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Predictors of confidence in research: a cross-sectional survey of pharmacists in the north of England

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Abstract

Objective: Pharmacist-led research is key to optimizing medicines use and improving pharmacy services, yet it is not yet widely embedded into careers. This study aims to identify predictors of confidence in meeting the research learning outcomes in the Royal Pharmaceutical Society (RPS) Post-Registration Foundation and Core Advanced curricula, to provide targeted recommendations for building research capability and capacity within the profession.

Methods: The study was a cross-sectional electronic survey, distributed to eligible pharmacists in March 2023 (n = 253). The survey gathered demographic information, research experience, and self-reported confidence in meeting the research learning outcomes in the RPS Post-Registration Foundation and Core Advanced curricula. Pre-determined independent variables were analysed using two binomial logistic regression models (one per curriculum) to identify predictors of the dichotomous variable: confidence with meeting all research learning outcomes in that curriculum.

Key findings: Participants were more likely to self-report as confident (versus not confident) with meeting all research learning outcomes in a curriculum if they had recent experience (within the previous 12 months) of research or research-related activities, held a postgraduate research qualification, had undertaken research training outside of a postgraduate qualification, discussed research in their appraisal, or worked in the hospital sector. Conversely, male gender, years practicing, and protected time for research did not predict confidence.

Conclusion: A targeted approach, including improving access to research methods training, experience-based learning, mentorship, and linking research projects to key organizational objectives, could be the key to developing research capability and capacity across all sectors and career stages.

Keywords: pharmacists; research; advanced practice; workforce development; competence; cross-sectional survey

Introduction

The World Health Organization recognizes research as key to understanding health problems and developing, implementing, and evaluating solutions to address them [1]. Research correlates with better patient experience and provides the evidence base for practice [2, 3]; thus directives establish it as a core duty for all healthcare professionals [4, 5]. In addition to patient benefits, research engagement may reduce burnout [6] and improve workforce recruitment, wellbeing, and retention [7].

The International Pharmaceutical Federation (FIP) emphasizes the importance of research in improving the pharmacy profession's contribution to health, by calling for evidence of the impact of the pharmacy workforce and services on patient outcomes [8]. The inclusion of research competencies in pharmacy educational frameworks in the UK and beyond [9–12] sets a professional expectation for research at all career stages. Pharmacists in the UK can now undertake credentialing processes offered by the Royal Pharmaceutical Society (RPS) at three levels. The Post Registration Foundation Curriculum (PRFC) [10], Core Advanced Curriculum (CAC) [11], and Consultant Pharmacist Curriculum (CPC) [12] require pharmacists to demonstrate competence across four pillars: clinical practice, leadership and management, education, and research. Although pharmacists are uniquely poised to lead medicines optimization research, they are frequently underrepresented in National Institute for Health and Care Research (NIHR) programmes [13] and find it more difficult to demonstrate competence in research than any other pillar of practice [14, 15]. The 'Collaborative Care Model', based upon the RPS curricula, challenges the traditional siloing of pharmacists' professional duties, advocating that roles combining research and clinical practice produce pharmacists more capable of understanding and responding to the needs

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of patients, services and the workforce, and more empowered to implement and evaluate solutions [16]. Given the importance of research to patients, healthcare professionals, and systems, increasing the capability and capacity of the pharmacist workforce is imperative.

Previous literature has identified barriers and enablers to pharmacists conducting research; however, these studies use definitions of research that are narrower in scope than those described in the RPS curricula [17–20]. Hence, this study is the first to identify and examine predictors of self-reported research confidence as defined by a professional framework to include audit, quality improvement (QI), and service evaluation (SE). This study aimed to understand self-reported research confidence across all sectors of pharmacy practice and stages of career development. The objectives were to (i) describe pharmacists' research experience and activity, (ii) describe self-reported confidence with each research learning outcome from the PRFC and CAC, and (iii) use two logistic regression models (LgRs) to analyse predictors of confidence with (a) the research learning outcome in the PRFC (LgR1) and (b) all four research learning outcomes in the CAC (LgR2). The rationale was to gather baseline data across the north of England to inform regional discussions on optimizing the use of resources to provide pharmacists with skills and opportunities to incorporate research into routine practice. The results of this study could inform strategy to support upskilling of the current and future pharmacist workforce to meet the professional expectations of research described in the RPS curricula.

