Practice pharmacists and their influence on prescribing in UK general practice: a cross-sectional study

Mary Carter[1],*, Sarah Chapman[1,2], Philip Rogers[1], Margaret Watson[3],

[1]Department of Life Sciences, University of Bath, Claverton Down, Bath BA2 7AY, United Kingdom
[2]Institute of Pharmaceutical Sciences, Kings College London, Franklin-Wilkins Building, Stamford Street, London SE1 9NH, United Kingdom
[3]Strathclyde Institute of Pharmacy and Biomedical Sciences, University of Strathclyde, 161 Cathedral Street, Glasgow G4 0RE, United Kingdom
*Correspondence: Department of Life Sciences, University of Bath, Claverton Down, Bath BA2 7AY, UK. E-mail: mary.d.carter@exeter.ac.uk

Abstract

Objectives: At the time of the survey, just over 2000 pharmacists were employed in UK general practice. Little is known about their influence on prescribing, and more specifically, the extent of their use of Audit and Feedback (A&F), an evidence-based method for behaviour change. This study aimed to explore pharmacists' current influence on prescribing in UK general practice.

Methods: A cross-sectional, online survey was open to general practice pharmacists in England, Northern Ireland, Scotland, and Wales between 9 September 2021 and 31 October 2021. The survey comprised 36 items, informed by the literature, including multiple choice and free-text questions about pharmacist responsibilities, involvement in prescribing audits (including use of A&F), use of prescribing guidelines, beliefs about influence on prescribing, and access to training and support. Descriptive statistics and frequencies were generated, and parametric analyses were conducted.

Key findings: In total, 155 responses were received from pharmacists in diverse practice locations, with a wide range of practice pharmacist experience. The majority (80%, $n = 121$) conducted prescribing audits, but only 21% ($n = 32$) reported undertaking A&F. Most respondents (90%, $n = 140$) used guidelines to inform their work, and 75% ($n = 116$) would welcome training on influencing prescribing. Pharmacists using A&F were more likely to believe in their ability to influence prescribing and to acknowledge this activity as part of their role.

Conclusion: Despite substantial evidence of its effectiveness, A&F is under-used by practice pharmacists. An increased awareness and enablement of practice pharmacists in effective techniques might promote greater evidence-based prescribing in general practice.

Keywords : pharmacists; prescribing; general practice; evidence-based practice; guideline

Introduction and background

Pharmacists were integrated into general practice teams to increase capacity, reduce general practitioner (GP) workload, and to address medicine-related challenges, including polypharmacy, prescribing variation, and rising expenditure on medicines [1, 2]. At the time of the survey, there were over 2000 pharmacists employed across UK general practices [3, 4], and this number has grown substantially since [5].

Prescribing in general practice is influenced by multiple intersecting factors [6], but little is known about how practice pharmacists actively influence their colleagues' prescribing behaviour. Audit and Feedback (A&F) is a process by which data about specific aspects of an individual's or group's practice are collected and compared with guidelines, professional standards, or peer performance. This information is fed back to individuals or groups so that they can assess and adjust their practice [7]. It is an effective method of influencing prescribing [8]; presenting feedback more than once, in both written and verbal formats, with an individual report has been shown to optimize its effectiveness [9, 10]. A recent systematic review of A&F interventions involving pharmacists as key contributors demonstrated their influence on prescribing behaviour in general practice settings [11].

This study aimed to explore pharmacists' current influence on prescribing in UK general practice.

Method

Survey

An online survey was developed using JISC OnlineSurveys© (GDPR-compliant [12], ISO/27001-certified [13]). The survey content was informed by the literature, including previous research by the authors [6, 11].

Two general practice pharmacists assessed the face validity [14] of the questions. The survey was piloted with five general practice pharmacists in England and Scotland, who assessed accessibility, navigation, and content using various computer and mobile devices. The survey comprised 36 items, half of which were multiple choice questions ($n = 18$), with the remaining items using '*tick all that apply*' ($n = 8$), free text ($n = 5$), numeric ($n = 4$), and one ranking question. Five- and seven-point Likert scales were used for reporting agreement with statements ($n = 6$), assessment of methods for influencing prescribing ($n = 1$), and indicating frequency of audits and working with other pharmacists ($n = 2$).

