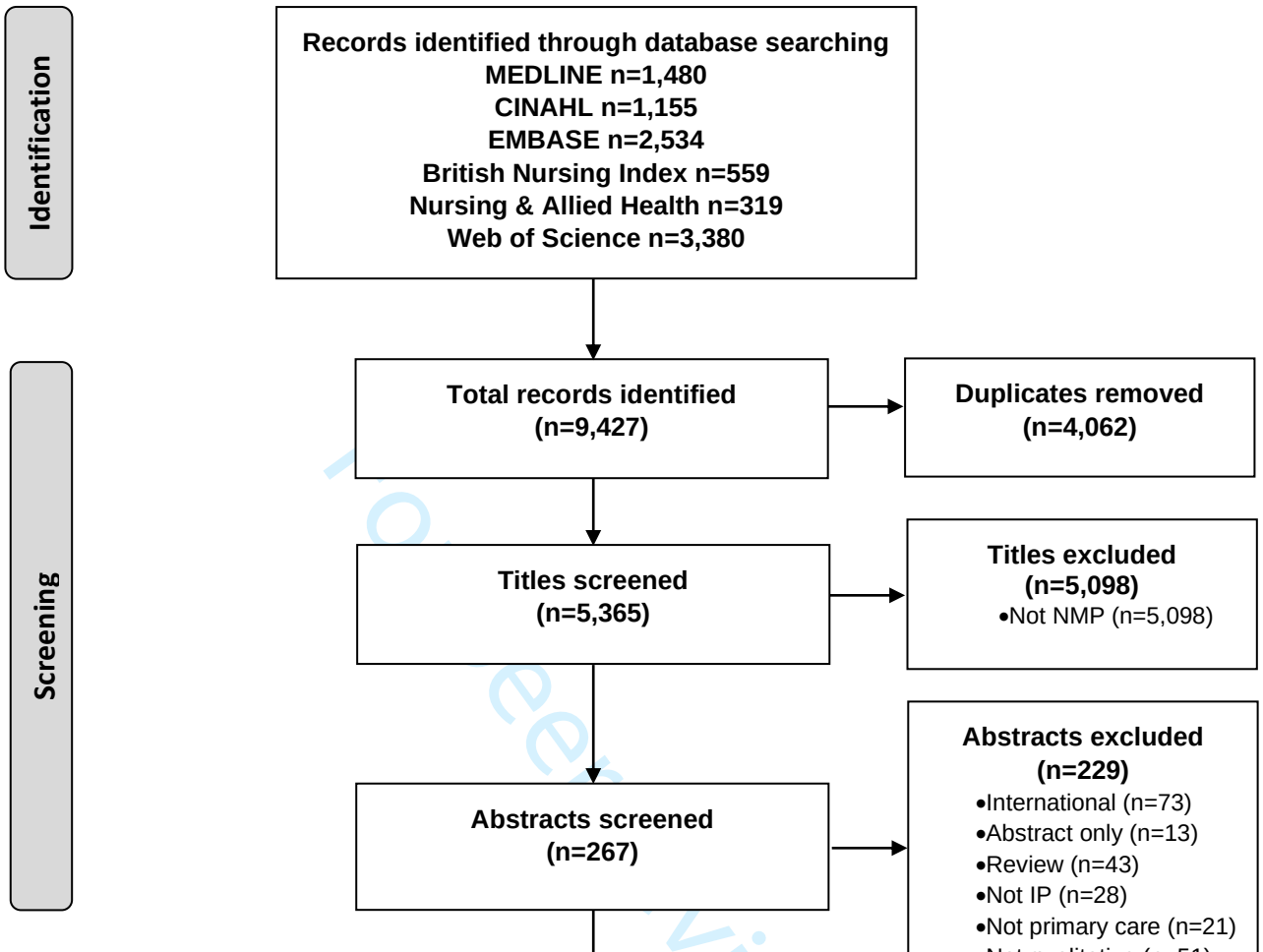

SupplementaryFile1_V2.0_19112021

Supplementary File 1. MEDLINE search string

	EBSCO host; MEDLINE	
1	(MM "Family Practice")	42,149
2	(MM "Primary Health Care")	52,315
3	(MM "Physicians, Family")	11,183
4	(MH "Community Health Nursing")	19,640
5	(MH "Community Health Workers")	5,502
6	(MH "Community Health Services")	32, 035
7	(MH "Community Health Centres")	34,071
8	TI (community N1 health) OR AB (community N1 health)	41,477
9	TI (community N1 care) OR AB (community N1 care)	13,601
10	TI (primary N1 health) OR AB (primary N1 health)	28,349
11	TI (primary N1 care) OR AB (primary N1 care)	138,944
12	TI (general N1 practice*) OR (AB general N1 practice*)	45,549
13	TI (general N1 practitioner*) OR AB (general N1 practitioner*)	53,594
14	TI (family N1 practice*) OR AB (family N1 practice*)	10,921
15	TI (family N1 practitioner*) OR AB (family N1 practitioner*)	2,955
16	TI (gp N1 practice*) OR AB (gp N1 practice*)	2,067
17	TI (gp N1 service*) OR AB (gp N1 service*)	433
18	TI (gp N1 clinic*) OR AB (gp N1 clinic*)	341
19	OR/1-18	343,938
20	TI prescrib* OR AB prescrib*	153,174
21	TI independent prescrib* OR AB independent prescrib*	508
22	TI non-medical prescrib* OR AB non-medical prescrib*	208
23	OR/20-22	153,174
24	TI nurs* OR AB nurs*	460,786
25	TI physiotherap* OR AB physiotherap*	26,543
26	TI pharmacist* OR AB pharmacist*	34,354
27	TI (podiatr* OR chiropod*) OR AB (podiatr* OR chiropod*)	3,274
28	TI radiographer* OR AB radiographer*	1,746
29	TI (dietician* OR dietician*) OR AB (dietician* OR dietician*)	7,306
30	TI paramedic* OR AB paramedic*	7,958
31	TI optometr* OR AB optometr*	3,584
32	OR/24-31	533,864
33	23 AND 32	12,932
34	TI nurs* N1 prescrib* OR AB nurs* N1 prescrib*	1,054
35	TI pharmacist* N1 prescrib* OR AB pharmacist* N1 prescrib*	751
36	TI physiotherap* N1 prescrib* OR AB physiotherap* N1 prescrib*	105
37	TI paramedic* N1 prescrib* OR AB paramedic* N1 prescrib*	4
38	TI podiatr* N1 prescrib* OR AB podiatr* N1 prescrib*	15
39	TI chiropod* N1 prescrib* OR AB chiropod* N1 prescrib*	2
40	TI dietician* N1 prescrib* OR AB dietician* N1 prescrib*	18
41	TI dietitian* N1 prescrib* OR AB dietitian* N1 prescrib*	3
42	TI radiograph* N1 prescrib* OR AB radiograph* N1 prescrib*	61
43	TI optometr* N1 prescrib* OR AB optometr*N1 prescrib*	14
44	OR/34-43	1,985
45	33 OR 44	12,993
46	19 AND 45	2,417
47	LIMITS Full Text, Published 20100101-20201231, Peer-reviewed, English language	1,480

SupplementaryFile2_V2.0_19112021

Supplementary File 2. Quality Assessment Tool for Studies with Diverse Designs scores

	Afseth & Paterson 2017	Boreham 2013	Bowskill 2014	Brodie 2014	Carter 2021	Cole & Gillett 2015	Courtenay 2010	Courtenay 2017	Courtenay 2019	Cousins & Donnell 2012	Daughtry & Hayter 2010	Dhalivaal 2011	Downer & Shepherd 2010	Hopkins 2015	Holden 2018	Inch 2019	Kelly 2010	Lane 2020	Latham & Nyatanga 2018a,b	Maddox 2016	Stenner 2011	Weiss 2016	Williams 2018
Explicit theoretical framework	3	1	0	0	3	0	1	0	3	1	0	0	3	3	3	0	0	3	3	0	0	0	3
Statement of aims/ objectives in main body of report	3	3	3	2	3	3	2	3	3	2	3	2	3	3	3	3	3	2	3	2	3	3	3
Clear description of research setting	3	3	3	2	3	2	3	2	3	3	3	2	1	2	2	3	2	3	3	2	3	3	2
Evidence of sample size considered in terms of analysis	0	0	0	0	1	0	0	0	2	3	0	3	0	3	3	3	1	1	2	3	0	0	0
Representative sample of target group of a reasonable size	2	3	3	2	2	3	3	3	2	3	1	2	0	3	3	3	3	3	1	3	3	3	3
Description of procedure for data collection	3	3	3	2	3	1	2	2	3	3	2	2	2	3	3	1	1	3	3	3	3	3	2
Rationale for choice of data collection tool(s)	2	2	0	0	2	0	0	2	3	1	0	2	3	2	2	0	0	3	3	2	0	0	0
Detailed recruitment data	2	2	3	1	3	2	3	2	3	2	2	3	1	3	3	3	2	3	3	3	3	3	3
Statistical assessment of reliability & validity of measurement tool(s) (Quan)	n/a	0	2	n/a	n/a	0	n/a	0	n/a	n/a	n/a	n/a	n/a	2	2	0	0	n/a	n/a	n/a	n/a	n/a	n/a
Fit between stated research question & method of data collection (Quan)	n/a	3	3	n/a	n/a	1	n/a	2	n/a	n/a	n/a	n/a	n/a	3	3	3	0	n/a	n/a	n/a	n/a	n/a	n/a
Fit between stated research question & format & content of data collection tool (Qual)	1	3	2	2	3	1	0	3	3	0	0	2	0	2	2	1	0	3	1	1	0	3	2
Fit between research question & method of analysis	3	3	3	2	2	1	3	3	3	3	3	0	3	3	3	1	2	3	3	3	3	3	3
Good justification for analytical method selected	1	2	0	1	2	0	0	2	2	0	0	0	3	2	2	0	0	2	3	1	0	0	2
Assessment of reliability of analytical process (Qual)	0	2	0	1	1	0	3	2	0	3	0	0	0	0	0	0	0	0	0	3	3	0	3
Evidence of user involvement in design	3	2	2	0	2	0	0	3	1	0	0	0	0	0	0	3	2	2	0	1	0	0	3
Strengths & limitations critically discussed	2	0	2	1	3	0	1	3	3	1	1	0	1	2	2	2	0	3	2	3	2	1	3
Total	28	32	29	16	33	14	21	32	33	25	15	18	20	33	36	26	16	33	30	30	23	22	32
Max score possible	42	48	48	42	42	48	42	48	42	42	42	42	42	42	48	48	48	42	42	42	42	42	42

SupplementaryFile3_V2.0_19112021

Supplementary File 3 – Analytical themes and sub-themes showing link of indicative quotations to barriers and facilitators

Analytical Theme	Descriptive Theme	Data theme	Indicative quotations	Barriers/facilitators
Analytical theme 1: Preparation – organisational readiness for implementation	Theme 1.1: Clarifying need & advantage of independent prescribing	Clarifying clinical/service need for IP	•*"You're not waiting for medics to .. do your prescribing, you can do it as an autonomous practitioner …the most crucial aspect of it—continuity of care."* (1) •*"I'm not sure that the qualification would improve my level of patient care [Doctors] sign scripts as required."* (2)	F - Clinical/service advantage of IP. B - Lack of clinical/service advantage of IP.
		Establishing service pathway gaps	•*"Because I have to write, send it to the GP, it has to land on the GP's desk, then the patient has gotta make an appointment to see that GP, then the prescription comes from the GP, and then they go and fulfil that prescription and then make an appointment to come back and see me."*(3) •*"I feel reasonably comfortable that we can manage them ..by directing them to the pharmacist or the GP. I don't feel that it's particularly hampering my treatment...."* (3) •*" "A viable (pharmacist) IP service would depend on successfully addressing the many points in the circuit of prescribing where it can go wrong."*(4)	F- Identified service pathway gaps. B - Expedient medicines pathways
		Role clarity	•*"When I start working in a practice, I tend to try and agree ground rules, or rules of engagement….about what it is they want me to do, and if they're fairly broad, then that's okay, in some cases they're fairly narrow.."*(5) •*" So basically our p-formulary [personal formulary] has to match up with what we're doing, and .. that's when you say, 'actually no, I'm not prescribing tramadol or I am not prescribing whatever they're asking for."*(5) •*"I don't think all our colleagues are clear about non-medical prescribing."*(6) •*"I think as soon as they* (reception staff) *realize you can prescribe they expect you to be able to do exactly what doctors can do. They don't understand your limitations…."* (7)	F- IP role clarity F- Team understanding of IP B - Lack of IP role clarity B - Lack of team understanding of IP
	Theme 1.2: Managerial leadership and support	Role of managers	•*"I phoned up for advice...but she (manager) really didn't know… Anything I knew, I knew myself."* (8) •*"I've had nothing but support. They created a consulting room for me, put all the systems in place, the diagnostics, even putting notices in the notice-board for the first year or two so the patients were aware. And the staff were all made aware of it, we have practice meetings, the practice nurse was consulted.""*(9) •*"I know I wouldn't get the support from work for their funding…I would do it, but it's funding"*(3) •*" "I was challenged the other day … to ask why I hadn't written end of life charts …and I wouldn't do it because I did not have enough medical information about that patient."*(10)	F – Medical/managerial support/leadership. F - Stakeholder consultation F - Clinical record/IT access B - Lack of medical/managerial support/leadership. B – Lack of course funding. B - Lack of clinical record/IT access
		Recognising value	•*"We probably weren't prepared to remunerate her* [nurse prescriber] *as much as she thought she should be, because partly in our eyes she wasn't going to be doing that much extra."*(9) •*"It's just like having another partner who can deal with certain conditions,*	F - Medical/managerial support/leadership.

