

# Adoption of clinical pharmacist roles in primary care:

## longitudinal evidence from English general practice

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### Abstract

#### Background

Over the past decade, the number of clinical pharmacists working within multidisciplinary teams in English general practices has expanded.

#### Aim

To examine changes in quality of prescribing after the adoption of clinical pharmacist roles in English general practices.

#### Design and setting

Longitudinal cohort study in English general practice.

#### Method

Two-way fixed-effects regression was used to compare differences in prescribing indicators in general practices with and without pharmacists between September 2015 and December 2019.

#### Results

Between September 2015 and December 2019, the proportion of practices employing a clinical pharmacist increased from 236/7623 (3.1%) to 1402/6836 (20.5%). Clinical pharmacist implementation resulted in statistically significant reductions in total costs of medicines per 1000 patients (−0.85%, 95% confidence interval [CI] = −1.50% to −0.21%), the total number of opioid prescriptions per 1000 patients (−1.06%, 95% CI = −1.82% to −0.29%), and the average daily quantity of anxiolytics per 1000 patients (−1.26%, 95% CI = −2.40% to −0.12%). Clinical pharmacist implementation also resulted in reductions in the total number of prescriptions per 1000 patients (−0.58%, 95% CI = −1.30% to 0.13%)

and the total number of antibiotic prescriptions per 1000 patients (−0.51%, 95% CI = −1.30% to 0.27%) that trended towards statistical significance. There were no statistically significant differences in the share of broad-spectrum versus narrow-spectrum antibiotics (0.02%, 95% CI = −0.07% to 0.11%) and the oral morphine equivalence of high-dose opioids (>120 mg per 24 h) per 1000 patients (1.19%, 95% CI = −0.46% to 2.85%).

#### Conclusion

This analysis is limited by practice-level data but supports the hypothesis that clinical pharmacist implementation results in improvements in prescribing quality.

#### Keywords

clinical pharmacy; drug prescription; healthcare quality; pharmacist; prescribing; primary care.

### Introduction

Over the past decade there have been several policy initiatives that have expanded the clinical pharmacist workforce in English general practice. The *General Practice Forward View*, published in 2016, committed to employing 1500 clinical pharmacists to work in general practice over 5 years.<sup>1</sup> The subsequent Additional Roles Reimbursement Scheme, launched in 2019, further expanded the clinical pharmacy workforce with the aim of recruiting six clinical pharmacists for each primary care network (PCN) by 2024.<sup>2,3</sup> As of September 2023, there are over 6500 clinical pharmacists working in general practice in England either

employed by a PCN or directly by a general practice.<sup>4</sup>

The ambition by NHS England has been to expand the number of pharmacists working in general practice with responsibility for optimising medicines management, conducting medication reviews, and independent prescribing and deprescribing.<sup>5,6</sup> When the authors refer to clinical pharmacists in this article, they are referring specifically to pharmacists working within multidisciplinary teams in general practice and consulting directly with patients.<sup>7</sup> This differs from the role of community pharmacists within pharmacies as dispensers and retailers of medicines, alongside providing other NHS services.<sup>8</sup>

International evidence on the impact of pharmacists working within primary care teams on prescribing outcomes is mixed, with some evidence of significant reductions in the number of prescriptions and medication costs per patient.<sup>9,10</sup> Focusing on England, a pilot evaluation of clinical pharmacists working within general practices found evidence that clinical pharmacists could improve access to appointments for people with long-term conditions, facilitate deprescribing, and reduce medication errors.<sup>7,11</sup> Further analysis of practice-level data has found significant associations between the number of allied health professionals (including clinical pharmacists) working in general practice and fewer prescriptions of

## How this fits in

There has been rapid expansion of clinical pharmacists working within multidisciplinary teams in general practice in England over the past decade that has not been subject to robust evaluation. This study examined the impact of the first wave of clinical pharmacist expansion in general practice, between September 2015 and December 2019, when clinical pharmacists were directly employed by practices. The study found that clinical pharmacist implementation was associated with reduced prescribing costs per patient and reductions in the total number of items, opioids, antibiotics, and anxiolytics prescribed per patient. Future research is needed to evaluate the second wave of clinical pharmacist implementation in general practice, when they are employed by primary care networks.

broad-spectrum antibiotics and costs per item prescribed.<sup>12</sup> However, the analysis did not examine the impact of the number of clinical pharmacists independently. Additional analysis of a broader set of prescribing indicators would contribute to a more comprehensive understanding of the influence of clinical pharmacist implementation in English general practice on quality of prescribing. This study addresses this gap in the literature by examining changes in quality of prescribing following adoption of clinical pharmacist roles in English general practice.