The survey (Supplementary Material 1) included the following sections (number of items in brackets):

- Demographic and employment information (9)
- Range of responsibilities (3)
- Involvement in prescribing audits (including A&F) (13)
- Use and attitude towards prescribing guidelines (4)
- Beliefs about influencing prescribing (5)
- Access to training and support (2)

Before accessing survey questions, respondents viewed an online participant information sheet describing the study and completed a checkbox to consent to participate.

Participants and recruitment

Eligible respondents were pharmacists working in general practices in England, Northern Ireland, Scotland, and Wales. There is no centralized register of general practice-based pharmacists in the UK. As such, the researcher contacted UK Schools of Pharmacy and pharmacist networks by email and Twitter© to request help in disseminating the survey link. The survey was promoted via Twitter©, using handles and hashtags associated with pharmacy-related organizations, groups, and influential individuals in NHS/Government bodies; Royal Colleges; Clinical Commissioning Groups (CCGs)/Health Boards; health, education, and research networks (details in Supplementary Material 2). Reminder messages targeting specific Twitter© handles were posted in a weekly schedule which commenced 2 weeks after the survey opened. Respondents were invited to enter a prize draw as an incentive to participate. The survey was open from 9 September 2021 to 31 October 2021.

Analysis

Respondents' data were exported to IBM SPSS v26© for cleaning and analysis. Partial responses and missing data were excluded from the analysis. Coherence between responses to overlapping or similar questions was checked. Descriptive statistics and frequencies were generated. Parametric analyses (Pearson's Chi-squared test (χ^2)) were conducted to evaluate between-group differences or associations for categorical variables. Friedman's test and Kendall's coefficient of concordance (W) were used to examine ranking variables. Adjustment for multiple testing was not considered appropriate for this exploratory study [15].

Ethical approval and consent

This study was approved by the Research Ethics Approval Committee for Health (ref. EP 20/21 043), University of Bath. Prior to indicating their consent to participate in the online survey, potential participants viewed a full explanation of the purpose of the study their rights as participants, and the anonymity of any data collected.

Patient and public involvement

This study specifically examined pharmacists' experiences of their work in general practice, and their beliefs about influencing prescribing in this setting. Patients were not involved in the design or conduct of the research.

This study is reported in compliance with the STROBE [16] checklist (included with submission).

Results

Respondent characteristics

The survey was completed by 155 respondents (Table 1), the majority (72%, *n* = 111) of whom were female. They worked a median of 32 (IQR 25,38) hours/week in their practice role. While most were experienced pharmacists with a median of 14 (IQR 8,22) years post-registration, their experience in a general practice role was considerably less, with a median of 2 (IQR 1,5) years.

Most respondents (79%, *n* = 123) were from England and 19% (*n* = 29) from other UK nations. Most respondents

Table 1. Respondent characteristics (*n* = 155).

Characteristic	Respondents % (*n*)
Gender	
Female	72 (111)
Male	27 (41)
Prefer not to say	1 (1)
Missing	1 (2)
Hours per week in general practice	
≤10	3 (4)
11–20	8 (13)
21–30	34 (53)
31–40	54 (83)
Missing	1 (2)
Years since registration	
≤5	20 (32)
6–10	12 (18)
11–20	38 (59)
21–30	17 (27)
31–40	11 (16)
>40	1 (1)
Missing	1 (2)
Years in general practice	
≤5	32 (50)
6–10	17 (27)
11–20	34 (52)
>20	16 (24)
Missing	1 (2)
UK region[a]	
East Midlands	9 (14)
East of England	8 (12)
London	12 (18)
North East England	5 (8)
North West England	8 (12)
South East England	15 (23)
South West England	18 (28)
Yorkshire	5 (8)
England (total)	*79 (123)*
Northern Ireland	2 (3)
Scotland	14 (22)
Wales	3 (4)
Missing	2 (3)

[a]Office for National Statistics Nomenclature of Territorial Units for Statistics [17].

reported having audit responsibilities (including A&F), and this did not vary by location (UK region [17]), post-registration, or practice role experience.

Employment situation

Most respondents (87%, *n* = 135) worked for one employer, 18 respondents (12%) reported working for two employers, and two respondents indicated three employing organizations. The sole employer was a Primary Care Network (PCN—England only) for 33% (*n* = 51) of respondents or a general practice for 29% (*n* = 45). Other respondents reported working solely for a commissioning organization (15%, *n* = 23), a GP Federation (8%, *n* = 13), or a GP cluster/Neighbourhood Care Network (Wales only) (1%, *n* = 2).