Methods

Sample

The study was conducted in the north of England, comprising three Integrated Care System (ICS) areas in the North West and four in the North East and Yorkshire. Inclusion criteria were pharmacists registered with the General Pharmaceutical Council, currently practicing in any sector in a north of England ICS, at any stage of career development. Although an *a priori* sample size was not defined, for the binomial logistic regression analysis the number of events per variable (EPV) was 13.25 and 6.5 for LgR1 and LgR2, respectively. This was based on simulation studies showing that bias, error, and confidence interval coverage in models with 5–9 EPV are comparable to those with 10–16 [21].

Measures

The survey (Supplementary File 1) was developed by the lead author (FW) using Online Surveys (Jisc, Bristol, UK) and refined in consultation with co-authors (M.K., H.J., J.B., and P.F.). All questions were mandatory to eliminate missing data. Only the correct number of responses to multiple-choice questions could be submitted. Upper and lower limits were used for numerical data fields to reduce typographical errors.

Part 1 collected data relating to predictor variables. To satisfy EPV requirements in the context of sample size constraints, 8 independent variables were selected based on the literature [17–20, 22] and the authors' experiences of practice. Any postgraduate research qualification ('0 = no', '1 = yes'); any other research training (defined as research training outside of a postgraduate qualification; '0 = no', '1 = yes'); recent (within the previous 12 months) experience of research (including audit, QI, and SE; '0 = no', '1 = yes'); 10% of job plan protected for research ('0 = no', '1 = yes'); and routine discussion of research during annual appraisal ('0 = no', '1 = yes') were selected due to previous reporting of knowledge, training, experience, time and support as key enablers to pharmacist research [17–20]. Audit, QI, and SE were included in addition to traditional definitions of research, consistent with the RPS curricula. There is a paucity of evidence regarding the proportion of pharmacists' time that should be protected for research; therefore, 10%, equating to one half-day for staff working 1.0 whole time equivalent (WTE), was agreed by the authors as the minimum required for meaningful engagement in research. Gender was included as female pharmacists are underrepresented in research publications [22] ('0 = female', '1 = male'). The authors agreed that research opportunities may be greater in secondary care, where multidisciplinary working facilitates interprofessional collaboration [23] with colleagues who are more experienced in designing and delivering research [13]. As data points were too low to compare all sectors, a dichotomous predictor was created for secondary care ('0 = no', '1 = yes'). Finally, the continuous variable years practicing was collected based on the authors' observations in practice that research experience tends to be developed later in the pharmacist career trajectory. Given its potential as a predictor of research confidence, participants were asked to report their ethnicity; however, data were spread thinly across many categories, precluding its use in an LgR.

Part 2 collected data relating to the two dichotomous variables. Firstly, the research learning outcomes from each curriculum were displayed, alongside corresponding descriptions of the standards required to meet them. Participants were asked to indicate, for each outcome, their confidence that they could demonstrate practice at that level, using a five-point Likert scale: really unconfident, unconfident, neutral, confident, and really confident. This measure has previously been used to assess pharmacists' confidence in meeting learning outcomes in the CPC [16].

To dichotomize confidence, Likert responses 'really unconfident', 'unconfident', and 'neutral' were coded as '0 = no'(i.e. not confident) and 'confident' and 'really confident' as '1 = yes' (i.e. confident) for each research learning objective. Responses for each of the four research learning outcomes in the CAC were combined and further coded as '0 = no' if any of the four outcomes were not confident and '1 = yes' if all four outcomes were confident, representing confidence across the CAC research domain.

The survey was piloted in January 2023 with 10 pharmacists, identified through NHS England networks, who met the inclusion criteria for participation and provided a wide range of clinical and research experience. Piloting confirmed survey completion would take approximately 15 min and identified where questions required re-wording to ensure clarity of meaning across sectors and career grades. Data were not collected and pilot participants were re-invited to answer the final survey.

Procedure

Convenience and snowball sampling were used to recruit respondents to the survey, which was live for 4 weeks (20th February to 17th March 2023). Pharmacists registered to mailing lists held by NHS England School of Pharmacy and Medicines Optimisation North were contacted about the study. Two emails containing a weblink to the survey were

sent (an initial email on 20th February and a reminder on 13th March), in which recipients were asked to complete the survey and cascade the weblink to eligible pharmacists in their organizations and regional networks. The weblink was posted on social media (Twitter) and UK Clinical Pharmacy Association (UKCPA) message boards. No incentives were offered.