## Method

### Study cohort

The analysis in this study focused on all general practices in England between September 2015 and December 2019. During this period, clinical pharmacists were directly employed by practices and therefore it is possible to attribute their presence within specific practices. Mixed employment of clinical pharmacists, either directly by general practices or by PCNs, begins beyond this period. This time period was also chosen as it avoids any influence on prescribing created by the COVID-19 pandemic.

Information on the primary care workforce involved in direct care was obtained from NHS England,<sup>4</sup> and practice-level information on population characteristics such as age, gender, and deprivation from the Office for Health Improvement and Disparities.<sup>13</sup> The study focused exclusively on the number of

clinical pharmacists working in general practice in the primary analysis, and did not include pharmacy technicians or advanced pharmacy practitioners as these roles have different responsibilities to clinical pharmacists.<sup>5</sup> However, these roles were included in a supplementary analysis to ascertain if this changed the results.

Pharmacy technicians undertake some tasks understood as not requiring professional or clinical judgement such as patient counselling regarding safe use of medicines, medicines reconciliation, and taking drug histories under the supervision of a clinical pharmacist.<sup>14</sup> Advanced pharmacy practitioners are autonomous clinicians that are typically independent prescribers and typically see patients with minor ailments and conduct complex medicines reviews.<sup>15</sup>

### Study outcomes

In total, data were extracted on seven different prescribing indicators. Data were retrieved on a quarterly basis from the NHS Business Service Authority (BSA) English Prescribing Dataset for the following indicators:

- total number of prescriptions per 1000 patients;
- total costs of medicines per 1000 patients;
- total number of antibiotic prescriptions per 1000 patients;
- share of broad-spectrum versus narrow-spectrum antibiotics;
- total number of opioid prescriptions per 1000 patients;
- oral morphine equivalence of high-dose opioids (>120 mg per 24 h) per 1000 patients; and
- average daily quantities (ADQs) of anxiolytics per 1000 patients.

Relevant British National Formulary (BNF) codes were identified for these indicators from the Open Prescribing website (<https://openprescribing.net>). The relevant BNF codes used to extract each indicator are also contained in Supplementary Table S1. ADQ is a unit of measure that refers to actual prescribed daily doses for a medicine, which differs from defined daily doses, which is a unit of measure that represents the assumed average maintenance dose per day, of a medicine, when used for its main indication in adults.<sup>16</sup>

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There is no consensus regarding which prescribing indicators should be used to measure quality of prescribing in primary care settings.<sup>17</sup> In the current study the selection of prescribing indicators was based on indicators that have been used in previous studies to estimate the quality of prescribing in primary care.<sup>12,18–20</sup> High levels of opioid, anxiolytic, antibiotic, and broad-spectrum antibiotic prescribing are commonly used examples of low-value care.<sup>21</sup> The total number of prescriptions per patient is often used as an indicator to measure the extent of polypharmacy present in practice populations,<sup>10</sup> and the total cost of medicines can reflect the efforts of pharmacists during medication reviews to either stop medicines, undertake generic substitution, or substitution to cheaper medicines with the same clinical indications.<sup>22</sup> It is also known that there is variation in these prescribing indicators among the English population according to different population characteristics such as deprivation, age, and gender.<sup>12,19,20,23</sup>

### Statistical analysis

The goal was to estimate changes in average differences in prescribing outcomes that materialise in general practices that hire a clinical pharmacist, compared with the general practices that did not. A two-way fixed-effects (TWFE) regression approach was used to compare differences in prescribing indicators in practices

with and without pharmacists following implementation. TWFE regression is a commonly used method for estimating treatment effects with variability in treatment timing using observational (panel) data (in this case the addition of clinical pharmacist roles to the general practice team).<sup>24</sup> TWFE can account for differences between practices in each time period, and time-invariant confounding between practices using fixed effects.