Just over half of the respondents worked in more than one practice (52%, *n* = 81) and served patient populations of between 10,000 and 30,000 (53%, *n* = 82). The remainder worked with larger practices (>30,000) (25%, *n* = 38), and 22% (*n* = 34) worked with smaller practices (<10,000).

The majority of respondents (75%, *n* = 116) reported working with other pharmacists in their general practice on a daily or weekly basis. Few respondents were the sole pharmacist in the practice (14%, *n* = 21) while the remainder (11%, *n* = 17) worked with other pharmacists, but on a less frequent basis, i.e. monthly or less. Respondents who reported working for a PCN were significantly more likely to work daily or weekly with other pharmacists (χ^2 = 6.94, df = 1, *P* = .008).

Responsibilities in general practice

Survey respondents delivered a broad range of general practice services (Fig. 1). The median number of responsibilities reported was 12 (IQR 10,14). Nearly all participants undertook responsibilities that included delivering services to patients and activities, which gave them an opportunity to influence prescribing in the practice. The majority of respondents (≥90%) reported managing prescribing queries (*n* = 148), providing patient advice (*n* = 142), medicines reconciliation (*n* = 140), and liaising with community pharmacists (*n* = 140). Fifty-nine respondents (38%) were independent prescribers. In terms of influencing prescribing, the majority (78%, *n* = 121) also reported conducting prescribing audits.

Twenty-one respondents (14%) indicated 'Other' responsibilities, including supervision (*n* = 6), other prescription-related tasks (*n* = 3), reviewing (test results) (*n* = 2), care home support (*n* = 2), monitoring (drugs) (*n* = 2), Liaison with multi-disciplinary team (*n* = 2), new patient checks (*n* = 1), consultations (*n* = 1), and practice performance management (*n* = 1).
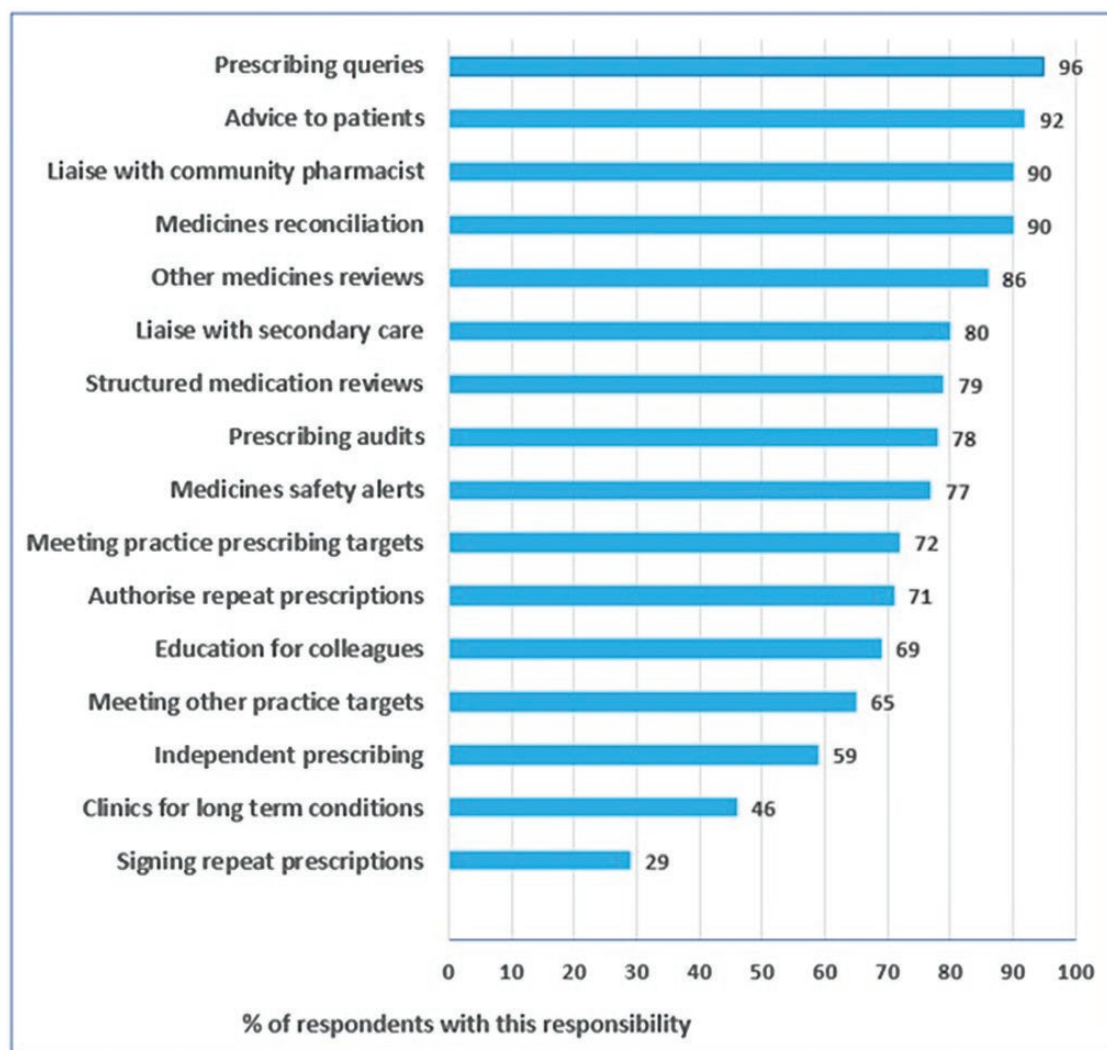