SupplementaryFile3_V2.0_19112021

Analytical Theme	Descriptive Theme	Data theme	Indicative quotations	Barriers/facilitators
			and who also works as a nurse within the practice."[9]	B - Lack Medical/managerial support/leadership.
		Culture	•*" 'I can't imagine how anyone can do our jobs without being a prescriber now … it has given me another layer of knowledge and, the other side of it is, if you're advising people, you should have that knowledge."(1)'* •*"… I mean if you want to be a doctor, be a doctor, if you want to be a nurse, be a nurse, but if you're a nurse you can't do nice bits of doctoring that you feel…."*[9] •*"In some surgeries generally the nursing team can feel a bit threatened by having pharmacist prescribers, …. It's about identifying our different areas of expertise and.. working together."*[9]	F - Prescribing integral to advanced practice. B - Prescribing considered outside professional practice scope
	Theme 1.3: Inter-professional environment	Inter-professional relationships	•*"… they've got a good skill mix, so everyone's got their slightly different areas of expertise..." So quite often the doctors will still ring me and say – or pop in and say – what do you recommend for this, what are we supposed to be prescribing for this?"*[9] •" …the engagement from Doctor… as the sort of the overall lead GP for that care home, was very disappointing".[11] •*"It was building that trust that you could do it, and you...were competent…you observed safety aspects."*[12]	F - Established physician relationships. F - Good inter-professional relationships B - Poor/absent physician relationships
		Communication & collaboration	•*"We have regular clinical meetings as a practice – myself, the GPs and the nurse. And then we also have multidisciplinary meetings every 6–8 weeks. "*[9] •*"I don't really feel they'd (*GPs*) listen to me…they'd be like, well, we're GPs, we're the partners here, we make the decisions and that's final really. I do feel it's a fait accompli here…this is the way this place has been run for a long, long time."*[9]	F - Inter-professional collaboration/communication networks. B - Lack of inter-professional collaboration/communication networks.
Analytical theme 2: Training – optimising practitioner readiness for independent prescribing	Theme 2.1: Selecting the right practitioners	Selection	•*" I presume I need to do a minor illness course first, which my GP has not agreed to for last three years."*[2] •*"I wanted to do the nurse prescribing course for two years .. my employing GPs will not support me, even though all my work is in extended or advanced role."*[2]	B - Inconsistent selection policies B - Lack of workforce planning.
		Skills & aptitudes	•*"You have to be competent, not only with your history taking… but examination skills; you have to be able to relate those findings… to the patient in a language that they can understand."*[13] •*"I think that is very important that they don't skimp. When I come in she'll take my weight, do my feet, do my blood pressure, want to know when I last had my eyes checked. .. I have all the blood tests done, and we go through those, what's wrong, what's right."*[14] •*" I would definitely come back to see the nurse prescriber again; I don't*	F - Practitioner specialist skills F - Service user acceptance of IP. B - Lack of practitioner specialist skills.

SupplementaryFile3_V2.0_19112021

Analytical Theme	Descriptive Theme	Data theme	Indicative quotations	Barriers/facilitators
			see that there's any difference really between seeing the doctor or the nurse prescriber. The nurse prescriber seems to have just as much knowledge as the doctor…"[15]	
		Motivation & commitment	•*"I don't think we get paid enough to make those decisions."*[3] •*"I have undertaken a large amount of further training ..with very little financial remuneration.. in my leisure time, to the exclusion of leisure activities. Eventually, one would hope for some incentive beyond job satisfaction."* [2] •*"The patients are aware of your skills and they know you're making decisions and prescribing for them. It gives you a sense of satisfaction."*[6] •*"For me prescribing right does carry a lot of accountability and responsibility and .. I'm not sure that's something I'd want to take on board."*[3]	F - Professional/personal adoption incentive B - Lack of professional/personal adoption incentive B - Fear of responsibility/accountability/error
	Theme 2.2: Preparing and supporting practitioners during training	Expectations of training	•*"Reassurance that I could do [the course] with present qualifications or what I need to do to obtain these before I do the prescriber's course."* [2] •*"Nurses that have done course say [very] intense and difficult.*[2] •*"Need info about what it involves, assessment, funding etc. Also general career advice."*[2]	B - Lack of course information.
		Study leave	•*"As much as I would like but there be no-one doing my work while I am* •*away...have to catch up."*[16] •*"I plan to do asthma training and then like to do minor illness training, but when I do I will have to do most of it in my own time – this puts me off nurse prescribing."*[2]	B - Lack of backfill/protected/study time
		Designated Medical Practitioners	•*"I think when we did our prescribing training … some of us had a lot of very .. proactive support from the medical mentors and some of us had less than that."*[10] •*"I had to educate (DMP).. on how the course works."*[17] •*"…I think the two of us were kind of floundering a bit … we still had slightly differing ideas as to what competency meant."*[17]	F - DMP role clarity/good DMP supervision. B - Lack of DMP role clarity/supervision/availability.
Analytical theme 3: Transition - ensuring early prescribing support	Theme 3.1: Transition as a point of vulnerability	Self-confidence	•*"When you've done the course, you lose a lot of confidence, because you learn a lot more about, you know the dilemmas and the ethics of prescribing… so, then, it's actually harder to prescribe (it) independently."*[5] •*"In some ways, it's like motherhood I think, you feel adequately prepared and then it happens and I think oh my goodness, this is bigger than I thought…"*[1] •*"I think they* [doctors] *sort of assume sometimes that we know more than we do, and I think they assume we have huge confidence in our skills when we don't…"*[12]	F - Prescribing confidence/competence. B - Lack of prescribing confidence/ competence.
	Theme 3.2: Nurturing confidence	Minimum competence	•*" I have quite a limited range that I feel confident doing, using and I haven't gone outside it…"*[12] •*"I think you have got to realize your limitations and put a stop on it when you feel your skills aren't adequate."*[7]	F - Delineated scope of prescribing competence F - Clinical/professional protocols/guidelines.

SupplementaryFile3_V2.0_19112021

Analytical Theme	Descriptive Theme	Data theme	Indicative quotations	Barriers/facilitators
	and competence		•*"I do know where my competencies are and where my weaknesses are, and I don't sort of go beyond my scope of practice."*[9] •"*I suppose virtually everything that I see and talk about is influenced by NICE in the first instance, and the relevant NICE guidance, whatever it might be."*[18] •*'I'm happy with exacerbations and chest infections, so, like UTIs* [urinary tract infections] *and wound infections, but anything that's going beyond that, I just don't feel confident in myself to be going out and doing that."*[12]	F- Adequate formulary B - Inappropriate patient/team pressure for prescribing B – Unclear/absent clinical protocols/ guidelines
		Experience & exposure	•*"The first time I had to ask the GP if I was actually on the right lines.. It's not as difficult the second and the third and the fourth time."*[8] •*"It's like learning to drive and then the first time you actually go out without someone sat by you …"*[1] •*"Most of my colleagues have stuck with their original prescribing competence. I reacted to questions that were being asked – could you do X? So I thought, well, could I do X? And I've then made myself competent in that particular area."*[9] *". . .as I've become more experienced. . .I'm more aware now, I suppose, of the – the complexities of certain patients."*[19]	F - Exposure to prescribing opportunity B - Delayed registration post qualification
	Theme 3.3: Transition support needs	Informal & formal support systems	•*"I suppose the bottom line is I don't get any formal support. I mean, I get support in an informal way from GPs and the consultant and my colleagues."*[12] •*"There are times when .. it's slightly more complex, so .. I'll go and get some advice.. I think it's really important to function in this way."*[9] •*"If I am in any whatsoever doubt then I just buzz through to the GP (family physician)."*[5]	F – Medical supervision. B – Lack of medical supervision.
Analytical theme 4: Sustainment - maximising and developing independent prescribing	Theme 4.1: Service delivery	Impact on workload	•*"A big disadvantage is that a lot of doctors have offloaded their work on to us. Workload has increased so much and you have to go to a lot of meetings, often in your own time".*[7] •*"We're really, really fortunate here. . .our appointment times, if you're booked into the nurse clinic, they're half-hour appointments, so we can really spend time providing the education and explaining why we're not giving antibiotics."*[19] •*"Oh, it has changed dramatically. Workload had trebled. We see most of the minor ailments. We have taken a lot more on—the more knowledge you get the higher the workload. We do all medication reviews and all hypertension reviews."* [7] •*"Non-medical prescribing consultations—the time tends to be much longer."*[20]	F - Consultation time. B - Time/workload constraints.
	Theme 4.2: Supporting IP role development	Role/service expansion	•*"I don't see how that* (mental health NMP scope extension for benzodiazepine management) *could happen with the QOF (Quality and Outcomes Framework) targets ... For* (mental health) *there's not a target ... so I genuinely don't think it's going to become part of the practice nurses remit."*[20] •*"I'd like to put my name somewhere regularly along with the doctors.., so*	F – Employment model. F - National incentives/policy initiatives for IP B – Employment model. B - IP Role isolation.

SupplementaryFile3_V2.0_19112021

Analytical Theme	Descriptive Theme	Data theme	Indicative quotations	Barriers/facilitators
			I'm there...part of the surgery. But because … I'm not employed by the surgery, other than being extra, additional help occasionally… it kind of leaves me in a bit of no-man's land."(9) •*"It's altered my role quite in depth … We see anything from an ingrown toenail to somebody with chest pain. In the afternoon we work on an appointment basis, running chronic disease .. and weight management clinics."*(7) •*"I found myself being given referrals for much more complex problems than perhaps I had been given before. I found myself in the position where GPs were actually expecting me to initiate treatment or to suggest what treatment they might give."*(8) •*"I have learnt over the years… extending my scope of practice as I felt more confident, and then went and sort of commissioned training or shadowed somebody, just so that I can improve my competencies and take on more of the long-term conditions and manage them in general practice."*(9)	B – Lack of national incentives/policy initiatives for IP B - Lack of local policies for IP
		Continued professional development	•*"Expanding your prescribing may be difficult, not because of your knowledge of the drugs, but because there's no training at a good enough level for the other stuff, .. how do you become competent to treat osteoporosis, there are no courses."*(5) •*"I don't think I have increased my scope over the years; to be frank."*(12) •*"Most of my colleagues have stuck with their original prescribing competence. I reacted to questions … could you do X?... And I've then made myself competent..."*(9) •*" ..what I would love is to sort of have a week or two a year when I was buddied up with a doctor, and he/she made me do all the prescribing. It would be terrifying but it would really make me learn."*(12) •*"We take group learning very seriously, we have clinical catch up … where if anyone has found any new exciting evidence or guidelines or examples of good practice we do tend to talk inter-professionally."*(18)	F - CPD/supervision B - Lack of CPD/supervision
		Evaluation & Reflection	•*". . .it's something that's a .. priority.. for me and my team here, so we're doing a lot of work .., both in terms of auditing, so we understand how much prescribing's going on. We also are looking at appropriateness of prescribing, so auditing case notes against the local guidelines and providing feedback to prescribers…So it's high up on our agenda."*(19) •*"No. I haven't had a prescribing update. Even trying to get an update on how to use your British National Formulary, any new drugs, is difficult."*(6) •*"[W]e have a training session, like an audit with the local CCG team, in relation to our practices antibiotic prescribing and comparing it to the area in the north west… so that kind of helped influence .. my antibiotic prescribing."* (18) •*"…we don't as a group kind of get together… as clinicians and feeding*	F - Audit/feedback on prescribing practice. B - Governance/accountability structures B - Lack of governance/accountability structures

SupplementaryFile3_V2.0_19112021

Analytical Theme	Descriptive Theme	Data theme	Indicative quotations	Barriers/facilitators
			back information, events that have happened … significant events … we don't have joint CPD."[18]	

CCG – clinical commissioning group, CFIR – Consolidated Framework for Implementation Research, CPD – continued professional development, DMP – designated medical practitioner, DOI – Diffusion of Innovations, IP – independent prescribing.

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Reporting checklist for systematic review and meta-analysis. CRD42019124400

Based on the PRISMA guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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In your methods section, say that you used the PRISMAreporting guidelines, and cite them as:

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		Reporting Item	Page Number
Title			
	#1	Identify the report as a systematic review, meta-analysis, or both.	1
Abstract			
Structured summary	#2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number	2
Introduction			
Rationale	#3	Describe the rationale for the review in the context of what is already known.	4

Objectives	#4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5
Methods			
Protocol and registration	#5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address) and, if available, provide registration information including the registration number.	5
Eligibility criteria	#6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rational	6
Information sources	#7	Describe all information sources in the search (e.g., databases with dates of coverage, contact with study authors to identify additional studies) and date last searched.	6
Search	#8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplementary file 1
Study selection	#9	State the process for selecting studies (i.e., for screening, for determining eligibility, for inclusion in the systematic review, and, if applicable, for inclusion in the meta-analysis).	6
Data collection process	#10	Describe the method of data extraction from reports (e.g., piloted forms, independently by two reviewers) and any processes for obtaining and confirming data from investigators.	7
Data items	#11	List and define all variables for which data were sought (e.g., PICOS, funding sources), and any assumptions and simplifications made.	7
Risk of bias in individual studies	#12	Describe methods used for assessing risk of bias in individual studies (including specification of whether this was done at the study or outcome level, or both), and how this information is to be used in any data synthesis.	N/A

Summary measures	#13	State the principal summary measures (e.g., risk ratio, difference in means).	N/A
Planned methods of analyis	#14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I2) for each meta-analysis.	7
Risk of bias across studies	#15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	N/A
Additional analyses	#16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	N/A
Results			
Study selection	#17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	7, Figure 1 PRISMA
Study characteristics	#18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citation.	8,
Risk of bias within studies	#19	Present data on risk of bias of each study and, if available, any outcome-level assessment (see Item 12).	N/A
Results of individual studies	#20	For all outcomes considered (benefits and harms), present, for each study: (a) simple summary data for each intervention group and (b) effect estimates and confidence intervals, ideally with a forest plot.	N/A
Synthesis of results	#21	Present the main results of the review. If meta-analyses are done, include for each, confidence intervals and measures of consistency.	8-25
Risk of bias across studies	#22	Present results of any assessment of risk of bias across studies (see Item 15).	Supplementary file 2
Additional analysis	#23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	N/A

Discussion			
Summary of Evidence	#24	Summarize the main findings, including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., health care providers, users, and policy makers	17, 26
Limitations	#25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review level (e.g., incomplete retrieval of identified research, reporting bias).	28
Conclusions	#26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	28
Funding			
Funding	#27	Describe sources of funding or other support (e.g., supply of data) for the systematic review; role of funders for the systematic review.	30

BMJ Open

Barriers and facilitators to implementation of non-medical independent prescribing in primary care in the United Kingdom: a qualitative systematic review.