The study's treatment was defined as having at least one headcount clinical pharmacist active within a general practice, irrespective of how many hours they work within the practice. A range of controls were included within the regression model to adjust for differences in patient population (age-gender structure, quintile of patient-weighted Index of Multiple Deprivation [income component], and practice population size), workforce composition (GP full-time equivalents [FTEs] per 1000 patients, nurse FTEs per 1000 patients, and FTEs of direct patient care staff excluding pharmacists per 1000 patients), and practice characteristics (dispensing practices and contracting model). FTE measures how many total full-time employees or part-time employees add up to full-time employees for each staff group. In this study the workforce controls were lagged by one-quarter as their levels are likely to inform employment decisions in the following quarter. All analyses were conducted using Stata (version 18).

As a robustness check, in the current study the authors also examined whether the findings changed when classifying practices according to number of clinical pharmacists per practice. This was achieved by splitting the sample of (treated) general practices into tertiles based on the number of FTE pharmacists per 1000 patients for each practice.

## Results

### Descriptive statistics

Between September 2015 and December 2019, the proportion of practices employing a clinical pharmacist increased from 236/7623 (3.1%) to 1402/6836 (20.5%) (Figure 1). The reduction in the number of GP practices has been noted in previous analyses.<sup>25</sup>

Variation in the number of pharmacists per 1000 patients was also seen (see Supplementary Figure S1). When splitting GP practices into tertiles based on number of pharmacists per 1000 patients, the first tertile has between 0.000 and 0.047 pharmacists per 1000 patients, the second tertile has between 0.047 and 0.077 pharmacists per 1000 patients, and the third tertile has between 0.077 and 0.156 pharmacists per 1000 patients.

There were only small differences in the average share of female patients, level of deprivation, and age breakdown of patient populations in GP practices that adopted a pharmacist and those that did not (Table 1). There were also only small differences in the average

contract status of GP practices (general medical services versus alternative provider medical services versus personal medical services contracts) between those with and without clinical pharmacists. Practices that adopted clinical pharmacists were, on average, larger than those that did not during this study's period of analysis as they had higher numbers of registered patients (10 585 versus 7308 patients). There were also notable differences in the average number of other staff FTE per 1000 patients. Practices that implemented a clinical pharmacist during the study period also had higher average numbers of GP FTEs per 1000 patients (5.73 versus 4.00), nurse FTEs per 1000 patients (2.95 versus 1.84), and other staff involved in direct patient care per 1000 patients (1.77 versus 1.10).

When focusing on unadjusted baseline differences in prescribing indicators between practices that adopted a pharmacist versus those that did not, it can be seen that adopting practices had, on average, reduced oral morphine equivalence of high-dose opioids per 1000 patients (145 mg versus 135 mg), ADQs of anxiolytics per 1000 patients (338 versus 317), and share of broad-spectrum versus narrow-spectrum antibiotics (8.29% versus 7.90%). Although these differences were not statistically significant, adopting practices also had, on average, reduced numbers of total prescriptions per 1000 patients (1633 versus 1616 items), antibiotic prescriptions per 1000 patients (55 versus 54 items), and total costs of medicines per 1000 patients (£12 311 versus £12 266) (Table 1).

### Main analysis

Clinical pharmacist implementation resulted in statistically significant reductions in total costs of medicines per 1000 patients (-0.85%, 95% confidence interval [CI] = -1.50% to -0.21%), the total number of opioid prescriptions per 1000 patients (-1.06%, 95% CI = -1.82% to -0.29%), and the ADQs of anxiolytics per 1000 patients (-1.26%, 95% CI = -2.40% to -0.12%). Clinical pharmacist implementation also resulted in reductions in the total number of prescriptions per 1000 patients (-0.58%, 95% CI = -1.30% to 0.13%), and the total number of antibiotic prescriptions per