Figure 1. Respondents' general practice responsibilities.

Other professional roles outside general practice included working in community pharmacy (*n* = 11), as educators (*n* = 5), CCG/Health Board pharmacist (*n* = 4), hospital and NHS 111 responsibilities (*n* = 3 each).

Involvement in prescribing audit (including A&F)

Of the 121 (78%) respondents who indicated that they conducted prescribing audits in their practice(s), few (*n* = 32) reported using A&F. These respondents comprise the '*A&F* group'; the 89 respondents who did not describe their audit work as A&F are categorized as the '*Standard Audit* group' (Table 2). Thirty respondents did not conduct prescribing audits. Four respondents indicated that audits were conducted by pharmacy technicians or medical students.

No significant difference was shown between respondents with audit responsibilities and those with none in terms of their practice pharmacist employment hours, overall post-registration experience, or practice pharmacist experience. Pharmacists working for PCNs were more likely to conduct prescribing audits (χ^2 = 7.68, df = 1, *P* = .006).

Audit techniques used to influence prescribing

Details of prescribing audits conducted by respondents in the *A&F* Group were compared with those in the *Standard Audit* Group (Table 2).

Use and evaluation of prescribing guidelines

Most respondents agreed or strongly agreed (hereafter referred to as agreed) that they used clinical/prescribing guidelines to inform their prescribing decisions (95%, *n* = 147) and as a basis for influencing their colleagues prescribing (94%, *n* = 145).

Local and NICE guidelines were most often used for '*most working sessions*' (by 64%, *n* = 99 and 58%, *n* = 90 respondents, respectively). Agreement among respondents about the most important characteristic of guidelines (*Clearly presented, Accessible, Clinically relevant, Relevant to my patients, Credible*) was low (Kendall's coefficient of concordance [0.078, *P* < .001]). Other resources mentioned included specialist guidelines (e.g. condition-specific guidelines, British National Formulary) [18], Red Whale (provides online resources and education for primary healthcare professionals) [19], and NEWT (guidance for prescribing and administration of medicines for patients with swallowing difficulties) [20].

Beliefs about influencing prescribing

Respondents were asked about their beliefs regarding their influence on prescribing by indicating their agreement or otherwise with a series of statements (Table 3) (majority response in **bold**).

When asked to evaluate methods for influencing prescribing, *Prescribing audit and feedback of results* was assessed by respondents as effective/very effective in influencing prescribing by the majority of respondents irrespective of whether it was delivered to individuals (70%, *n* = 109) or groups (71%, *n* = 108). Around one in four respondents considered this method of influencing prescribing to be only 'somewhat effective' when delivered to individuals (25%, *n* = 39) or groups (26%, *n* = 41).

Most respondents indicated that an *interactive discussion* (88%, *n* = 136) or a *presentation by a specialist* (85%, *n* = 132) or a *pharmacist* (63%, *n* = 98) on a prescribing topic

Table 2. Details of prescribing audits.