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Title

Barriers and facilitators to implementation of non-medical independent prescribing in primary care in the United Kingdom: a qualitative systematic review.

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Abstract (293 words)

Objectives

To support workforce deficits and rising demand for medicines, independent prescribing (IP) by nurses, pharmacists and allied health professionals is a key component of workforce transformation in UK healthcare. This systematic review of qualitative research studies used a thematic synthesis approach to explore stakeholders' views on IP in primary care and identify barriers and facilitators influencing implementation.

Setting

UK primary/community care.

Participants

Inclusion criteria were UK qualitative studies of any design, published in the English language. Six electronic databases were searched between January 2010 and September 2021, supplemented by reference list searching. Papers were screened, selected and quality-appraised using the Quality Assessment Tool for Studies with Diverse Designs. Study data were extracted to a bespoke table and two reviewers used NVivo software to code study findings. An inductive thematic synthesis was undertaken to identify descriptive themes and interpret these into higher order analytical themes. The Diffusion of Innovations and Consolidated Framework for Implementation Research were guiding theoretical anchors.

Primary and secondary outcome measures: N/A.

Results

Twenty-three articles addressing nurse, pharmacist and physiotherapist IP were included. Synthesis identified barriers and facilitators in four key stages of implementation: 1) "Preparation", 2) "Training", 3) "Transition" and 4) "Sustainment". Enhancement, substitution, and role specific implementation models reflected three main ways that the IP role was used in primary care.

Conclusions

In order to address global deficits, there is increasing need to optimise use of IP capability. Although the number of independent prescribers continues to grow, numerous barriers to implementation persist. A more coordinated and targeted approach is key to overcoming barriers identified in the four stages of implementation and would help ensure that IP is recognised as an effective approach to help alleviate workforce shortfalls in the UK, and around the world. PROSPERO registration number CRD42019124400.

Article Summary

Strengths and limitations of this study

- Adopting a qualitative synthesis facilitated contextual understanding into the implementation of non-medical independent prescribing (IP) in primary care settings in the UK.
- Higher order analytical themes were identified that offer in-depth interpretation of non-medical IP implementation in UK primary care.
- The theoretical lens improved understanding of the generalisability of factors known to facilitate non-medical IP in UK primary care.
- Grey literature was excluded from the synthesis.

Key words

Implementation, barriers, facilitators, non-medical prescribing, independent prescribing, primary care, meta-synthesis

Introduction

Equitable access to primary care improves health outcomes, lowers costs and enhances patient experience[1, 2]. Global workforce deficits[3-5] and the rising prevalence of long-term conditions[6, 7], multimorbidity[8-10] and COVID-19[11] have severely threatened primary care sustainability[12-15]. Medicines use in global priorities including diabetes and cardiovascular diseases is increasing, with worldwide drug therapy days rising in 2019 to 1.8 trillion and an average of 234 days per person/year[16]. With one in four adults in United Kingdom (UK) primary care taking five or more medicines daily[17], the workforce implications for meeting prescribing needs are profound.

Mobilising primary care to improve workforce and service sustainability is a global challenge[5, 18]. As in other countries[19, 20], primary care in the four devolved UK nations (i.e., England, Scotland, Wales, Northern Ireland) has undergone significant restructuring and reorganisation[21-24]. In England, for example, the 2019 NHS long-term plan amalgamated GP practices into primary care networks (PCN), covering populations of 30-50,000[25]. Pooling resources to achieve government targets[26] with the promise of extra non-medical staff (e.g., advanced/specialist clinical pharmacists, dieticians, paramedics and physiotherapists), PCNs were expected to offer additional hours within broader service options[27]. While the impact of the new 2021/22 Health and Care Bill on primary care workforce transformation in England remains uncertain[28], the diverse skills of the non-medical advanced practice workforce including prescribing capability are likely to remain important for addressing UK primary care prescribing and medicines optimisation needs[29-31].

In line with global movements to enhance the skills of non-medical healthcare professionals, over 90,000 UK nurses, pharmacists, optometrists, radiographers, physiotherapists, podiatrists, dieticians and paramedics[32] under serial legislative changes[33-36] and with accredited additional training[37-39] are authorised to prescribe using supplementary and/or independent forms. Although UK legislation restricts dieticians and diagnostic radiographers to supplementary prescribing, as reported by professions with dual supplementary/IP rights (e.g., nurses, pharmacists, physiotherapists, podiatrists) IP is more workable[40, 41] and has largely superseded supplementary prescribing in many UK non-doctor led primary and community care services[42-44]. Enabling the autonomous initial assessment and on-going management of patient prescribing and medicines optimisation needs, IP increases practitioner autonomy/expertise[29, 45-47], enhances clinical outcomes compared to doctor-led care[29] and results in high service-user satisfaction[48]. Across contemporary primary care

settings in the UK and internationally IP is an increasingly essential component of service re-design[45, 49-54].

Despite its many benefits, the UK adoption rates for IP vary[55, 56], with medical opposition to prescribing roles[57, 58], training course drop-out[46], delayed prescribing onset[59, 60] and role underuse reported[61-64]. Difficulties with implementation are frequently cited[43, 46, 59, 65-67]. Several UK[68, 69] and international systematic[54, 70-72] and literature reviews,[73, 74] have focused on implementation barriers and/or facilitators. However, these have been profession-specific[54, 70-72, 74], have included international models with varying legislative/jurisdictional levels of prescribing autonomy[54, 70-72] and/or have addressed prescribing in heterogenous care settings[54, 68, 69, 74]. None have synthesised qualitative studies in all IP eligible professions in UK primary care. Considering IP enhances workforce skills and builds capacity for service redesign and improved sustainability[42, 75-77], identifying and understanding the challenges to its implementation is ever pressing[78, 79].

Aim

This qualitative meta-synthesis aimed to identify barriers and facilitators that influence implementation of IP in UK primary care.

Theoretical perspective

This review is broadly informed by the Diffusion of Innovations theory[80, 81] and the Consolidated Framework for Implementation Research[82, 83] which provided theoretical anchors for identifying contextual factors likely to influence implementation[84-89].

Methods

This qualitative meta-synthesis is reported following the Enhancing transparency in reporting the synthesis of qualitative research (ENTREQ) guidelines[90] which incorporates elements of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement[91]. Thematic qualitative meta-synthesis[92, 93] permits synthesis of context-embodied research and is a suitable method for identifying factors influencing implementation[94-96]. The review was registered in PROSPERO (CRD42019124400)[97].

Search strategy

A systematic search of UK literature on primary and community care IP was undertaken in January 2021 and updated in September 2021. Barriers/facilitators to healthcare innovations are conceptually well established[98-102] and thus grey literature was excluded. Search terms

were developed according to the Sample, Phenomenon of Interest, Design, Evaluation, Research Type (SPIDER) tool[103] and tested based on truncations of words related to prescribing, community/primary care and UK non-medical healthcare professions with IP authority (e.g., nurses, pharmacists, optometrists, physiotherapists, podiatrists, paramedics and radiographers). Wild card and Boolean Search Operators were used. Qualitative search terms were not included[104, 105]; all citations were screened for qualitative methodology. Search strings (see supplementary file 1 examples) were adapted for 6 electronic databases (EBSCO - MEDLINE, CINAHL, OVID – EMBASE, ProQuest - British Nursing Index, Nursing & Allied Health, Web of Science). The 2010 inception search date reflected major UK coalition governmental change and the introduction of landmark legislative reforms[106-109] that decentralised UK primary/community care commissioning[110]. Inclusion criteria applied to study selection are shown in Table 1. Retrieved citations were downloaded to EndNote V.X9 and duplicates removed.

Table 1 Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
► Primary research conducted in the UK (England, Scotland, Northern Ireland and/or Wales)	► International/UK literature reviews, meta-analyses or meta-synthesis and/or grey literature
►Studies employing participatory and/or non-participatory data collection methods within any qualitative, quantitative or mixed methods design	►Quantitative studies not employing qualitative data collection methods
►Studies addressing IP by legislated non-doctor healthcare professionals	►Studies addressing supplementary, dependent and/or collaborative models of prescribing
►Studies addressing primary/ community care IP	►Studies addressing secondary care and/or mixed primary and secondary care IP
►Studies presenting empirical evidence of barriers and/or facilitators to IP implementation	
►Studies addressing non-context specific educational programmes for non-medical IP	
► Peer reviewed, full text articles published between 01 January 2010 and 30 September 2021 in the English language	

Screening and eligibility

Two reviewers (JE, NC) independently assessed all titles and abstracts against the inclusion criteria and the full-text versions of papers deemed potentially relevant were obtained and reviewed. Papers found not to meet the criteria during screening were excluded with

reasons recorded as shown in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) table (Figure 1). Reference list hand searching supplemented database searching.

Figure 1 goes here

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses depicting study selection, screening, eligibility for inclusion and synthesis (adapted from Page et al 2021)[91].

Quality assessment

In keeping with the scope of a qualitative meta-synthesis[111, 112], studies were not excluded on the basis of quality assessment[92, 113]. Methodological appraisal of individual papers was undertaken using the Quality Assessment Tool for Studies with Diverse Designs (QATSDD)[114], which has demonstrated validity and test-retest reliability for assessing the reporting and methodological transparency of diverse study designs[115]. The tool uses a 4-point scoring system for assessment of qualitative studies (14 questions) and mixed methods studies (16 questions), resulting in total possible scores of 42 and 48 respectively [114]. Scoring was undertaken by one reviewer (JE) and any uncertainties were discussed and resolved with a second reviewer (NC). Supplementary file 2 provides a detailed breakdown of questions and the grading of study manuscripts.

Data extraction

Study data were extracted by one author (JE) to a bespoke table adapted from recommended templates[116]. This collated contextual and methodological information, data on barriers and/or facilitators and main findings and was piloted on 5 index studies to ensure consistency and usability. Data extraction was recursive and involved repeated review/update between ensuing analysis stages[117].

Data analysis and synthesis

The aim of thematic analysis was to develop a coherent synthesis of barriers and facilitators that influenced IP across stages of the implementation continuum[118-120]. Data analysis followed a four stage, iterative process described by Thomas and Harden (2008)[121] (Table 2). Qualitative "data" referred to participant quotations, (sub)themes, explanations, hypotheses or new theory, observational excerpts and author interpretations[122]. Barriers were defined as "any obstacle (material or immaterial) impeding adoption, implementation

and/or sustainability of IP"[123, 124] and facilitators were defined as "any obstacle (material or immaterial) enhancing adoption, implementation and/or sustainability of IP"[123, 124].

Table 2 Stages of analysis

Stage 1	In-depth reading and familiarisation with individual papers, data extraction
Stage 2	Inductive line-by-line coding of highest quality, index papers (n=5) to develop a set of "open codes" by two independent reviewers (JE, NC).
Stage 3	Codes discussed/agreed, grouped into descriptive themes using NVivo[125]; codebook applied to all papers, and expanded/modified by identifying new codes/themes and/or merging/renaming existing codes/themes[126].
Stage 4	Descriptive themes organised into higher order analytical themes and matrix charted with corresponding indicative quotes

Rigour within the analytical process

To ensure analytic rigour, two independent reviewers (JE, NC) initially performed inductive line-by-line data coding from 5 highest quality index papers (stage 2). Each reviewer produced sets of open data codes which were compared and discussed. If different codes and/or different interpretations were assigned to a concept, these were discussed and revised. Disagreements were resolved by a third reviewer (MC). Data codes were subsequently grouped into descriptive themes, creating a codebook for application to all papers (stage 3). To identify possible contradictory cases and clarify thematic commonalities within studies[127], a matrix of participant quotes was charted to constituent themes (see Supplementary file 3)[128].

Patient and public involvement

The review was conducted as part of a PhD exploring paramedic IP in UK primary care, for which a University service user/carers group was instrumental in informing study design and methods. However, as the systematic review focused on implementation challenges and not patient-related outcomes, the group was not involved its design or conduct.

Results

Twenty-three of the 5,365 original articles identified met inclusion criteria[129-152] (see Figure 1. PRISMA table).

Study characteristics and quality assessment

Table 3 summaries the study characteristics and quality assessment scores of included articles. Studies were undertaken in in England [131, 134, 135, 138, 140, 142, 143, 145, 148-152], Scotland

[129, 130, 132, 141], or across devolved UK nations [133, 136, 137, 144, 146]. The representation of independent prescribers from Wales [133, 136] and Northern Ireland [144, 146] was limited.