The study was deemed service evaluation by the NHS England research governance officer, with no requirement for NHS ethical approval. Respondents were required to read a participant information sheet, self-declare eligibility (GPhC-registered pharmacist practicing in the north of England), and confirm consent before accessing the survey questions. No identifiable information was collected.

Data were exported to SPSS (Version 29; IBM SPSS Statistics, IBM). To address objectives (i) and (ii), descriptive and frequency analyses were conducted on data related to research experience and self-reported confidence.

To address objective (iii), two separate LgRs were used to estimate the independent effect of each of the eight predictors on confidence meeting the research learning outcome in the PRFC (LgR1) and all four research learning outcomes in the CAC (LgR2).

Results

Table 1 shows the demographic and job characteristics of the 253 survey respondents. Continuous variables are presented alongside measures of central tendency and spread. Categorical and Likert data are presented as numbers and proportions. The median number of years practicing was 14; 168 (66.4%) were female; 188 (74%) were from a White background; and 171 (67.6%) worked in secondary care.

Fifty-four participants (21.5%) held at least one postgraduate research qualification, ranging from postgraduate certificate to doctorate. A further 43 (17.0%) were working towards such qualifications. Less than a third (30.4%, 77/253) had undertaken other research training, defined as any training undertaken outside of a postgraduate qualification, the most common being Good Clinical Practice, held by 56 (22.1%).

The majority of participants (65%, 164/253) reported having no protected time for research. Seventy five (29.6%) were aware of research being included in their job description, whereas 46 (18.2%) were unsure. Fifty (19.8%) routinely discussed research during their annual appraisal, whereas 82 (32.4%) only discussed research if they initiated the conversation on the topic, and a further 26 (10.3%) only if they were currently involved in research.

Almost two-thirds (64.4%, 163/253) of participants reported experience of at least one research activity (including QI, SE, and audit), either recently (within 12 months) or historically (longer than 12 months ago) (Fig. 1). Pharmacists most frequently reported collecting and analysing data; designing audit, QI, or SE; and disseminating findings. Fewer had written a research protocol, obtained ethical approvals, published in peer-reviewed journals, or applied for research funding. The least frequent activity, acting as Principal Investigator for a research study, was reported by only 9.9% (25/253) of respondents.

Confidence meeting each research learning outcome is reported in Table 2. Confidence (answering 'confident' or 'really confident') was lowest for CAC Outcome 5.2: identifying and addressing gaps in the evidence base to generate new

Table 1. Participant characteristics (n = 253).

Characteristic	n = 253	
Gender, n (%)		
Female	168 (66.4)	
Male	82 (32.4)	
Prefer not to say	3 (1.2)	
Ethnicity, n (%)		
White—British	169 (66.8)	
White—Other	11 (4.3)	
White—Irish	8 (3.2)	
Black—British (African)	11 (4.3)	
Asian/Asian British (Indian)	14 (5.5)	
Asian/Asian British (Pakistani)	18 (7.1)	
Asian/Asian British (Bangladeshi)	2 (0.8)	
Asian/Asian British (Chinese)	8 (3.2)	
Asian—other	3 (1.2)	
Any Arab background	2 (0.8)	
Prefer not to say	7 (2.8)	
Time practicing as a registered pharmacist (years)		
Median (IQR 1 and 3)	14 (6.25 and 22)	
Primary sector of employment, n (%)		
Secondary care	171 (67.6)	
Primary care	53 (20.9)	
Community pharmacy	14 (5.5)	
Academia	6 (2.4)	
Multi-sector	3 (1.2)	
Other	6 (2.4)	
Integrated Care System (ICS), n (%)		
Humber and North Yorkshire	17 (6.7)	
North East and North Cumbria	34 (13.4)	
South Yorkshire	34 (13.4)	
West Yorkshire	57 (22.5)	
Cheshire and Merseyside	35 (13.8)	
Greater Manchester	55 (21.7)	
Lancashire and South Cumbria	21 (8.3)	
Postgraduate research qualification, n (%)	Completed	Undertaking
Postgraduate certificate in research	11 (4.6)	3 (1.3)
Postgraduate diploma in research	5 (2.1)	2 (0.8)
Postgraduate masters (MSc or MRes)	30 (11.9)	13 (5.1)
Advanced Clinical Practitioner (ACP) masters	17 (7.1)	7 (2.9)
Doctorate	15 (5.9)	18 (7.1)
PhD	11 (4.6)	11 (4.6)
DPharm	4 (1.7)	4 (1.7)
EdD	0	3 (1.3)
Other research training, n (%)		
Any	77 (30.4)	
'In house' training within own organization	36 (14.2)	
NIHR First Steps into Research	7 (2.8)	
NIHR Integrated Clinical Academic Internship	4 (2.8)	
RPS/NIHR Pharmacy research modules	5 (2.0)	
Good Clinical Practice (GCP)	56 (22.1)	
Principal Investigator (PI) training	8 (3.2)	
Other	17 (6.7)	