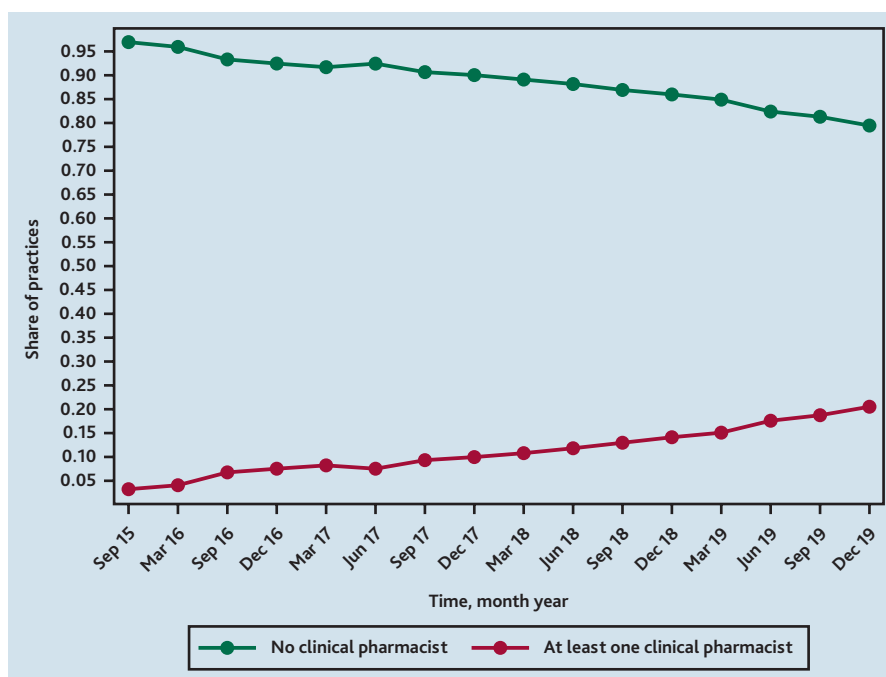


Figure 1. Share of control and treatment practices over time.

**Table 1. Baseline descriptives for always controls and treated practices with at least one clinical pharmacist<sup>a</sup>**

Characteristic	Control		Treated		Difference	
	Mean	SD	Mean	SD	Difference	P-value
<b>Practice characteristics</b>						
Share of patients by age group, %						
0–4	5.81	1.53	5.91	1.56	–0.10	0.0203
5–14	11.54	2.37	11.61	2.35	–0.07	0.3292
15–44	38.87	8.31	39.22	8.75	–0.36	0.1487
45–64	26.13	4.03	25.66	4.09	0.47	0.0001
65–74	9.73	3.48	9.67	3.55	0.06	0.5661
75–84	5.62	2.14	5.59	2.15	0.03	0.6493
≥85	2.30	1.08	2.33	1.07	–0.03	0.4105
Share of female patients, %	50.05	2.04	50.30	1.63	–0.25	<0.0001
Total patient population	7308	3896	10 585	5476	–3277	<0.0001
GP FTE in previous month	4.00	2.54	5.73	3.50	–1.73	<0.0001
Nurse FTE in previous month	1.84	1.37	2.95	2.24	–1.11	<0.0001
Other DPC FTE in previous month	1.10	1.45	1.77	2.00	–0.67	<0.0001
IMD, income, % of practices						
Quintile 1	21.27		19.85		1.42	0.1178
Quintile 2	20.57		21.22		–0.65	0.5395
Quintile 3	19.46		20.97		–1.51	0.3006
Quintile 4	19.02		21.16		–2.14	0.0221
Quintile 5	19.69		16.80		2.88	0.0183
GP contract, % of practices						
APMS	2.52		2.24		0.28	0.5987
GMS	66.90		68.33		–1.42	0.4230
PMS	24.81		27.81		–3.00	0.0297
Unknown	5.76		1.62		4.14	<0.0001
<b>Raw prescribing indicators</b>						
Total costs of medicines per 1000 patients, £	12 311	3276	12 266	3084	45	0.6371
Total number of prescriptions per 1000 patients, items	1633	537	1616	499	17	0.2851
Total number of antibiotic prescriptions per 1000 patients, items	55	23	54	15	1	0.0964
Share of broad-spectrum versus narrow-spectrum antibiotics, %	8.29	3.71	7.90	3.02	0.39	0.0002
Total number of opioid prescriptions per 1000 patients, items	64	31	64	28	0	0.7178
Oral morphine equivalence of high-dose opioids per 1000 patients, mg	145	103	135	83	10	0.0008
Average daily quantity of anxiolytics per 1000 patients	338	213	317	176	20	0.0008
	<i>n</i>		<i>n</i>		<i>N</i>	
<b>Observations</b>	4733		1532		6265	
<i>Control practices never adopt a clinical pharmacist. Treated practices adopt a clinical pharmacist during our period of analysis. <sup>a</sup>T-tests were used to ascertain if the difference between treatment and controlled groups was statistically significant. APMS = alternative provider medical services. DPC = direct patient care staff excluding pharmacy-related roles. FTE = full-time equivalent. GMS = general medical services. IMD = Index of Multiple Deprivation. PMS = personal medical services.</i>						