Sixteen studies used qualitative methods [129, 132, 133, 135, 137-142, 146-152], six used mixed methods [130, 131, 134, 136, 143, 144] and one employed a qualitative survey [145].

Fifteen studies addressed nurse IP[129-131, 134-136, 138-142, 145, 148, 150, 152], seven included pharmacists[132, 133, 137, 144, 146, 149, 151] and one study focused on physiotherapists[143]. Where indicated, studies were conducted pre-2011[130, 131, 135, 139-141, 145, 149-151], between 2011-2015 [129, 132, 134, 136, 147, 148, 152] or between 2016-2019 [133, 137, 144, 146].

Table 3. Characteristics of included studies (n=23) and key barriers and facilitators

Author(s), year	Country, Setting	Study focus, Participants	Barriers	Facilitators	QATSDD score
Afseth et al (2017)	Scotland. HEI.	Views on prescribing training. 6 NIP trainees, 6 DMPs	1, 2, 3	4, 5, 6, 7, 8	67%
Boreham et al (2013)	Scotland.	Views on prescribing training. 87 NIP trainees, 10 HEI leads.	1, 2, 3, 8, 9	4, 5, 9, 10, 11	67%
Bowskill et al (2014)	England. HEI.	Views on prescribing training 6 IP trainees, 3 IPs (unspecified professions)	1, 3, 9	12	60%
Brodie et al (2014)	Scotland. Gen-P, Comm.	Views on prescribing role. 4 NIPs, 4 PIPs.	8, 13, 14, 15, 16, 17, 18, 19	9, 10, 20, 21, 22, 23, 24	38%
Carter et al (2021)	England, Scotland, Wales. Gen-P, Comm pharmacy.	Factors influencing prescribing and role of practice pharmacists on evidence based prescribing. 6 GPs, 6 NIPs, 6 PIPs, 12 key informants.	25, 26, 27	9, 11, 24, 28, 29, 30, 31, 32, 61	78%
Cole & Gillett (2015)	England. Comm pall care.	Prescribing practices. 6 NIPs.	2, 3, 15, 26, 27, 33, 34, 35, 36, 37, 38	21, 28, 30, 37, 61	29%
Courtenay et al (2010)	England. Gen-P, Comm clinics.	Patient experiences/views of nurse prescribing. 41 patients.		10, 11, 22, 39	50%
Courtenay et al (2017)	England, Scotland, Wales. Gen-P, Comm clinics.	Patient experiences/views of nurse and pharmacist antibiotic prescribing for respiratory tract infection. 16 NIPs, 1 PIP, 22 patients.	27	22, 23, 39, 40, 41	67%
Courtenay et al (2019)	UK (unspecified countries). Gene-P, OOH, IC.	Factors influencing antibiotic prescribing for respiratory tract infection. 17 NIPs, 4 PIPs.	18, 27, 38, 42, 43	6, 10, 11, 22, 23, 24, 28, 29, 32, 39, 40, 41, 44, 57	78%
Cousins & Donnell (2012)	England. Gen-P.	Views on prescribing role. 6 NIPs.	3, 16, 18, 27, 34, 35, 37, 42, 45,	6, 9, 10, 20, 24, 28, 61	59%
Daughtry et al (2010)	England. Gen-P.	Experiences of prescribing role. 8 practice NIPs.	3, 6, 18, 27, 29, 35, 62,	5, 8, 9, 10, 11, 24, 28, 29, 30, 44, 46, 47, 57, 61	36%
Dhalivaal et al (2011)	England. Gen-P.	Patient views on nurse prescribing. 15 patients.		22, 39	43%
Downer & Shepherd (2010)	Scotland. Comm.	Views on prescribing role. 8 district NIPs.	3, 15, 17, 18, 35, 37, 38, 45, 48, 49, 62	3, 9, 10, 30, 44, 57, 61	48%
Herklots et al (2015)	England. Comm.	Experiences of prescribing. 7 community matron IPs.	3, 15, 16, 18, 35, 38, 48, 49, 62	6, 7, 10, 11, 12, 22, 29, 47, 57, 61	43%
Holden et al (2019)	England.	Medicines optimisation practices. 20 physio non-IPs, 1 physio-IP.	3, 13, 36, 42, 45, 50, 62	10, 21	75%
Inch et al (2019)	England, Scotland, Northern Ireland. Elderly residential care	Feasibility of implementation. 2 P non-IPs, 4 PIPs, 6 GPs, 16 care home staff, 2 patients, 3 relatives, 1 dietician non-IP.	3, 49	10, 21, 22, 23, 52	54%

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Author(s), year	Country, Setting	Study focus, Participants	Barriers	Facilitators	QATSDD score
Kelly et al (2010)	England. Gen-P.	Barriers to adoption of IP. 31 practice NIPs, 120 N non-IPs.	1, 2, 3, 9, 13, 35, 36, 42, 45, 50, 51, 53, 54, 55		33%
Lane et al (2020)	England, Scotland, Northern Ireland. Elderly residential care	Barriers and facilitators to prescribing. 27 P non-IPs, 29 GPs, 12 care home staff, 7 patients, 7 relatives.	3, 35, 43, 48, 49	6, 7, 8, 10, 11, 21, 22, 39, 46, 52, 56	78%
Latham & Nyatanga (2018a,b)	England. Comm pall care.	Views on prescribing role. 6 NIPs.	3, 15, 18, 27, 35, 36, 38, 49, 50, 60	7, 8, 10, 11, 12, 20, 21, 22, 30, 44, 52, 57, 61	71%
Maddox et al (2016)	England. Gen-P, Comm, Nursing homes, Comm pharmacy.	Barriers and facilitators to prescribing. 25 NIPs, 5 PIPs.	3, 15, 16, 26, 27, 29, 33, 37, 42, 48, 62	6, 7, 10, 12, 24, 29, 30, 42, 47, 57, 61	71%
Stenner et al (2011)	England. Gen-P, Comm clinics.	Patient views on nurse prescribing. 41 patients.		11, 22, 23, 29, 39	55%
Weiss et al (2016)	England. Gen-P.	Views on prescribing role. 7 NIPs, 7 PIPs, 7 GPs.	3, 6, 17, 25, 35, 45, 49, 51, 56, 58, 59, 63	3, 6, 8, 11, 12, 22, 24, 29, 39, 44, 46, 47, 63	52%
Williams et al (2018)	England. OOH/unscheduled care.	Factors influencing nurse and GP antibiotic prescribing for respiratory tract infection. 15 NIPs, 15 GPs.	15, 16, 18, 26, 27, 34, 49, 59	6, 12, 22, 23, 24, 28, 32, 41	76%

Comm – community, DMPs – designated medical practitioners, Gen-P – general practice, GPs – general practitioners, HEI – higher educational institute, IC – integrated care, NIP – nurse independent prescribers, N non-IPs – nurse non-prescribers, pall – palliative, physio-IP – physiotherapist independent prescriber, physio non-IPs – physiotherapist non-prescribers, PIPs – pharmacist independent prescribers, OOH – out of hours.

Barriers: 1=Lack of backfill/protected/study time, 2=Lack of DMP role clarity/supervision/availability, 3=Lack of medical/managerial support/leadership, 14=Lack of national IP incentives/policy initiatives, 15=Lack of clinical record/IT access, 16=Lack of CPD/supervision, 17=IP role isolation, 18=Time/workload constraints, 19=Lack of IP strategy, 25= Lack of inter-professional collaboration/communication networks, 26=Unclear/absent clinical protocols/guidelines, 27=Inappropriate patient/team pressure for prescribing, 33=Lack of local policies for IP, 34=Lack of governance/accountability structures, 35=Lack of team understanding of IP, 36=Lack of clinical/service advantage of IP, 37= Lack of peer support/mentoring, 38=Lack of prescribing confidence/competence, 42=Fear of responsibility/accountability/error, 43=Lack of practitioner specialist skills, 45=Lack of professional/personal adoption incentive, 48=Poor/absent physician relationships, 49=Lack of IP role clarity, 50=Expedient medicines pathways, 51= Prescribing considered outside professional practice scope, 53=Lack of course information, 54=Inconsistent selection policies, 55= Lack of workforce planning, 58=Formulary restrictions, 59=Lack of service user acceptance, 60=Delayed registration post qualification, 62=Lack of medical supervision, 63=Employment model

Facilitators: 4=DMP role clarity/good DMP supervision, 5=Inter-professional training model, 6= IP role clarity, 7=Established physician relationships, 8=Medical/managerial support/leadership, 9= Professional/personal adoption incentive, 10=Clinical/service advantage of IP, 11=Inter-professional collaboration/communication networks, 12=Peer support/mentoring, 13=Lack of course funding, 20=Prescribing integral to advanced practice, 21=Identified service pathways gaps, 22= Practitioner specialist skills, 23=Consultation time, 24=CPD/supervision, 28=Clinical/professional protocols/guidelines, 29= Prescribing confidence/competence, 30= Exposure to prescribing opportunity, 31=Adequate formulary, 32=National incentives/policy initiatives for prescribing, 39=Service user acceptance of IP, 40= Governance/accountability structures, 41=Audit/feedback on prescribing practice, 44=Good interprofessional relationships, 46=Stakeholder consultation, 47=Team understanding of IP, 52=Clinical record/IT access, 56= Employment model, 57=Medical supervision, 61=Delineated scope of prescribing competence

All studies reported results from primary care IP implementation; in general practice[138-140, 145], community domiciliary/residential care[134, 141, 142, 144, 146, 148, 152] or mixed general practice/community settings[129-133, 135-137, 143, 149, 150]. Participants included nurse/pharmacist prescribers[132, 134, 136-139, 141, 142, 148, 149, 151, 152], nurse/physiotherapist non-prescribers[143, 145], nurse non-medical prescriber trainees and educational staff[129-131], service-users[135, 136, 140, 150] and multi-disciplinary team members[144, 146, 151, 152]. Studies explored training[129-131], IP roles[132, 138, 139, 141, 148, 151], patient acceptance[135, 140, 150], prescribing/medicines optimisation practices[133, 134, 136, 142, 143, 152], implementation feasibility[144] and barriers and/or facilitators[137, 145, 146, 149].

The methodological quality of included studies (see Table 3 summary) was average, with a QATSDD mean score 25 (range 13-36), mainly due to seven low scoring studies[132, 134, 139-142, 145]. Common methodological weaknesses were: lack of explicit theoretical framework[132, 134, 139, 140, 142, 145], limited/absent rationale for choice of analytical methods[132, 134, 139-142, 145] and lack of reliability assessment for analytical processes[132, 134, 139-142, 145]. Methodological strengths of higher scoring studies were: statement of aims/objectives in main body of report[130, 133, 136, 137, 143, 147, 152], description of data collection procedures[130, 133, 137, 143, 146, 147, 149] and fit between research question and method of analysis[130, 136, 137, 143, 146, 147, 149, 152]. Notably studies providing richer contextual descriptions[133, 137, 146, 148, 149, 152], and/or using implementation theory[137, 146] explored barriers and/or facilitators in greater depth.

Identification of barriers and facilitators and key stages of implementation

Implementation of IP in primary care was found to be complex and influenced by a myriad of organisational service, team and individual stakeholder level barriers and facilitators. Informed by descriptive/data themes, these fell into four major analytical themes, each of which is presented as a key stage in the implementation process as follows:

1) Analytical theme 1: Preparation – organisational readiness for implementation
2) Analytical theme 2: Training – optimising practitioner readiness for IP
3) Analytical theme 3: Transition – ensuring early prescribing support
4) Analytical theme 4: Sustainment – maximising and developing IP

Table 4 provides an overview of analytical themes, associated descriptive/data themes and summative findings. Examples of indicative quotations making up these themes are presented in Supplementary file 3. Factors presented within themes acted as barriers and/or facilitators to implementation, e.g., poor managerial support was a barrier, while proactive managerial support and leadership facilitated implementation. It is acknowledged that

barriers and facilitators overlap some themes and in some cases are interdependent. For example, lack of mentoring relationships with doctors limited opportunity for informal support, which in turn prevented prescribing competence development and risked loss of prescriber confidence[142, 149]. Therefore, to avoid duplication of findings, barriers and facilitators are presented within the themes deemed most appropriate, yet their presence and influence is acknowledged elsewhere. Given that the majority of data were derived from studies conducted in England or mixed geographical settings, it was not possible to deduce differences in barriers and facilitators across the devolved UK nations.