Table 1. Continued

Characteristic	*n* = 253
Research included in job description, *n* (%)	75 (29.6)
Research activity discussed at appraisal, *n* (%)	
Routinely	50 (19.8)
If initiated by participant	84 (33.2)
If research active	26 (10.3)
Never	93 (36.8)
Job plan protected for research, *n* (%)	
0% of job plan	164 (64.8)
>0% and <10% of job plan	34 (13.4)
≥10% of job plan	55 (21.9)

evidence (38.3%, 97/253) and highest for CAC Outcome 5.1: interpreting the evidence base (58.1%, 147/253).

The proportion of respondents confident with the PRFC research learning outcome was 42.3% (107/253), compared to 20.5% (52/253) who reported confidence with all four CAC research learning outcomes.

Binomial logistic regression

Two LgRs were built to evaluate the effect of predictor variables on each of the two dependent variables: Confidence with PRFC (LgR1) and Confidence with CAC (LgR2), where confidence was defined as self-assessing as 'confident' or 'really confident' on the Likert scale for all learning outcomes within that curriculum.

Full details of variable selection and assumption checks for each LgR, described here in brief, can be found in Supplementary File 2. For each LgR, the eight predictor variables identified *a priori*, were subjected to Hosmer and Lemeshow's purposeful selection [24]. Relaxed thresholds for the variable entry criterion ($P < 0.25$), variable retention criterion ($P < 0.15$), and confounding level (15%) were used, which increases the likelihood of important confounders being retained in addition to statistically significant co-variants, particularly for samples containing 240–600 participants [25]. The Box–Tidwell procedure [26] confirmed a linear relationship between years practicing and the logit transformation of the dependent variables. All other predictors were categorical. Multicollinearity between all potential predictor variables was assessed using bivariate analysis and was defined as a Pearson's correlation coefficient between two variables greater than 0.8 or a variable inflation factor of any variable greater than 2.5 [27].

The final LgR1 of predictors of confidence with the PRFC research learning outcome included five statistically significant predictors: recent experience, any postgraduate research qualification, other research training, discussion of research in appraisal, and hospital sector. The final LgR2 of predictors of confidence with the CAC research learning outcomes included four predictors; of these, any postgraduate research qualification and recent experience were statistically significant, whilst other research training and hospital sector were not. With respect to goodness of fit, both LgR1 and LgR2 were statistically significant, χ^2 [5] = 108.977, $P < 0.001$ and χ^2 [4] = 47.768, $P < 0.001$, respectively. Further fit characteristics are displayed in Table 3.

The strongest predictor of confidence in the PRFC research domain was recent experience (aOR 5.707, $P < 0.001$), followed by postgraduate research qualification (aOR 4.439, $P < 0.001$) and informal research training (aOR 4.335, $P < 0.001$). Routine discussion of research during appraisal (aOR 3.165, $P = 0.006$) and hospital sector (aOR 2.218, $P = 0.03$) also positively predicted confidence (Table 4).

The strongest predictor of overall confidence with the CAC research domain was holding a postgraduate research qualification (aOR 4.478, $P < 0.001$), followed by recent experience (aOR 3.330, $P = 0.002$) (Table 5).

Discussion

This is the first study to identify and examine predictors of UK pharmacists' self-reported confidence in meeting the research learning objectives in the RPS PRFC and CAC. The majority of pharmacists (64.3%) surveyed reported experience of research or research-related activities (audit, SE, or QI); yet a minority were confident they could meet the research learning outcomes in the PRFC (42.3%) and CAC (20.5%). Whilst the most important predictors for research confidence were postgraduate research qualifications and recent experience; other research training, discussion of research in appraisal, and hospital sector also contributed to the LgRs.