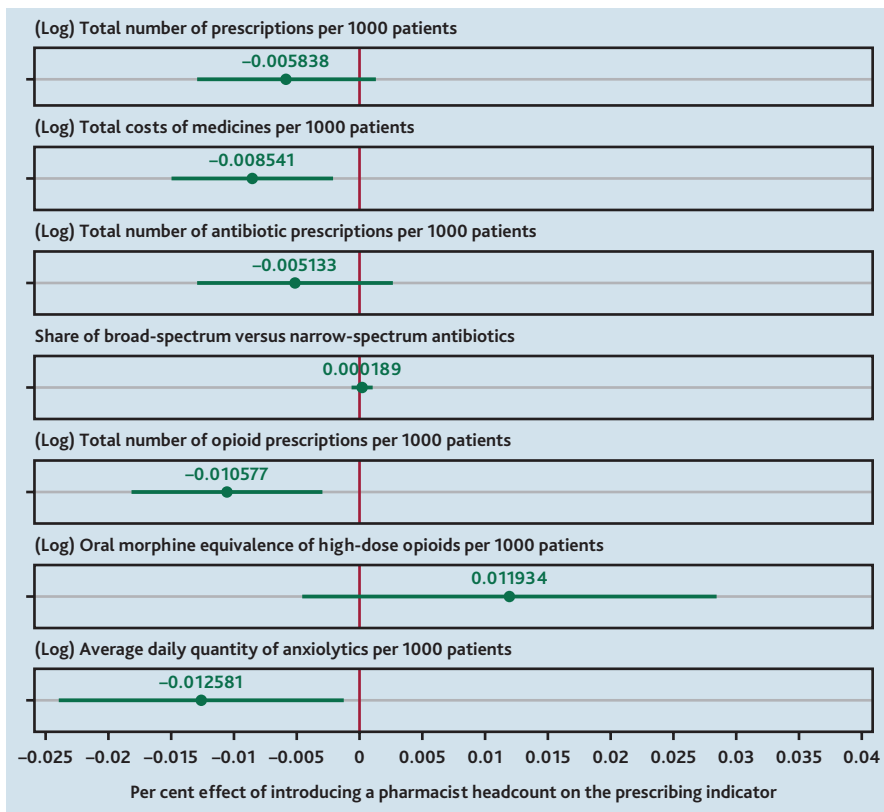
1000 patients (–0.51%, 95% CI = –1.30% to 0.27%) that trended towards statistical significance. There were no statistically significant differences in the share of broad-spectrum versus narrow-spectrum antibiotics (0.02%, 95% CI = –0.07% to 0.11%) and the oral morphine equivalence of high-dose opioids (>120 mg per 24 h) per 1000 patients (1.19%, 95% CI = –0.46%

to 2.85%). Full regression results, including coefficients for covariates, are included in Supplementary Table S2.