Details of prescribing audits	A&F (*n* = 32) % (*n*)	Standard audit (*n* = 89) % (*n*)
Frequency of pharmacist's audit		
Daily	6 (2)	3 (3)
Weekly	19 (6)	6 (5)
Monthly	34 (11)	33 (29)
3-monthly	16 (5)	25 (22)
6-monthly	22 (7)	13 (12)
Yearly	3 (1)	15 (13)
Not applicable	0 (0)	6 (5)
Responsibility for identifying topic of audit[a]		
Respondent alone	56 (18)	58 (52)
Respondent with colleagues	69 (22)	74 (66)
Senior colleagues	47 (15)	61 (54)
Commissioning organization	59 (19)	65 (58)
Comparator for audit[a]		
Previous prescribing data from the practice	88 (28)	80 (71)
Prescribing data from other local practices	72 (23)	56 (50)
Prescribing data from other similar practices	44 (14)	42 (37)
National prescribing data	66 (21)	55 (49)
National standards or guidelines	59 (19)	69 (61)
Respondent responsible for reporting audit results	84 (27)	61 (54)
Recipient of audit results[a]		
Practice team	78 (25)	55 (49)
Audit result reported to individual colleague	38 (12)	21 (19)
Colleagues in their professional groups	47 (15)	35 (31)
Mode of reporting audit results[a]		
Email	63 (20)	44 (39)
Face-to-face	69 (22)	47 (42)
Telephone	9 (3)	1 (1)
Online video	22 (7)	15 (13)
Format of report[a]		
Verbal/oral	69 (22)	55 (49)
Text-based	41 (13)	35 (31)
Graphical information	50 (16)	36 (32)
Electronic dashboard	9 (3)	3 (3)
Frequency of report (number of times given)		
Once only	34 (11)	43 (38)
Twice	25 (8)	11 (10)
More than twice	25 (8)	7 (6)
Missing	16 (5)	40 (35)

[a]>1 response allowed.

were effective. The majority of respondents (74%, *n* = 114) also considered a *practical teaching session based on the application of guidelines* to be effective in influencing prescribing behaviour. In addition, 35% (*n* = 54) indicated that the *receipt of guidelines* was effective/very effective in influencing prescribing while 23% (*n* = 36) considered this method to be somewhat ineffective/not effective at all.

Table 3. Respondents' beliefs about their influence on prescribing.

	Strongly agree % (*n*)	Agree % (*n*)	Neither agree/ disagree % (*n*)	Disagree% (*n*)	Strongly disagree % (*n*)
I believe my prescribing recommendations are implemented in my practice(s)	28 (43)	**53 (82)**	16 (25)	3 (4)	0
I am confident that I am able to influence prescribing in my practice(s)	30 (46)	**47 (72)**	19 (30)	3 (5)	<1 (1)
Influencing prescribing in my practice(s) is the main purpose of my role	15 (23)	**38 (59)**	23 (35)	22 (34)	2 (3)

Table 4. Respondents' experience of training and support.

	Strongly agree % (*n*)	Agree % (*n*)	Neither agree/ disagree % (*n*)	Disagree% (*n*)	Strongly disagree % (*n*)
I have received formal training (e.g., in-person/online course) about how to influence prescribing	14 (21)	19 (30)	15 (23)	**40 (62)**	12 (18)
I have received informal training (e.g., on-the-job, discussion with colleagues) about how to influence prescribing	16 (24)	**46 (71)**	17 (26)	17 (23)	7 (10)
I belong to a peer network or forum for support and knowledge-sharing	30 (46)	**45** (70)	10 (15)	9 (14)	5 (8)

20 respondents provided free-text comments about potential topics/formats for training, including influencing skills (*n* = 5), audit techniques (*n* = 3), group training/sharing best practice (*n* = 4).

Most respondents checked whether their prescribing recommendations had been implemented through discussion with colleagues (88%, *n* = 137) and using prescribing audits (55%, *n* = 86). Nine of 23 respondents who provided free-text additional information indicated that they checked individual patient records for this purpose; three others checked reports from external organizations.