Table 4. Analytical themes and sub-themes from included studies, with summative findings

Analytical Theme	Descriptive Theme	Data theme	Summative findings
Analytical theme 1: Preparation – organisational readiness for implementation	Theme 1.1: Clarifying need & advantage of independent prescribing	Clarifying clinical/service need for independent prescribing	• Establishing a clear service/clinical need for IP[130, 135, 137-139, 141, 149] and identifying existing gaps in medicines pathways was a key requisite and facilitator for adoption[132, 134, 143, 144, 146, 148]. • Team clarity on the need for adoption cemented IP role intentions and avoided role dissonance following implementation[133, 142, 144, 146, 149, 151]. • Managerial leadership/support for IP was essential for ensuring initial and on-going infrastructural, funding and other implementation support needs[129-132, 134, 138, 139, 141-144, 146, 148, 151]. • Trusting interprofessional relationships, collaboration/team-working built confidence in IP and facilitated team support for implementation[129, 130, 133, 135, 137, 139, 141, 142, 146, 148, 149, 151].
		Establishing service pathway gaps	
		Role clarity	
	Theme 1.2: Managerial leadership and support	Role of managers	
		Recognising value	
		Culture	
	Theme 1.3: Inter-professional environment	Inter-professional relationships	
		Communication & collaboration	
Analytical theme 2: Training – optimising practitioner readiness for independent prescribing	Theme 2.1: Selecting the right practitioners	Selection	• Adoption was impeded by inconsistent candidate selection policies and lack of workforce planning[143, 145]. Individual practitioner expectation of professional/personal benefit remained a key driver for IP adoption[131, 132, 133, 138, 139, 141]. • Skills requisite to IP (e.g., physical assessment and communication skills) were important factors influencing service user and team acceptance of IP[135, 136, 140, 144, 146, 148, 150-152] • Motivational barriers (e.g., lack of remuneration, fear of litigation and competing professional or personal commitments) disincentivised training uptake[138, 143, 145].
		Skills & aptitudes	
		Motivation & commitment	
	Theme 2.2: Preparing and supporting practitioners during training	Expectations of training	• Lack of information on NMP training and support for managing competing work, personal/ academic commitments negatively influenced student learning experiences[129-131, 145, 148]. • Standardised allocation of study leave/backfill/protected time and prepared practice mentors were essential to support learning[129-131, 134]. • Additional training buddying schemes helped students better manage the competing demands of training whilst working[131].
		Study leave	
		Designated Medical Practitioners	
Analytical theme 3: Transition – ensuring early prescribing support	Theme 3.1: Transition as a point of vulnerability	Self-confidence	• Transition was a point of high vulnerability for new prescribers with an initial lack of confidence often under-recognised by teams[137, 139, 141, 142, 148, 149]. • Delineating a minimum scope of practice by restricting formulary and/or using guidelines/protocols facilitated early growth of competence and confidence[138, 139, 141, 142, 149, 151]. • Early exposure to prescribing opportunity, time and structured support systems with medical supervision were essential in transition[129, 132-134, 136-139, 141, 148, 149].
	Theme 3.2: Nurturing confidence & competence	Minimum competence	
		Experience & exposure	
	Theme 3.3: Transition support needs	Informal & formal support systems	
Analytical theme 4: Sustainment – maximising and developing independent prescribing	Theme 4.1: Service delivery	Impact on workload	• IP could increase workload and imposed time constraints[132, 137-139, 141, 142, 148, 152]. Role underuse was a risk in community settings if infrastructural requisites (e.g., electronic prescribing/IT clinical record access) failed to be implemented[132, 134, 141, 142, 148, 149]. • IP for service redesign and sustainability was facilitated by competence development, CPD opportunity and medical/managerial leadership[132, 133, 136, 139, 141, 142, 144, 146, 148, 149, 151, 152]. • CPD provision and formal evaluation of IP implementation was inconsistent and lacked
	Theme 4.2: Supporting role development	Role/service expansion	
		Continued professional development	
		Evaluation & Reflection	

			standardisation in primary care[132, 138, 142, 149, 152]. • 'Enhancement', 'substitution', and 'role specific' implementation models based on the maintenance or change in prescribing competence, service reconfiguration and/or substitution of services were identified[132, 139, 141, 142, 144, 146, 148, 149, 151]

CPD – continued professional development, DMPs – designated medical practitioners, GPs – general practitioners, IP – independent prescribing, IPs – independent prescribers, NMP – non-medical prescribing

Analytical theme 1: Preparation – organisational readiness for implementation

This analytical theme refers to barriers and facilitators influential to the planning phase of implementation which related to the service need and relative advantage of implementing IP, the need for consistent managerial leadership and an inter-professional environment that was conducive to team implementation.

Descriptive Theme 1.1: Clarifying need and advantage of implementing independent prescribing

Identifying shortfalls in existing medicines pathways and how IP could fill service gaps were key steps in this stage. Studies described a highly qualified, specialist nursing and pharmacy workforce delivering unscheduled, scheduled and out-of-hours services[132, 134-139, 141, 142, 144, 146, 148, 150-152] who routinely made autonomous clinical decisions necessitating prescribing and medicines optimisation skills[129, 135-137, 142, 148, 150, 152]. IP held tangible advantage over former methods of accessing prescribed medicines which involved request, referral and/or the counter-signing of prescriptions by doctors. Subject to GP workload[134, 144, 146] and constrained availability[142, 144, 146, 148], these methods were labour intensive[142-144, 146, 148], inefficient[138, 142, 143, 148], and burdened services and patients through the need for additional healthcare contacts[135, 139, 141, 143, 144, 148, 150]. By removing the need for doctor input, IP improved responsiveness with respect to medicines[135, 137, 141, 142, 144, 146, 148, 150], enhanced care quality[132, 144, 148], and helped prevent adverse outcomes[142].

Lack of team clarity and transparency on IP role intentions were persistent barriers to implementation[139, 141, 142, 144, 146, 148, 149, 151]. Poor team understanding of IP could limit integration[151], and promote role ambiguity[151] or misuse[132, 138, 142, 149]. Consultative team stakeholder processes facilitated clarification of current medicines pathways bottle necks[146], helped cement clinical advantage of IP[146] and encouraged a collective understanding of implementation[144, 146, 151]. Conversely, if existing medicines pathways were perceived to be expedient and IP held limited advantage, adoption was less likely[143, 145].

Descriptive Theme 1.2: Managerial leadership and support

Lack of managerial leadership and support were highly cited barriers to implementation that persisted across the review decade. Nurse/pharmacist prescribers reported stage specific and on-going funding[130, 143, 145], training[131, 132, 134, 138, 139, 141, 142, 149] and infrastructural needs[132, 134, 141, 142, 148, 149] that extended across the IP implementation trajectory. Managerial support was, however, frequently reported to diminish post-adoption[130-132, 134, 138, 139, 141-143, 145, 148, 149] and many practitioners believed managers lacked knowledge about IP[132, 138, 139, 143, 145] or misunderstood its potential for improving service quality[132, 145]. Nurses/pharmacists

ascribed high value to IP for improving service efficiency[137, 138, 141, 142, 148, 149] and skill utilisation[132, 134, 138, 142], perceiving it extended clinical knowledge beyond prescribing[132, 134, 142, 148], enhanced clinical confidence[132, 139, 141, 142, 148] and job satisfaction[138, 141, 148], and facilitated team education[132, 144, 151]. They perceived themselves a unique workforce resource with potential for better mobilisation in under-resourced areas (e.g., mental health)[132]. However, there was a perception that management lacked appreciation of primary care workforce aspirations for IP[145] and overlooked its scope[132, 143, 145]. Better recognition and commitment were considered essential for leveraging and driving IP services forward[132].

Ensuring teams understood IP and its role within care delivery mitigated subsequent barriers[138, 139, 142, 151] and was critical for implementation success[139, 141, 142, 144, 146, 148, 149, 151]. Doctors, receptionists[138, 139, 151], dispensing pharmacists[148, 151], and peer colleagues[141, 148, 149, 151] all played supervisory and/or infrastructural roles in IP implementation and understanding the need for this input was essential. While staff clarity on their roles in relation to IP positively influenced willingness to provide enabling supports such as clinic administration[138, 151], record access[146], and clinical supervision/pharmaceutical advice[142, 148] lack of team understanding of IP was a barrier that was cited repeatedly across the review decade[134, 138, 139, 141, 142, 145, 146, 148, 149, 151].

Descriptive Theme 1.3: Inter-professional environment

Respectful, trusting inter-professional relationships promoted an appreciation of different professional skill sets[151], helped ratify the purpose of IP[129, 151] and built team confidence in the prescribing competence of nurses and pharmacists[129, 142]. Good relationships facilitated information transfer[142], promoted supervision provision[149, 151], shared learning[129] and team working[151]. Acceptance and positive attitudes towards IP as a shared skill were facilitative to implementation [144, 146, 151] and mitigated the likelihood of “turf wars” emerging if IP roles was perceived to encroach on professional territories[151]. While many nurses/pharmacists reported positive relationships with doctors[139, 141, 142, 148, 151], others described jurisdictional tensions over prescribing authority[139, 145, 151]. Building trust for IP where relationships were weak took time[144], and given the important supervisory role of doctors in IP[132, 134, 138, 141, 142, 148, 149], consideration of their strength in adoption planning is pertinent. Good communication networks were more likely where established relationships and positive attitudes towards IP prevailed[142, 151], and were important for imparting information to teams about IP [138, 144, 146], for developing supervision and peer support[142, 148] and promoting teamwork[146, 151].

Analytical theme 2: Training – optimising practitioner readiness for independent prescribing

This analytical theme refers to the extent to which organisations select and prepare the right practitioners for IP training, as well as how they support and maximise students' learning experiences.

Descriptive Theme 2.1: Selecting the right practitioners

Overall, strategic planning for IP workforce selection lacked scrutiny, and practitioner choice[130, 132, 138], expectation of improved job satisfaction[138, 145, 148], efficiency and patient benefit[130, 138] were the primary drivers for implementation across the review period. Training course drop out[130] and failure to prescribe following training[132, 134], suggest a need to ensure selection procedures match skills and capabilities to IP and increase the chances of organisational return on IP training investment. Synthesis identified essential skills[132, 135, 137, 138, 140, 148, 150, 152] and personal motivation[130, 132] as important considerations. Study demographic data indicated a clinically experienced workforce[132, 138, 139, 148, 149], with degree/higher degree educational and/or specialist skills attainment[130, 135, 142, 150]. Advanced physical assessment and clinical specialty skills not only suggested expertise and theoretical knowledge to underpin IP but were also recognised by patients as important contributors to care quality[135, 140, 150]. Patients reported high levels of confidence in IP led care, with the caveat that prescribers demonstrated knowledge and expertise[135, 140, 150]. Good interpersonal, communication, examination, history taking and diagnostic skills were key. These were mandatory for differential diagnosis[135-137, 150, 152] and holistic management[138, 148, 152], for conferring practitioner prescribing/non-prescribing decisions [136, 137, 152] and managing treatment concordance[132, 135, 137, 140, 146, 150, 152] and patient expectations for medicines[136, 137, 152]. Motivational deterrents to IP uptake that were identified by non-prescribing nurses[145] and physiotherapists[143] were being near retirement[145], a reluctance to undertake further advanced training[143, 145], concerns about training rigor[143], and a perception of effort/remuneration imbalance[143, 145]. Although IP job satisfaction and professional benefits were considered future adoption drivers[145] lack of financial remuneration in particular disincentivised practice nurse[145] and physiotherapy adoption[143].

Descriptive Theme 2.2: Preparing and supporting practitioners during training

UK non-medical prescribing training programmes employ profession-specific or inter-professional models, delivering 26 days equivalent fulltime education alongside a supervised learning in practice period[129]. Given the onus for safe prescribing, programmes were reported by students and nurse/pharmacist prescribers to be academically rigorous[131, 148]. There was evidence however that students lacked key knowledge about generic training

models[145], the learning expectations of different pedagogies[129], as well as course assessment and portfolio requirements[130]. Expecting narrower, speciality specific rather than generic training was common[130, 148]. Students found the academic demands of training whilst continuing their usual clinical duties challenging indicating a need to better balance work, personal and academic commitments[129, 131]. The degree of allocated support time[130, 131] and the quality of mentoring during supervised practice learning[129] were key influences on student learning experiences. Adequate study leave, protected time and backfill respectively optimised study time, reduced personal time encroachment and negated the need to absorb usual role duties whilst training[130]. Despite organisational requirement to confirm study leave arrangements pre-training, primary care allocation was highly unstandardised, with some students entering training without a confirmed agreement[130]. Prepared practice mentors with clarity on their role obligations in general provided a higher level of input to students[129], and good mentor-student relationships that continued post-training facilitated transition[134]. Additional training buddying schemes helped students better manage the competing demands of training whilst working, although time constraints limited their uptake[131].

Analytical theme 3: Transition – ensuring early prescribing support

This analytical theme highlighted the importance of the post-qualification transition period in the development of prescribing confidence/competence and identified a high need for supervision and informal and formal support. Delineating the scope of prescribing competence facilitated early implementation.

Descriptive Theme 3.1: Transition as a point of vulnerability

Many nurses/pharmacists held vivid memories of anxiety and fear during their first IP encounters[139, 141, 142, 148, 149], reporting a diminution of self-confidence during the early transition period[137, 139, 141, 142, 148, 149]. This finding traversed the review decade and was unrelated to how prepared prescribers felt by training[139, 148]. Heightened awareness of the risks of error[149], the cautionary approach instilled by training[139, 149], and liability for personal accountability[141, 148] fuelled feelings. It was recognised that self-confidence and competence development were essential for prescribing[139, 149] and mitigated anxiety[148], but were highly dependent on exposure to prescribing opportunities[148, 149], time[139, 149] and above all, the level of available support[129, 134, 141, 148, 149]. Without a channel for accessing supervision, nurses/pharmacists could doubt competence, lose confidence and defer from prescribing[149]. This led to a lack of competence development and underutilisation of IP[149] and suggests that greater acknowledgement of transitional developmental needs is necessary.

Descriptive Theme 3.2: Nurturing competence and confidence

Establishing competence boundaries and recognising personal limitations were important enablers in transition[139, 149]. Nurse/pharmacist prescribers defined competence as the immediate clinical areas in which they had the knowledge and confidence to prescribe[138, 139, 141, 142, 149, 151]. Delineating individual scope of prescribing practice by restricting the range of medicines prescribed to circumscribed clinical areas[138, 142, 148, 151] in line with clinical guidelines and protocols[139] encouraged the early development of competence[149]. Alternatively, prescribing outside these boundaries[139], as in complex polypharmacy or comorbidity[134, 142], was deemed risky, unsafe and unprofessional[138, 149, 151]. Nurses/pharmacists reported that teams often failed to recognise their self-confidence issues related to competence[142], and exerted inappropriate expectations for IP[134, 138, 139]. Recognising that as a new skill, development of prescribing competence was time and opportunity dependent[139, 148, 149] several nurses expressed anxiety that prescribing skills would diminish during transition if not utilised[148].