#### Supplementary analyses

The results for the supplementary analyses that focused on higher and lower numbers of pharmacists per 1000 patients are reported in Supplementary Tables S3–S5. These

demonstrated that the findings are primarily driven by the GP practices within the tertile with the highest number of pharmacists per 1000 patients (see Supplementary Figure S2). In these GP practices, there are larger statistically significant reductions than in the primary analysis for total number of prescriptions per 1000 patients (–2.02%, 95% CI = –3.90% to –0.14%), total costs



**Figure 2.** Effect of introducing a pharmacist headcount on practice prescribing. All models were estimated using two-way (time and unit) fixed effects, using practices with a zero headcount of pharmacists as control units. Standard errors were clustered at the level of GP practices. Dots represent point estimates, and lines around them represent the 95% confidence intervals. All models included the following control variables: share of patients in 5-year age-gender bands (0–4-year-old males is the omitted reference group); total number of patients registered with the GP practice; GP FTE in previous month; nurse FTE in previous month; FTE of other direct patient care staff (excluding pharmacy-related roles) in previous month; type of GP practice contract; quintile of IMD (income component) weighted by practice patient population. Full regression results are included in Supplementary Table S2. FTE = full-time equivalent. IMD = Index of Multiple Deprivation.

of medicines per 1000 patients (–2.88%, 95% CI = –4.54% to –1.21%), total number of antibiotic prescriptions per 1000 patients (–2.71%, 95% CI = –4.61% to 0.82%), total number of opioid prescriptions per 1000 patients (–3.40%, 95% CI = –5.41% to –1.38%), and the ADQs of anxiolytics per 1000 patients (–4.25%, 95% CI = –6.72% to –1.77%) (see Supplementary Table S5).

The further supplementary analysis that included pharmacy technicians and advanced pharmacy practitioners within the study’s definition of pharmacy staff did not change the overall findings and which prescribing indicators were statistically significant (see Supplementary Table S6).

## Discussion

### Summary

This research demonstrates changes in a broad range of prescribing indicators following the introduction of a clinical pharmacist in general practice. Significant results include reduced prescribing costs and reductions in total number of items, opioids, antibiotics, and anxiolytics prescribed. This supports the hypothesis that clinical pharmacist implementation results in some improvements in quality of prescribing and patient safety in primary care settings. There were no

statistically significant differences in the share of broad-spectrum versus narrow-spectrum antibiotics, and the oral morphine equivalence of high-dose opioids between practices that implemented clinical pharmacists versus those that did not.

### Strengths and limitations

A major strength of the current analysis was a methodological approach that attempted to remove confounding by exploiting variation in the timing of implementation of clinical pharmacists across GP practices. Despite this, there are some limitations of this analysis that need to be acknowledged when interpreting the findings.

First, this analysis was focused on aggregate prescribing indicators at the practice level. This can overlook the impact of clinical pharmacists on individual patients, which is important as there is evidence of a positive impact of medication reviews by clinical pharmacists on quality of prescribing for individual patients.<sup>26,27</sup>

Second, the current analysis did not examine how the roles and responsibilities of individual clinical pharmacists varied within and between practices and the associated impact on quality of prescribing. Unfortunately, this was not possible as no national

data collections exist describing this information.

Third, although the study adjusted for different population and workforce factors between treatment and control practices to the extent this was possible, it was not possible to account for unobservable differences in medical complexity of patients registered between treatment and control practices that are not captured by age and gender.

Fourth, the current analysis does not account for other policy developments at the national or local level, such as quality improvement and incentive programmes targeted towards improved prescribing.<sup>28</sup> It is possible that practices that prioritised implementation of these schemes may also be more likely to employ pharmacists and therefore this could have influenced the results. In light of these points, the authors refrain from attaching a clear causal interpretation to the current results.

Fifth, it was not possible to account for the activity of pharmacists employed by local commissioning bodies (that is, clinical commissioning groups), who can provide prescribing advice and medicines management services to practices. This is because there is no way of attributing their activity within individual practices.

Finally, it can be argued that further insights could be gained by examining a broader range of prescribing indicators. For example, there are a range of further prescribing indicators used by Open Prescribing (<https://openprescribing.net>), NHS BSA,<sup>29</sup> and within the NHS England Quality Premium.<sup>28</sup> However, as mentioned in the current study, there is no consensus on what prescribing indicators should be used to assess quality of prescribing at the GP practice

level.<sup>17</sup> Although the authors of the current study relied on prescribing indicators that have been commonly used in the existing academic literature, it is acknowledged future research is needed to examine more recently developed indicators.