Respondents in the A&F group, when compared with all other respondents, reported stronger belief that their prescribing recommendations were implemented (χ^2 = 29.52, df = 8, *P* < .001) and more confidence in their ability to influence their colleagues' prescribing (c^2 = 43.74, df = 8, *P* < .001). There was no significant difference in responses to the statement *Influencing prescribing in my practice(s) is the main purpose of my role*.

Training and peer support for influencing prescribing

Respondents were asked to describe their experience of training and networking (Table 4). While most respondents (61%, *n* = 95) agreed that they had received informal training for influencing prescribing, only one third agreed that they had undertaken formal training for this purpose (33%, *n* = 51). Most respondents (75%, *n* = 116) indicated a desire to undertake additional training on this topic; 75% (*n* = 116) reported a preference for formal training; a smaller proportion (68%, *n* = 106) would welcome additional informal training.

Most respondents (75%, *n* = 116) currently belonged to a peer network. Pharmacists who had received formal or informal training in influencing prescribing were more likely to express confidence in their ability to influence prescribing (χ^2 = 39.41, df = 16, *P* = .001 and χ^2 = 33.41, df = 16, *P* = .007, respectively).

Discussion
Principal findings
The survey was completed by 155 respondents who reported a wide range of responsibilities in general practice, including prescribing audit (78%) and A&F (21%). They typically valued and used local and national guidelines to influence prescribing. Receipt of formal and informal training and employment of specific auditing techniques (A&F) were all positively associated with respondents' confidence in their ability to influence and belief that their prescribing recommendations were implemented by their colleagues.

Strengths and limitations
The sample comprised a range of pharmacists, including those recently qualified as well as those with many years of experience and a variety of work patterns and employing organizations. Twitter© was used to promote and distribute the survey because of the lack of central register for general practice-based pharmacists. As such, it was not possible to calculate a true response rate, but it is estimated to be around 8% (i.e. 155 of 2000 pharmacists estimated to be working in general practices in the UK at the time of the survey) [3, 4]. This figure has since risen to 8576 pharmacy professionals currently working in general practice (the total includes 1859 pharmacy technicians) [5]. Females were over-represented (72%, *n* = 111); a greater proportion than reported by NHS Digital for pharmacists working in English general practices (61% females) [3] and survey respondents were based mainly in the South of England. The focus of this survey might have attracted pharmacists with a particular interest in influencing prescribing and those practising in general practices geographically close to University of Bath (or who trained at this institution).

The absence of an established register of practice-based pharmacists necessitated dissemination by an alternative

means. The selection of social media for distributing the survey has influenced its reach, and individuals who were not Twitter© users may have been unaware of the survey. In light of these limitations, caution is required when generalizing findings to the wider practice pharmacist population.

Pharmacists who participated in the survey were invited to evaluate methods for influencing prescribing; future research with other stakeholders, e.g. GPs and nurses, might provide alternative assessments of these methods. Furthermore, an examination of the ways in which pharmacists prioritize their general practice responsibilities would provide additional insights.

Comparison with existing literature

There is ongoing uncertainty about 'additional professional roles', including pharmacists, within general practices and PCNs [21]. Our study found that practice pharmacists' roles varied substantially and that they were employed in practices of different sizes and configurations, with PCN employees reporting greater engagement in prescribing audits. Participants had patient-facing roles and reported other activities in which their medicines' expertise was applied to optimize prescribing within their practice(s).

A&F interventions involving pharmacists have been found to be effective in general practice settings [22–24]. This current study investigated specific features of prescribing audits identified by previous research as contributing to greater A&F effectiveness. While most respondents reported that they conducted prescribing audits, a smaller proportion indicated responsibility for also reporting the results to their colleagues. The smaller proportion of respondents in the '*Standard Audit* group' who reported having responsibility for reporting results of audit (i.e. feeding back) suggests that other practice team members are involved in the feedback process, but the current study did not capture details relating to this.

Pharmacists mostly indicated that they report audit results only once, orally and to practice teams rather than individuals. Previous research has demonstrated that feedback given more than once, in more than one format, i.e. orally and written, and to individuals, is most effective in changing behaviour [8, 9, 25].