Strengths

The major strength of this study is the use of logistic regression analysis to assess the relative influence of each variable on self-reported confidence, whilst controlling for the effect of confounders. It is reported per the Consensus-Based Checklist for Reporting of Survey Studies [28], to demonstrate rigour and enable future replication.

Limitations

The cross-sectional methodology measures variables at a single time-point; therefore, relationships between predictors and confidence are correlational, rather than causal. Self-reporting may have resulted in under- or over-estimation of confidence [29], and self-selection means that research experience and confidence may be inflated in the sample compared to the population.

The modest sample size and low proportion self-reporting confidence with all four CAC research learning objectives meant that EPV in the corresponding model (LgR2) was less than 10. There is little published evidence supporting the number of EPVs required in logistic regression. One simulation study [30] suggests that fewer than 10 EPVs may increase the risk of model overfitting; however, others suggest this is too conservative and support the use of logistic regression models with 5–9 EPV [21].

It is difficult to assess the representativeness of the sample, as the characteristics of pharmacists across the north of England are not known for all variables. Internal data collected by NHS England show that the North of England secondary care pharmacist population, like the sample, is majority female and white British; however, these demographics were largely unknown across other sectors [31]. The community sector accounts for approximately half of the population [31]; therefore, caution should be exercised when generalizing these findings to that setting, as community pharmacists were underrepresented in the sample.

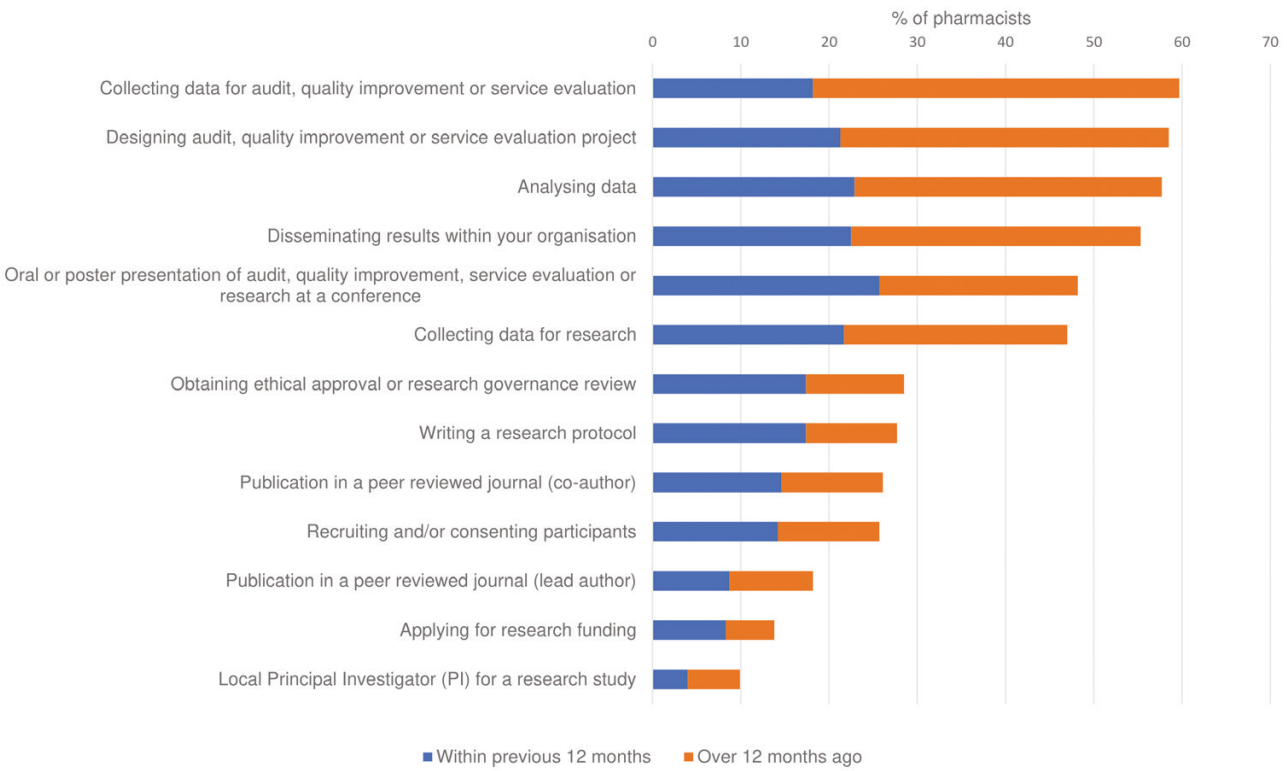

Figure 1. Participant recent (within the previous 12 months) and previous (over 12 months ago) experience of specific research and research-related activities (n = 253).