### Comparison with existing literature

Hayhoe *et al* focused on the impact of integrating pharmacists into primary care teams on health system indicators.<sup>9</sup> The two most examined prescribing indicators were the total number of medications and medication costs per patient. Eleven studies focused on the impact of clinical pharmacist implementation on the total number of medications,<sup>26,30–39</sup> with four studies showing small statistically

significant reductions,<sup>26,31,32,37</sup> two studies showing increases,<sup>35,36</sup> and five studies showing no statistically significant effect.<sup>30,33,34,38,39</sup> Twelve studies examined medication costs,<sup>31,33–35,37,39–45</sup> with only three studies showing a statistically significant reduction in medication costs associated with pharmacist implementation.<sup>31,37,45</sup> However, only three of these studies are from the UK (two of which showed reductions in medication costs),<sup>35,43,44</sup> with the majority of studies from the US, which may be less applicable to the UK context.

Croke *et al* undertook a systematic review and meta-analysis that examined the impact of integrating clinical pharmacists within general practice on the number of medications prescribed and potentially inappropriate prescribing (PIP) for patients with polypharmacy.<sup>10</sup> Nine studies focused on the number of medications prescribed per patient,<sup>31,37,46–52</sup> with reductions in medications seen in eight studies. Eleven studies focused on PIP,<sup>37,46,47,49,50,53–58</sup> with 10 studies demonstrating reductions in PIP in comparison with usual care. Although this review provides useful insights into the impact of clinical pharmacist implementation in primary care on quality of prescribing,<sup>10</sup> in the current study the authors were unable to analyse these metrics for patients with polypharmacy as aggregate population-level data were analysed across GP practices rather than patient-level data.

### Implications for research and practice

The current research provides evidence that supports the ongoing policy in England of expanding clinical pharmacists working within multidisciplinary teams in general practice. However, further research is needed to establish the exact mechanisms by which clinical pharmacists influence quality of prescribing for different indicators. For example, it is notable that clinical pharmacist implementation was associated with reductions in total antibiotic prescribing as clinical pharmacists typically do not manage acute illnesses that require antibiotics. It is possible that the presence of clinical pharmacists within general practice may influence antibiotic prescribing through other mechanisms such as antimicrobial stewardship interventions, education of GPs, or medication reviews of antibiotics on repeat prescription.<sup>59</sup>

There are also several other potential implications of clinical pharmacist implementation in primary care that should be the focus of future research. At the individual patient level, there has already been significant work establishing the positive impact of pharmacist-led interventions in primary care to reduce medical errors in primary care,<sup>60–62</sup> and community pharmacists to improve medical adherence.<sup>63,64</sup> However, more work could be undertaken to establish the specific implications of expanding the number of clinical pharmacists working in multidisciplinary teams in English general practices on medication adherence, patient satisfaction, and polypharmacy.

At the practice level, further research is also needed into the broader implications of pharmacist implementation on demand for primary care services, including utilisation of appointments for different primary care staff types. At the health system level, more could be done to understand how the implementation of clinical pharmacy roles in primary care has an impact on other services such as emergency department attendance or admissions to hospital. Bringing evidence together from the practice and health system-level perspectives would help facilitate cost-effectiveness studies to establish to what extent investment in clinical pharmacists in primary care is warranted versus other staff or interventions.

Finally, further research is needed to establish to what extent changes in clinical pharmacist employment processes, which have moved away from direct employment from general practice to employment within PCNs in recent years, has maintained these improvements in prescribing.

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#### Ethical approval

No ethical approval was required for this study.

#### Data

General practice workforce data were retrieved from NHS England Primary Care Workforce Quarterly Update. Accessible here: <https://digital.nhs.uk/data-and-information/publications/statistical/primary-care-workforce-quarterly-update/30-september-2023>. Practice characteristics were retrieved from the Office for Health Improvement and Disparities national general practice profiles. Accessible here: <https://fingertips.phe.org.uk/profile/general-practice>. Prescribing data were retrieved from the NHS Business Services Authority prescribing dataset. Accessible here: <https://www.nhsbsa.nhs.uk/prescription-data/prescribing-data/english-prescribing-data-epd>.

#### Provenance

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#### Competing interests

The authors have declared no competing interests.

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