This study concurs with previous research, which has emphasized the use of guidelines and availability of evidence to inform and enhance pharmacists' general practice work and suggests some ways in which pharmacists use this evidence within their work [6]. Respondents rated NICE and local guidelines highly for their clinical relevance and identified training based on guidelines as an effective vehicle for sharing and transferring knowledge about evidence-based prescribing. Prescribing audit and feedback of results, interactive discussions, and presentations by specialists were also viewed as effective ways of influencing prescribing. Pharmacists were confident they impacted prescribing in general practice settings, but not all identified influencing as the main purpose of their role. Respondents' confidence in their ability to influence complements recent literature reporting positive GP attitudes towards pharmacists in extended practice-based roles [26]. Previous studies have highlighted the need for training and peer support to optimize pharmacists' potential in general practice [26–28]. This study explored access to training and support for a specific purpose, i.e. to improve influencing skills, and found that most respondents would welcome additional formal and informal training on this subject.

Implications for research and practice

Pharmacists' knowledge and skills as medicines' experts should form the foundation of their delivery of effective, credible interventions to influence prescribing in general practice. With an expanding range of healthcare professionals authorized to prescribe in general practice, maintaining and improving prescribing quality is more important than ever. Pharmacists and pharmacy technicians are increasingly working in key additional roles in general practice, and this means that they are ideally placed to support practices to achieve the medicines-related goals that are integral to general medical services and direct enhanced services contracts. Despite substantial evidence of the effectiveness of A&F as a method of changing prescribing behaviour, particularly when delivered by pharmacists, it is substantially under-used. Only a small group of pharmacists identified their audit responsibilities as 'A&F', and auditing techniques do not always include the features which have been found to optimize behaviour change through A&F. Small refinements to these activities could increase their effectiveness and impact. Under-use of A&F is likely to be due in part to a lack of awareness and formal training in this technique.

Conclusions

This study demonstrates substantial variation in practice pharmacists' roles and responsibilities in general and, more specifically, with regard to their influence on prescribing behaviour. Despite extensive evidence of the effectiveness of Audit and Feedback in promoting evidence-based prescribing, this method is currently under-used by practice pharmacists. Initiatives are needed to support practice pharmacists in adopting audit and feedback to influence prescribers in general practice [14].

Supplementary Material

Supplementary data are available at *International journal of Pharmacy Practice* online.

Acknowledgements

Author contributions

M.C., P.R., and M.W. contributed to the design of the study; M.C. collected and analysed all the data; M.C., S.C., P.R., and M.W. contributed to the interpretation of the data for this manuscript. M.C. drafted the manuscript and S.C., P.R., and M.W. critically revised it and gave approval for the final version. All authors agree to be accountable for all aspects of the work.

Conflict of interest statement: None declared.

Funding

Data availability

The data underlying this article will be shared on reasonable request to the corresponding author. M.C. has complete on-going access to the survey data.