Descriptive Theme 3.3: Transition support needs

Reports of poor transition support pervaded the review decade[132, 134, 137, 138, 141, 142, 148, 149] and there was limited evidence of pre-emptive, formalised supervision provision[134]. Nurses reported this absence as immediately impactful[141], especially in isolated roles and in services with few prescribers[132, 149]. While nurses and pharmacists desired structured and informal supervision[142, 149], in all 7 studies addressing this theme[132, 134, 138, 141, 142, 148, 149], most could only access a variable level of informal support. “Open door” contemporaneous advice given by GPs was the primary source, although specialist doctors, peers and pharmacists were also consulted. Team receptiveness to providing this mentoring[149], its reliability[137, 141] and accessibility[148, 149] were key facilitators. Informal opportunities for discussion provided security[149] and were valued[138, 141, 148, 149]. Exemplifying barrier interdependence, lack of mentoring relationships with doctors limited opportunity for informal support, prevented prescribing and limited competence with specific medicines or clinical conditions[149]. In turn this necessitated re-engagement of GP referral for prescribing and culminated in inequitable patient medicines management[142, 149]. To address shortfalls in formal support provision, several prescribers set up local peer networks[134, 138, 142], however a strong desire for formalised mentorship was expressed[132, 138, 142, 149].

Analytical theme 4: Sustainment – maximising and developing independent prescribing

This analytical theme describes barriers and facilitators within the descriptive sub-themes of service delivery and supporting role development, which relate to how IP was used and maximised in primary care.

Descriptive Theme 4.1: Service delivery

Prescribers reported that IP promoted efficient, streamlined services[138, 139, 141, 142, 144, 148]. However, views on how it impacted individual practitioner workload differed[138, 139, 141, 142, 148, 149]. IP reportedly lengthened consultations[132, 138], added administrative tasks[141, 148] and increased job-related stress[138]. Undertaking in-depth holistic assessment to inform prescribing needs imposed time constraints[132, 152], which were exacerbated in strict ten-minute clinic allocation systems[137, 138]. Additional time and experience could however be mitigating[137, 152]. Community IPs reported their main workload barriers as administrative and related to absent or incompatible electronic record and prescription generation systems[134, 141, 142, 148, 149, 152]. Seeking clinical information caused significant delays, in some cases causing IPs to revert to GP referral for prescribing needs[134, 141, 148, 149]. However, recent IT accessibility was suggested to mitigate retrieval problems[146].

Attitudes towards role change because of IP also influenced perceptions about workload[138, 139]. Some prescribers perceived that GPs abdicated responsibility for prescribing following introduction of IP[148] which increased workload and job demand[138, 139]. Prescribers negatively referred to this as work offloading[139], and were suspicious of underpinning financial motives[145]. Alternatively, other prescribers viewed the benefits of IP at a broader service level and as an opportunity to reduce GP colleague workforce pressures[134, 146, 148]. While GPs in one study stressed that their acceptance of pharmacist IP rested on whether it increased existing workload[144] limited team member involvement within studies precluded synthesis of wider primary care workload impact of IP.

Descriptive Theme 4.2: Supporting role development

Despite limited contextual detail on workforce planning[132, 146, 151], three broadly categorised "models" of IP implementation were identified. The first "*Enhancement* "model introduced IP to enhance the efficiency of existing nurse/pharmacist roles without changing the pattern of service provision, client group or condition complexity[139, 141, 142, 149, 151]. The second "*Substitution*" model adapted existing IP roles to directly substitute or replace GP services, which required some level of structural re-organisation of care and/or a change in core prescribing competence[132, 141, 144, 146, 148], (e.g., substituting GPs in out-of-hours palliative care services and additionally managing non-cancer terminal illness[148]). The final, less

frequently evidenced "*Role specific*" model created new roles specifically for pharmacist prescribers, for which geriatric chronic disease and co-morbidity management were new areas of competence, and in which pharmacists assumed a transfer of responsibility from GPs for care home medicines management[144, 146]. One study found that the specific models of employment/funding influenced how well IP roles were integrated[151], with direct GP practice employment as opposed to commissioned PCT funded roles creating greater sense of permanence, better role use, and enhanced team involvement. This was assumed to result from improved relationships, trust and team building[144, 146].

A strategic top-down approach to implementation of IP was unclear from the reviewed studies, and overall an individual practitioner, bottom-up approach appeared to drive adoption. However, there was some evidence that where skill mix was recognised and valued within services[146, 151], CPD was readily available[151] and doctors provided leadership[139, 151] IP was used to greater extent for primary care redesign and service sustainability. Absent policy and national targets restrained IP resource allocation[132], whilst policy and national guidance was facilitative[144, 146]. Doctors also imposed constraints on IP by limiting clinical caseloads[139, 149], restricting formularies[134, 151] or by retaining sole diagnostic prescribing responsibility for patients[132, 146]. For some prescribers, competence expansion was synonymous with crossing job descriptions and mandated formal negotiation with employers[149].

Provision of CPD overall was inconsistent, untargeted to evolving learning needs[138, 149], and prescribers identified pharmacology[141], statutory drug updates[138] as key topics. Lack of confidence with heart failure[142], mental health conditions[132], polypharmacy and off-label prescribing[149] suggested CPD in co-morbidities warranted further input. Trust provision included forums/meetings[138, 142], commissioned training, national conference attendance[141, 151] and electronic journal resources[141]. However, provision varied widely and with few prescribers reporting accessible CPD systems[138, 142], there was agreement that improved implementation was necessary[132, 138, 141, 142, 149, 152].

With time and input to create support systems[142] and enhance communication concerning role boundaries[148] prescribers reported that IP integration improved. However, formal evaluation following implementation was rare[134], with only two studies[137, 152] identifying quality assurance activities such as audit and local/national data benchmarking in the context of antibiotic stewardship.

Discussion

The future of UK primary care is reliant on workforce expansion and introduction of new first-contact non-medical roles[27, 153-156]. Ensuring practitioners have the right skills to enable sustainable service development, at scale and pace is key[157, 158]. Recent reports of rising non-medical prescriber numbers in some regions of the UK[30, 79, 159] suggest healthcare providers are recognising the value of prescribing for skill-mix and workforce transformation. Ensuring implementation is optimised, sustained and IP roles are maximised for service and patient benefit is essential.

This is the first meta-synthesis evaluating barriers and facilitators to the implementation of IP by non-medical healthcare professionals in primary care. Guided by theory and synthesising factors across a continuum of implementation provides a temporal dimension and insight into three primary '*enhancement*', '*substitution*', and '*role specific*' models of implementation that previous UK systematic reviews lack[54, 68, 69, 74]. In its infancy in UK primary care non-medical prescribing research[137, 146, 160, 161], implementation theory is likely to become increasingly important for informing implementation strategies as the governance arrangements for extended prescribing rights grow in complexity [159] and the socio-political primary care landscape continues to change[162].

From stakeholders' experiences of implementing IP, barriers and facilitators were identified in four key analytical themes: '*Preparation',* '*Training*', '*Transition*' and '*Sustainment'*. While some interdependence and overlap is acknowledged, these themes present a stage based road map of barriers and facilitators for consideration in future implementation.

In the theme '*Preparation',* the importance of organisational readiness for implementing IP was reflected by a need for consistent managerial leadership/support, improved team understanding of prescribing role intentions and an interprofessional environment that supports novice prescribers. While nurses and pharmacists considered IP integral to advanced practice and essential to enhance workforce skill utilisation there was concern that it lacked strategic prominence in primary care. Accordingly, the '*Training*' theme identified a need for improved managerial recognition of primary care workforce aspirations for IP along with a need to ensure skills and motivations matched those necessary for training. In line with national reports[43, 46, 55], the response to the non-medical prescribing agenda has been sluggish in some UK regions [59], with reforms to commissioning either marginalising[59] or fragmenting its funding[110, 163]. Moreover, in common with national evaluations[43, 59, 164, 165], this synthesis identified a continuing practitioner led implementation of IP with largely voluntary uptake. Contrary to secondary care[62], there was limited evidence[144, 146] for policy driven service design or targeted strategy embedding IP within career or service pathways. This suggests a disjointed approach to implementation that may reflect the rapidly changing

policy and service context of UK primary care[166-168]. However, with a third of the non-medical general practice workforce near retirement age[169], and succession of IP roles lacking guarantee[151], sustainability of non-medical prescribing capability is a key concern for future management of primary care patient medicines needs[170].

Transition was identified as a key stage in implementation that warrants greater scrutiny and has resonance for professions such as paramedics who are new to prescribing. While its affective nature[171, 172] and need for bespoke support systems has been previously recognised[173, 174], few studies have specifically sampled novice prescribers[172, 175] to ascertain optimal supervisory requirements[171]. Despite extension of IP rights to optometrists, physiotherapists, radiographers, podiatrists and paramedics over the past thirteen years, focus on implementation issues during transition within each profession has been limited[43, 176, 177]. This is likely to be especially important for paramedics who, awarded IP rights in 2018 have not been subject to the supplementary prescribing lead in period that characterises other professions[178] and who are historically less well established in the primary care workforce[179, 180]. Early data suggesting challenges around role isolation, team expectations of paramedic IP and lack of legislative parity for controlled drugs warrants further exploration to determine whether paramedics too, face similar barriers identified by this review[177, 181].

In common with other UK reviews[68, 69], limited overall focus on long-term sustainability or strategy for implementation at either local, regional or national level was found. This was echoed by the dominance of the '*enhancement*', as opposed to '*role specific*' implementation models identified and may reflect the multiple changes made to policy[182], leadership[183] and commissioning[184] and the on-going embedding of new governance structures within primary care[185]. Of note, despite finding a need for more cohesive managerial support that extends across the entire implementation trajectory, minimal reference was made to the championing and change agent functions of non-medical prescribing leads[173, 174]. The Department of Health has long recommended implementation of non-medical prescribing under direction of a designated lead with strategic, operational and governance footholds[33]. A lack of representation in recent regional research[159] supports the tenet that many of these roles were not replaced in England following the abolition of primary care trusts[174]. Successful implementation is more likely when champions are fully organisationally supported[186] and provide sustained input to implementation activities[173, 187, 188]. However, a lack of role infrastructure, clarity and designated time[159, 174], along with the increasingly diverse non-medical prescribing workforce is challenging this important role. While other models of primary care workforce mentoring show promise[189], the repetition and frequency of barriers

exposed by this synthesis over the review decade indicate urgent need for a more cohesive approach to supporting IP.

Strengths and limitations

This review strengthens the UK evidence base by identifying challenges to IP implementation in traditional and contemporary primary care contexts. Using comprehensive search strategies and robust analysis methods, it highlights factors during '*Preparation',* '*Training*', '*Transition*' and '*Sustainment'* stages and models of implementation which can be used by practitioners and policymakers to identify areas for improving implementation support.

Although limited to UK literature, the theoretical lens ensured focus on common factors known to facilitate implementation (e.g., the need for leadership and championing) which are generalisable to any implementation context, either in the UK or internationally. We did not however include grey literature and although qualitative synthesis enabled rich description of elements perceived by stakeholders to influence implementation of IP in the UK, reviews that include quantitative literature in primary care are encouraged. Our focus on primary care excluded barriers and facilitators that may be unique to acute care and other settings. Moreover, as the non-medical prescribing agenda is disseminated across the NHS, it will be increasingly important to consider the theoretical basis for developing strategies to achieve more successful implementation of this complex innovation in different professions[67, 119, 190].

Conclusion

Globally, healthcare systems are implementing strategies to address workforce deficits that enhance the skills of nurses, pharmacists and other non-medical healthcare professionals. Integral to advanced scope of practice, it is imperative that IP capability is optimised through successful implementation. This meta-synthesis has identified persistent barriers at the '*Preparation',* '*Training*', '*Transition*' and '*Sustainment'* stages of implementation. A more coordinated and targeted approach to overcome barriers identified in these stages is key to ensuring that IP is an effective approach to helping alleviate workforce shortfalls in the UK, and around the world.

Contributors

JE and NC conceived the study. JE obtained funding, oversaw all aspects of the project and contributed to all stages. JE drafted this paper. JE designed and executed all the searches, data extraction, coding, and quality appraisal. NC contributed to all stages of the review,

including data extraction and coding. MC and NC contributed to the evolving synthesis and formulation of conclusions.