References

1. National Health Service. NHS Long Term Plan 2019. https://www.longtermplan.nhs.uk/publication/nhs-long-term-plan/ (January 2023, date last accessed).
2. NHS England. Pharmacy Integration Fund 2016. https://www.england.nhs.uk/commissioning/primary-care/pharmacy/integration-fund/ (January 2023, date last accessed).
3. NHS Digital. General Practice Workforce 2020. https://digital.nhs.uk/data-and-information/publications/statistical/general-and-personal-medical-services (January 2023, date last accessed).
4. Stewart D, Maclure K, Newham R *et al.* A cross-sectional survey of the pharmacy workforce in general practice in Scotland . *Fam Pract* 2019 37:206–12.
5. Stretch G. Pharmacists are the success story of general practice, and they are here to stay. *Pharm J* 2023;**311**.
6. Carter M, Chapman S, Watson MC. Multiplicity and complexity: a qualitative exploration of influences on prescribing in UK general practice. *BMJ Open* 2021;**11**:e041460. https://doi.org/10.1136/bmjopen-2020-041460
7. World Health Organisation Europe. *Using Audit and Feedback to Health Professionals to Improve the Quality and Safety of Health Care*. Denmark: Copenhagen, 2010.
8. Ivers N, Jamtvedt G, Flottorp S *et al.* Audit and feedback: effects on professional practice and healthcare outcomes. *Cochrane Database Syst Rev* 2012;CD000259. https://doi.org/10.1002/14651858.CD000259.pub3
9. Brehaut JC, Colquhoun HL, Eva KW *et al.* Practice Feedback Interventions: 15 suggestions for optimizing effectiveness. *Ann Intern Med* 2016;**164**:435–41. https://doi.org/10.7326/m15-2248
10. Colquhoun H, Michie S, Sales A *et al.* Reporting and design elements of audit and feedback interventions: a secondary review. *BMJ Qual Safety* 2017;**26**:54–60. https://doi.org/10.1136/bmjqs-2015-005004
11. Carter M, Abutheraa N, Ivers N *et al.* Audit and feedback interventions involving pharmacists to influence prescribing behaviour in general practice: a systematic review and meta-analysis. *Fam Pract* 2023;**XX**:1–14. https://doi.org/10.1093/fampra/cmac150
12. Information Commissioners Office. Guide to the UK General Data Protection Regulation (UK GDPR) 2018. https://ico.org.uk/for-organisations/guide-to-data-protection/guide-to-the-general-data-protection-regulation-gdpr/ (January 2023, date last accessed).
13. International Organisation for Standardization (ISO). ISO/IEC 27001 Information Security Management 2022. https://www.iso.org/standard/27001 (January 2023, date last accessed).
14. McLeod SA. What is validity? 2013. https://www.simplypsychology.org/validity.html (January 2023, date last accessed).
15. Bender R, Lange S. Adjusting for multiple testing--when and how? *J Clin Epidemiol* 2001;**54**:343–9. https://doi.org/10.1016/s0895-4356(00)00314-0
16. von Elm E, Altman DG, Egger M *et al*; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies. *Int J Surg* 2014;**12**:1495–9. https://doi.org/10.1016/j.ijsu.2014.07.013
17. Office for National Statistics. UK Geographies 2021. https://www.ons.gov.uk/methodology/geography/ukgeographies (January 2023, date last accessed).
18. British National Formulary. BNF Publications 2022. https://www.bnf.org/ (January 2023, date last accessed).
19. GP Update Limited. Red Whale Lifelong Learning for Primary Care: University of Reading. https://www.gp-update.co.uk/ (January 2023, date last accessed).
20. Wrexham Maelor Hospital Pharmacy Department. The NEWT Guidelines for administration of medication to patients with enteral feeding tubes or swallowing difficulties: Betsi Cadwaladr University Local Health Board (East); 2021. https://www.newtguidelines.com/ (January 2023, date last accessed).
21. The Kings Fund. *Integrating Additional Roles into Primary Care Networks*. London: The Kings Fund, 2022.
22. Avery AJ, Rodgers S, Cantrill JA *et al*. A pharmacist-led information technology intervention for medication errors (PINCER): a multicentre, cluster randomised, controlled trial and cost-effectiveness analysis. *Lancet* 2012;**379**:1310–9. https://doi.org/10.1016/s0140-6736(11)61817-5
23. Clyne B, Smith SM, Hughes CM *et al*; OPTI-SCRIPT study team. Effectiveness of a multifaceted intervention for potentially inappropriate prescribing in older patients in primary care: a cluster-randomized controlled trial (OPTI-SCRIPT Study). *Ann Fam Med* 2015;**13**:545–53. https://doi.org/10.1370/afm.1838
24. Lim WY, Singh A, Ng LM *et al*. The impact of a prescription review and prescriber feedback system on prescribing practices in primary care clinics: a cluster randomised trial. *BMC Fam Pract* 2018;**19**:120. https://doi.org/10.1186/s12875-018-0808-4
25. Colquhoun H, Carroll K, Eva KW *et al*. Advancing the literature on designing audit and feedback interventions: identifying theory-informed hypotheses. *Implement Sci* 2017;**12**:117. https://doi.org/10.1186/s13012-017-0646-0
26. Hasan Ibrahim AS, Barry HE, Hughes CM. General practitioners' experiences with, views of, and attitudes towards, general practice-based pharmacists: a cross-sectional survey. *BMC Prim Care* 2022;**23**:6. https://doi.org/10.1186/s12875-021-01607-5
27. Butterworth J, Sansom A, Sims L *et al*. Pharmacists' perceptions of their emerging general practice roles in UK primary care: a qualitative interview study. *Br J Gen Pract* 2017;**67**:e650–8. https://doi.org/10.3399/bjgp17X691733
28. Guenette L, Maheu A, Vanier MC *et al*. Pharmacists practising in family medicine groups: what are their activities and needs? *J Clin Pharm Ther* 2020;**45**:105–14. https://doi.org/10.1111/jcpt.13035