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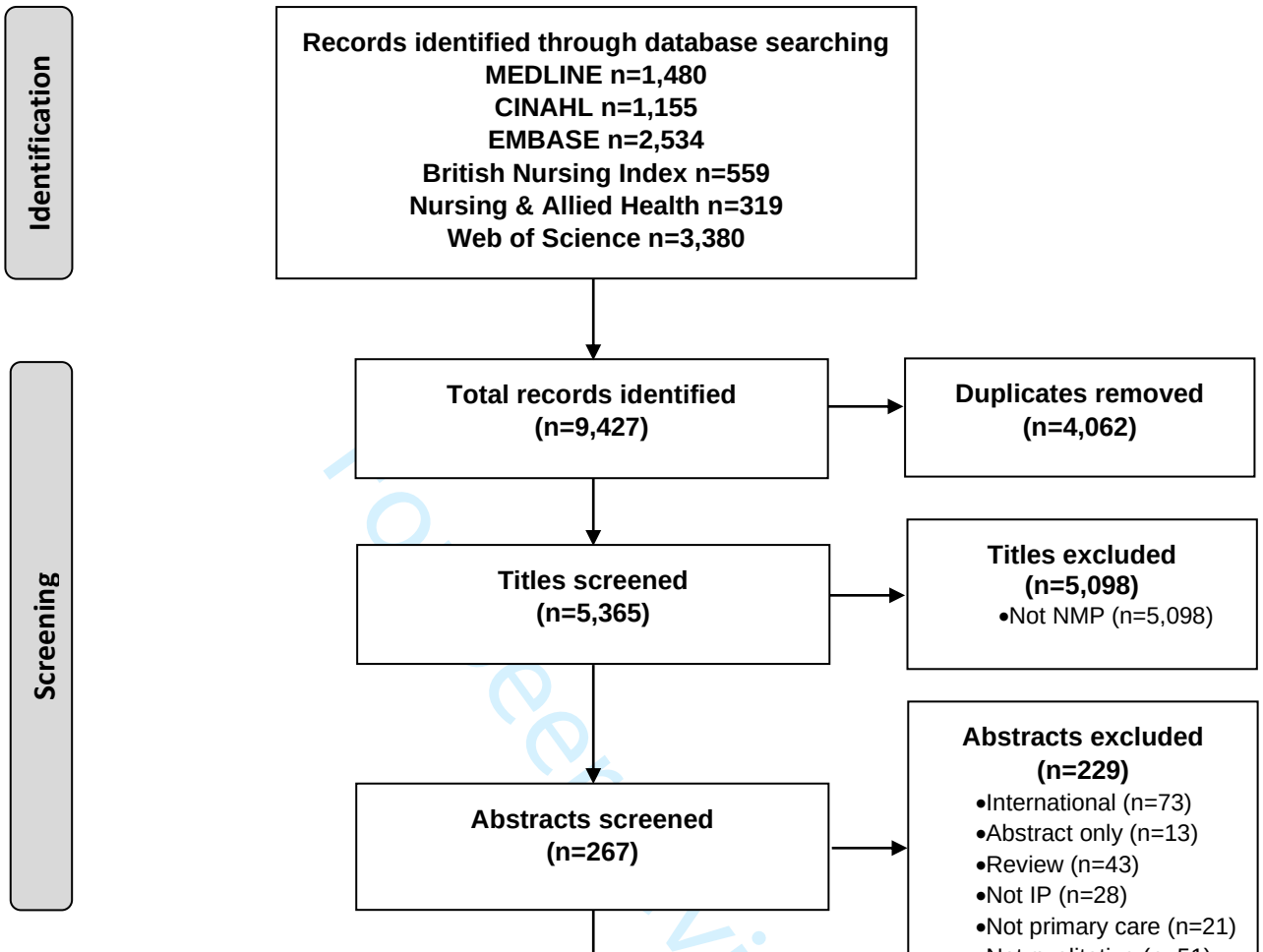

SupplementaryFile1_V2.0_19112021

Supplementary File 1. MEDLINE search string

	EBSCO host; MEDLINE	
1	(MM "Family Practice")	42,149
2	(MM "Primary Health Care")	52,315
3	(MM "Physicians, Family")	11,183
4	(MH "Community Health Nursing")	19,640
5	(MH "Community Health Workers")	5,502
6	(MH "Community Health Services")	32, 035
7	(MH "Community Health Centres")	34,071
8	TI (community N1 health) OR AB (community N1 health)	41,477
9	TI (community N1 care) OR AB (community N1 care)	13,601
10	TI (primary N1 health) OR AB (primary N1 health)	28,349
11	TI (primary N1 care) OR AB (primary N1 care)	138,944
12	TI (general N1 practice*) OR (AB general N1 practice*)	45,549
13	TI (general N1 practitioner*) OR AB (general N1 practitioner*)	53,594
14	TI (family N1 practice*) OR AB (family N1 practice*)	10,921
15	TI (family N1 practitioner*) OR AB (family N1 practitioner*)	2,955
16	TI (gp N1 practice*) OR AB (gp N1 practice*)	2,067
17	TI (gp N1 service*) OR AB (gp N1 service*)	433
18	TI (gp N1 clinic*) OR AB (gp N1 clinic*)	341
19	OR/1-18	343,938
20	TI prescrib* OR AB prescrib*	153,174
21	TI independent prescrib* OR AB independent prescrib*	508
22	TI non-medical prescrib* OR AB non-medical prescrib*	208
23	OR/20-22	153,174
24	TI nurs* OR AB nurs*	460,786
25	TI physiotherap* OR AB physiotherap*	26,543
26	TI pharmacist* OR AB pharmacist*	34,354
27	TI (podiatr* OR chiropod*) OR AB (podiatr* OR chiropod*)	3,274
28	TI radiographer* OR AB radiographer*	1,746
29	TI (dietician* OR dietician*) OR AB (dietician* OR dietician*)	7,306
30	TI paramedic* OR AB paramedic*	7,958
31	TI optometr* OR AB optometr*	3,584
32	OR/24-31	533,864
33	23 AND 32	12,932
34	TI nurs* N1 prescrib* OR AB nurs* N1 prescrib*	1,054
35	TI pharmacist* N1 prescrib* OR AB pharmacist* N1 prescrib*	751
36	TI physiotherap* N1 prescrib* OR AB physiotherap* N1 prescrib*	105
37	TI paramedic* N1 prescrib* OR AB paramedic* N1 prescrib*	4
38	TI podiatr* N1 prescrib* OR AB podiatr* N1 prescrib*	15
39	TI chiropod* N1 prescrib* OR AB chiropod* N1 prescrib*	2
40	TI dietician* N1 prescrib* OR AB dietician* N1 prescrib*	18
41	TI dietitian* N1 prescrib* OR AB dietitian* N1 prescrib*	3
42	TI radiograph* N1 prescrib* OR AB radiograph* N1 prescrib*	61
43	TI optometr* N1 prescrib* OR AB optometr*N1 prescrib*	14
44	OR/34-43	1,985
45	33 OR 44	12,993
46	19 AND 45	2,417
47	LIMITS Full Text, Published 20100101-20201231, Peer-reviewed, English language	1,480

SupplementaryFile2_V2.0_19112021

Supplementary File 2. Quality Assessment Tool for Studies with Diverse Designs scores

	Afseth & Paterson 2017	Boreham 2013	Bowskill 2014	Brodie 2014	Carter 2021	Cole & Gillett 2015	Courtenay 2010	Courtenay 2017	Courtenay 2019	Cousins & Donnell 2012	Daughtry & Hayter 2010	Dhalivaal 2011	Downer & Shepherd 2010	Hopkins 2015	Holden 2018	Inch 2019	Kelly 2010	Lane 2020	Latham & Nyatanga 2018a,b	Maddox 2016	Stenner 2011	Weiss 2016	Williams 2018
Explicit theoretical framework	3	1	0	0	3	0	1	0	3	1	0	0	3	3	3	0	0	3	3	0	0	0	3
Statement of aims/ objectives in main body of report	3	3	3	2	3	3	2	3	3	2	3	2	3	3	3	3	3	2	3	2	3	3	3
Clear description of research setting	3	3	3	2	3	2	3	2	3	3	3	2	1	2	2	3	2	3	3	2	3	3	2
Evidence of sample size considered in terms of analysis	0	0	0	0	1	0	0	0	2	3	0	3	0	3	3	3	1	1	2	3	0	0	0
Representative sample of target group of a reasonable size	2	3	3	2	2	3	3	3	2	3	1	2	0	3	3	3	3	3	1	3	3	3	3
Description of procedure for data collection	3	3	3	2	3	1	2	2	3	3	2	2	2	3	3	1	1	3	3	3	3	3	2
Rationale for choice of data collection tool(s)	2	2	0	0	2	0	0	2	3	1	0	2	3	2	2	0	0	3	3	2	0	0	0
Detailed recruitment data	2	2	3	1	3	2	3	2	3	2	2	3	1	3	3	3	2	3	3	3	3	3	3
Statistical assessment of reliability & validity of measurement tool(s) (Quan)	n/a	0	2	n/a	n/a	0	n/a	0	n/a	n/a	n/a	n/a	n/a	2	2	0	0	n/a	n/a	n/a	n/a	n/a	n/a
Fit between stated research question & method of data collection (Quan)	n/a	3	3	n/a	n/a	1	n/a	2	n/a	n/a	n/a	n/a	n/a	3	3	3	0	n/a	n/a	n/a	n/a	n/a	n/a
Fit between stated research question & format & content of data collection tool (Qual)	1	3	2	2	3	1	0	3	3	0	0	2	0	2	2	1	0	3	1	1	0	3	2
Fit between research question & method of analysis	3	3	3	2	2	1	3	3	3	3	3	0	3	3	3	1	2	3	3	3	3	3	3
Good justification for analytical method selected	1	2	0	1	2	0	0	2	2	0	0	0	3	2	2	0	0	2	3	1	0	0	2
Assessment of reliability of analytical process (Qual)	0	2	0	1	1	0	3	2	0	3	0	0	0	0	0	0	0	0	0	3	3	0	3
Evidence of user involvement in design	3	2	2	0	2	0	0	3	1	0	0	0	0	0	0	3	2	2	0	1	0	0	3
Strengths & limitations critically discussed	2	0	2	1	3	0	1	3	3	1	1	0	1	2	2	2	0	3	2	3	2	1	3
Total	28	32	29	16	33	14	21	32	33	25	15	18	20	33	36	26	16	33	30	30	23	22	32
Max score possible	42	48	48	42	42	48	42	48	42	42	42	42	42	42	48	48	48	42	42	42	42	42	42

SupplementaryFile3_V2.0_19112021

Supplementary File 3 – Analytical themes and sub-themes showing link of indicative quotations to barriers and facilitators

Analytical Theme	Descriptive Theme	Data theme	Indicative quotations	Barriers/facilitators
Analytical theme 1: Preparation – organisational readiness for implementation	Theme 1.1: Clarifying need & advantage of independent prescribing	Clarifying clinical/service need for IP	•*"You're not waiting for medics to .. do your prescribing, you can do it as an autonomous practitioner …the most crucial aspect of it—continuity of care."* (1) •*"I'm not sure that the qualification would improve my level of patient care [Doctors] sign scripts as required."* (2)	F - Clinical/service advantage of IP. B - Lack of clinical/service advantage of IP.
		Establishing service pathway gaps	•*"Because I have to write, send it to the GP, it has to land on the GP's desk, then the patient has gotta make an appointment to see that GP, then the prescription comes from the GP, and then they go and fulfil that prescription and then make an appointment to come back and see me."*(3) •*"I feel reasonably comfortable that we can manage them ..by directing them to the pharmacist or the GP. I don't feel that it's particularly hampering my treatment...."* (3) •*" "A viable (pharmacist) IP service would depend on successfully addressing the many points in the circuit of prescribing where it can go wrong."*(4)	F- Identified service pathway gaps. B - Expedient medicines pathways
		Role clarity	•*"When I start working in a practice, I tend to try and agree ground rules, or rules of engagement….about what it is they want me to do, and if they're fairly broad, then that's okay, in some cases they're fairly narrow.."*(5) •*" So basically our p-formulary [personal formulary] has to match up with what we're doing, and .. that's when you say, 'actually no, I'm not prescribing tramadol or I am not prescribing whatever they're asking for."*(5) •*"I don't think all our colleagues are clear about non-medical prescribing."*(6) •*"I think as soon as they* (reception staff) *realize you can prescribe they expect you to be able to do exactly what doctors can do. They don't understand your limitations…."* (7)	F- IP role clarity F- Team understanding of IP B - Lack of IP role clarity B - Lack of team understanding of IP
	Theme 1.2: Managerial leadership and support	Role of managers	•*"I phoned up for advice...but she (manager) really didn't know… Anything I knew, I knew myself."* (8) •*"I've had nothing but support. They created a consulting room for me, put all the systems in place, the diagnostics, even putting notices in the notice-board for the first year or two so the patients were aware. And the staff were all made aware of it, we have practice meetings, the practice nurse was consulted.""*(9) •*"I know I wouldn't get the support from work for their funding…I would do it, but it's funding"*(3) •*" "I was challenged the other day … to ask why I hadn't written end of life charts …and I wouldn't do it because I did not have enough medical information about that patient."*(10)	F – Medical/managerial support/leadership. F - Stakeholder consultation F - Clinical record/IT access B - Lack of medical/managerial support/leadership. B – Lack of course funding. B - Lack of clinical record/IT access
		Recognising value	•*"We probably weren't prepared to remunerate her* [nurse prescriber] *as much as she thought she should be, because partly in our eyes she wasn't going to be doing that much extra."*(9) •*"It's just like having another partner who can deal with certain conditions,*	F - Medical/managerial support/leadership.

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Analytical Theme	Descriptive Theme	Data theme	Indicative quotations	Barriers/facilitators
			and who also works as a nurse within the practice."[9]	B - Lack Medical/managerial support/leadership.
		Culture	•*" 'I can't imagine how anyone can do our jobs without being a prescriber now … it has given me another layer of knowledge and, the other side of it is, if you're advising people, you should have that knowledge."(1)'* •*"… I mean if you want to be a doctor, be a doctor, if you want to be a nurse, be a nurse, but if you're a nurse you can't do nice bits of doctoring that you feel…."*[9] •*"In some surgeries generally the nursing team can feel a bit threatened by having pharmacist prescribers, …. It's about identifying our different areas of expertise and.. working together."*[9]	F - Prescribing integral to advanced practice. B - Prescribing considered outside professional practice scope
	Theme 1.3: Inter-professional environment	Inter-professional relationships	•*"… they've got a good skill mix, so everyone's got their slightly different areas of expertise..." So quite often the doctors will still ring me and say – or pop in and say – what do you recommend for this, what are we supposed to be prescribing for this?"*[9] •" …the engagement from Doctor… as the sort of the overall lead GP for that care home, was very disappointing".[11] •*"It was building that trust that you could do it, and you...were competent…you observed safety aspects."*[12]	F - Established physician relationships. F - Good inter-professional relationships B - Poor/absent physician relationships
		Communication & collaboration	•*"We have regular clinical meetings as a practice – myself, the GPs and the nurse. And then we also have multidisciplinary meetings every 6–8 weeks. "*[9] •*"I don't really feel they'd (*GPs*) listen to me…they'd be like, well, we're GPs, we're the partners here, we make the decisions and that's final really. I do feel it's a fait accompli here…this is the way this place has been run for a long, long time."*[9]	F - Inter-professional collaboration/communication networks. B - Lack of inter-professional collaboration/communication networks.
Analytical theme 2: Training – optimising practitioner readiness for independent prescribing	Theme 2.1: Selecting the right practitioners	Selection	•*" I presume I need to do a minor illness course first, which my GP has not agreed to for last three years."*[2] •*"I wanted to do the nurse prescribing course for two years .. my employing GPs will not support me, even though all my work is in extended or advanced role."*[2]	B - Inconsistent selection policies B - Lack of workforce planning.
		Skills & aptitudes	•*"You have to be competent, not only with your history taking… but examination skills; you have to be able to relate those findings… to the patient in a language that they can understand."*[13] •*"I think that is very important that they don't skimp. When I come in she'll take my weight, do my feet, do my blood pressure, want to know when I last had my eyes checked. .. I have all the blood tests done, and we go through those, what's wrong, what's right."*[14] •*" I would definitely come back to see the nurse prescriber again; I don't*	F - Practitioner specialist skills F - Service user acceptance of IP. B - Lack of practitioner specialist skills.

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Analytical Theme	Descriptive Theme	Data theme	Indicative quotations	Barriers/facilitators
			see that there's any difference really between seeing the doctor or the nurse prescriber. The nurse prescriber seems to have just as much knowledge as the doctor…"[15]	
		Motivation & commitment	•*"I don't think we get paid enough to make those decisions."*[3] •*"I have undertaken a large amount of further training ..with very little financial remuneration.. in my leisure time, to the exclusion of leisure activities. Eventually, one would hope for some incentive beyond job satisfaction."* [2] •*"The patients are aware of your skills and they know you're making decisions and prescribing for them. It gives you a sense of satisfaction."*[6] •*"For me prescribing right does carry a lot of accountability and responsibility and .. I'm not sure that's something I'd want to take on board."*[3]	F - Professional/personal adoption incentive B - Lack of professional/personal adoption incentive B - Fear of responsibility/accountability/error
	Theme 2.2: Preparing and supporting practitioners during training	Expectations of training	•*"Reassurance that I could do [the course] with present qualifications or what I need to do to obtain these before I do the prescriber's course."* [2] •*"Nurses that have done course say [very] intense and difficult.*[2] •*"Need info about what it involves, assessment, funding etc. Also general career advice."*[2]	B - Lack of course information.
		Study leave	•*"As much as I would like but there be no-one doing my work while I am* •*away...have to catch up."*[16] •*"I plan to do asthma training and then like to do minor illness training, but when I do I will have to do most of it in my own time – this puts me off nurse prescribing."*[2]	B - Lack of backfill/protected/study time
		Designated Medical Practitioners	•*"I think when we did our prescribing training … some of us had a lot of very .. proactive support from the medical mentors and some of us had less than that."*[10] •*"I had to educate (DMP).. on how the course works."*[17] •*"…I think the two of us were kind of floundering a bit … we still had slightly differing ideas as to what competency meant."*[17]	F - DMP role clarity/good DMP supervision. B - Lack of DMP role clarity/supervision/availability.
Analytical theme 3: Transition - ensuring early prescribing support	Theme 3.1: Transition as a point of vulnerability	Self-confidence	•*"When you've done the course, you lose a lot of confidence, because you learn a lot more about, you know the dilemmas and the ethics of prescribing… so, then, it's actually harder to prescribe (it) independently."*[5] •*"In some ways, it's like motherhood I think, you feel adequately prepared and then it happens and I think oh my goodness, this is bigger than I thought…"*[1] •*"I think they* [doctors] *sort of assume sometimes that we know more than we do, and I think they assume we have huge confidence in our skills when we don't…"*[12]	F - Prescribing confidence/competence. B - Lack of prescribing confidence/ competence.
	Theme 3.2: Nurturing confidence	Minimum competence	•*" I have quite a limited range that I feel confident doing, using and I haven't gone outside it…"*[12] •*"I think you have got to realize your limitations and put a stop on it when you feel your skills aren't adequate."*[7]	F - Delineated scope of prescribing competence F - Clinical/professional protocols/guidelines.

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Analytical Theme	Descriptive Theme	Data theme	Indicative quotations	Barriers/facilitators
	and competence		•*"I do know where my competencies are and where my weaknesses are, and I don't sort of go beyond my scope of practice."*[9] •"*I suppose virtually everything that I see and talk about is influenced by NICE in the first instance, and the relevant NICE guidance, whatever it might be."*[18] •*'I'm happy with exacerbations and chest infections, so, like UTIs* [urinary tract infections] *and wound infections, but anything that's going beyond that, I just don't feel confident in myself to be going out and doing that."*[12]	F- Adequate formulary B - Inappropriate patient/team pressure for prescribing B – Unclear/absent clinical protocols/ guidelines
		Experience & exposure	•*"The first time I had to ask the GP if I was actually on the right lines.. It's not as difficult the second and the third and the fourth time."*[8] •*"It's like learning to drive and then the first time you actually go out without someone sat by you …"*[1] •*"Most of my colleagues have stuck with their original prescribing competence. I reacted to questions that were being asked – could you do X? So I thought, well, could I do X? And I've then made myself competent in that particular area."*[9] *". . .as I've become more experienced. . .I'm more aware now, I suppose, of the – the complexities of certain patients."*[19]	F - Exposure to prescribing opportunity B - Delayed registration post qualification
	Theme 3.3: Transition support needs	Informal & formal support systems	•*"I suppose the bottom line is I don't get any formal support. I mean, I get support in an informal way from GPs and the consultant and my colleagues."*[12] •*"There are times when .. it's slightly more complex, so .. I'll go and get some advice.. I think it's really important to function in this way."*[9] •*"If I am in any whatsoever doubt then I just buzz through to the GP (family physician)."*[5]	F – Medical supervision. B – Lack of medical supervision.
Analytical theme 4: Sustainment - maximising and developing independent prescribing	Theme 4.1: Service delivery	Impact on workload	•*"A big disadvantage is that a lot of doctors have offloaded their work on to us. Workload has increased so much and you have to go to a lot of meetings, often in your own time".*[7] •*"We're really, really fortunate here. . .our appointment times, if you're booked into the nurse clinic, they're half-hour appointments, so we can really spend time providing the education and explaining why we're not giving antibiotics."*[19] •*"Oh, it has changed dramatically. Workload had trebled. We see most of the minor ailments. We have taken a lot more on—the more knowledge you get the higher the workload. We do all medication reviews and all hypertension reviews."* [7] •*"Non-medical prescribing consultations—the time tends to be much longer."*[20]	F - Consultation time. B - Time/workload constraints.
	Theme 4.2: Supporting IP role development	Role/service expansion	•*"I don't see how that* (mental health NMP scope extension for benzodiazepine management) *could happen with the QOF (Quality and Outcomes Framework) targets ... For* (mental health) *there's not a target ... so I genuinely don't think it's going to become part of the practice nurses remit."*[20] •*"I'd like to put my name somewhere regularly along with the doctors.., so*	F – Employment model. F - National incentives/policy initiatives for IP B – Employment model. B - IP Role isolation.

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Analytical Theme	Descriptive Theme	Data theme	Indicative quotations	Barriers/facilitators
			I'm there...part of the surgery. But because … I'm not employed by the surgery, other than being extra, additional help occasionally… it kind of leaves me in a bit of no-man's land."(9) •*"It's altered my role quite in depth … We see anything from an ingrown toenail to somebody with chest pain. In the afternoon we work on an appointment basis, running chronic disease .. and weight management clinics."*(7) •*"I found myself being given referrals for much more complex problems than perhaps I had been given before. I found myself in the position where GPs were actually expecting me to initiate treatment or to suggest what treatment they might give."*(8) •*"I have learnt over the years… extending my scope of practice as I felt more confident, and then went and sort of commissioned training or shadowed somebody, just so that I can improve my competencies and take on more of the long-term conditions and manage them in general practice."*(9)	B – Lack of national incentives/policy initiatives for IP B - Lack of local policies for IP
		Continued professional development	•*"Expanding your prescribing may be difficult, not because of your knowledge of the drugs, but because there's no training at a good enough level for the other stuff, .. how do you become competent to treat osteoporosis, there are no courses."*(5) •*"I don't think I have increased my scope over the years; to be frank."*(12) •*"Most of my colleagues have stuck with their original prescribing competence. I reacted to questions … could you do X?... And I've then made myself competent..."*(9) •*" ..what I would love is to sort of have a week or two a year when I was buddied up with a doctor, and he/she made me do all the prescribing. It would be terrifying but it would really make me learn."*(12) •*"We take group learning very seriously, we have clinical catch up … where if anyone has found any new exciting evidence or guidelines or examples of good practice we do tend to talk inter-professionally."*(18)	F - CPD/supervision B - Lack of CPD/supervision
		Evaluation & Reflection	•*". . .it's something that's a .. priority.. for me and my team here, so we're doing a lot of work .., both in terms of auditing, so we understand how much prescribing's going on. We also are looking at appropriateness of prescribing, so auditing case notes against the local guidelines and providing feedback to prescribers…So it's high up on our agenda."*(19) •*"No. I haven't had a prescribing update. Even trying to get an update on how to use your British National Formulary, any new drugs, is difficult."*(6) •*"[W]e have a training session, like an audit with the local CCG team, in relation to our practices antibiotic prescribing and comparing it to the area in the north west… so that kind of helped influence .. my antibiotic prescribing."* (18) •*"…we don't as a group kind of get together… as clinicians and feeding*	F - Audit/feedback on prescribing practice. B - Governance/accountability structures B - Lack of governance/accountability structures

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Analytical Theme	Descriptive Theme	Data theme	Indicative quotations	Barriers/facilitators
			back information, events that have happened … significant events … we don't have joint CPD."[18]	

CCG – clinical commissioning group, CFIR – Consolidated Framework for Implementation Research, CPD – continued professional development, DMP – designated medical practitioner, DOI – Diffusion of Innovations, IP – independent prescribing.

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Reporting checklist for systematic review and meta-analysis. CRD42019124400

Based on the PRISMA guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the PRISMAreporting guidelines, and cite them as:

Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement

		Reporting Item	Page Number
Title			
	#1	Identify the report as a systematic review, meta-analysis, or both.	1
Abstract			
Structured summary	#2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number	2
Introduction			
Rationale	#3	Describe the rationale for the review in the context of what is already known.	4

Objectives	#4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5
Methods			
Protocol and registration	#5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address) and, if available, provide registration information including the registration number.	5
Eligibility criteria	#6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rational	6
Information sources	#7	Describe all information sources in the search (e.g., databases with dates of coverage, contact with study authors to identify additional studies) and date last searched.	6
Search	#8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplementary file 1
Study selection	#9	State the process for selecting studies (i.e., for screening, for determining eligibility, for inclusion in the systematic review, and, if applicable, for inclusion in the meta-analysis).	6
Data collection process	#10	Describe the method of data extraction from reports (e.g., piloted forms, independently by two reviewers) and any processes for obtaining and confirming data from investigators.	7
Data items	#11	List and define all variables for which data were sought (e.g., PICOS, funding sources), and any assumptions and simplifications made.	7
Risk of bias in individual studies	#12	Describe methods used for assessing risk of bias in individual studies (including specification of whether this was done at the study or outcome level, or both), and how this information is to be used in any data synthesis.	N/A

Summary measures	#13	State the principal summary measures (e.g., risk ratio, difference in means).	N/A
Planned methods of analyis	#14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I2) for each meta-analysis.	7
Risk of bias across studies	#15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	N/A
Additional analyses	#16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	N/A
Results			
Study selection	#17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	7, Figure 1 PRISMA
Study characteristics	#18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citation.	8,
Risk of bias within studies	#19	Present data on risk of bias of each study and, if available, any outcome-level assessment (see Item 12).	N/A
Results of individual studies	#20	For all outcomes considered (benefits and harms), present, for each study: (a) simple summary data for each intervention group and (b) effect estimates and confidence intervals, ideally with a forest plot.	N/A
Synthesis of results	#21	Present the main results of the review. If meta-analyses are done, include for each, confidence intervals and measures of consistency.	8-25
Risk of bias across studies	#22	Present results of any assessment of risk of bias across studies (see Item 15).	Supplementary file 2
Additional analysis	#23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	N/A

Discussion			
Summary of Evidence	#24	Summarize the main findings, including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., health care providers, users, and policy makers	17, 26
Limitations	#25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review level (e.g., incomplete retrieval of identified research, reporting bias).	28
Conclusions	#26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	28
Funding			
Funding	#27	Describe sources of funding or other support (e.g., supply of data) for the systematic review; role of funders for the systematic review.	30