Table 2. Likert results for each research learning outcome.

Curriculum	Curriculum outcome	Really unconfident *n* (%)	Unconfident *n* (%)	Neutral *n* (%)	Confident *n* (%)	Really confident *n* (%)
Post-registration Foundation	5.1 Seeks to be involved in research activities; actively disseminates outcomes to appropriate audiences	16 (6.3)	51 (20.2)	79 (31.2)	69 (27.3)	38 (15)
Core Advanced	5.1 Interprets and critically applies the evidence base to inform practice and care delivery at a team and/or service level	9 (3.6%)	39 (15.4)	58 (22.9)	102 (40.3)	45 (17.8)
	5.2 Identifies gaps in the evidence base; uses appropriate methods for addressing the identified gap(s), generating new evidence	23 (9.1)	63 (24.9)	70 (27.7)	79 (31.2)	18 (7.1)
	5.3 Implements change at a team and/or service level based on the outputs of their research and/or quality improvement activity and disseminates findings	18 (7.1)	46 (18.2)	79 (31.2)	83 (32.8)	27 (10.7)
	5.4 Collaborates with others in undertaking research and supports others to engage with research and improvement activities	19 (7.5)	40 (15.8)	81 (32)	88 (34.8)	25 (9.9)

Table 3. Fit characteristics for logistic regression models.

Model	χ^2	Nagelkerke R^2 (%)[a]	PAC (%)[b]	Sensitivity (%)	Specificity (%)	PPV (%)[c]	NPV (%)[d]
LgR1 (PRFC)	108.977 ($P < 0.001$)	47.5	79.6	70.8	86.1	78.9	80.0
LgR2 (CAC)	47.768 ($P < 0.001$)	27.2	82.4	34.6	94.9	64.3	84.7

[a]Percentage of variance explained by the model (weak relationship 20%; moderate relationship 20–40%; strong relationship >40%).
[b]Percentage Accuracy in Classification = percentage of cases correctly classified.
[c]Positive Predictive Value = ratio of respondents correctly classified as confident to all respondents classified as confident.
[d]Negative Predictive Value = ratio of respondents correctly classified as not confident to all respondents classified as not confident.

Table 4. Predictors of self-reported confidence with the Post-registration Foundation Curriculum research learning outcome.

Variable	Adjusted odds ratio (aOR)	95% C/I Lower	95% C/I Upper	*P* value
Recent research experience (within 12 months)	5.707	2.990	10.894	<0.001
Postgraduate research qualification[a]	4.439	1.933	10.191	<0.001
Other research training[b]	4.335	2.211	8.501	<0.001
Appraisal discussion[c]	3.165	1.386	7.229	0.006
Hospital sector[d]	2.218	1.081	4.551	0.03

[a]Any postgraduate qualification with a research component (postgraduate certificate, postgraduate diploma, postgraduate masters, doctorate).
[b]Research training undertaken outside of a postgraduate qualification.
[c]Routine discussion of research in annual appraisal.
[d]Compared to all other sectors (primary care, community, academia, other).

Table 5. Predictors of self-reported confidence with all four Core Advanced Curriculum research learning outcomes.

Variable	Adjusted odds ratio (aOR)	95% C/I Lower	95% C/I Upper	*P* value
Postgraduate research qualification[a]	4.478	2.164	9.263	<0.001
Recent research experience (within 12 months)	3.330	1.541	7.196	0.002
Hospital sector[b]	2.261	0.996	5.131	0.51
Other research training[c]	1.971	0.984	3.950	0.56

[a]Any postgraduate qualification with a research component (postgraduate certificate, postgraduate diploma, postgraduate masters, doctorate).
[b]Compared to all other sectors (primary care, community, academia, other).
[c]Research training undertaken outside of a postgraduate qualification.

Context

The proportion reporting recent experience (49.4%) was similar to that reported internationally, although the definition of research varies across studies [17, 18]. The most common research activities reported in the present study, including data analysis and dissemination of findings, were among those reported in a study of Canadian pharmacists [19]. Experience was more closely aligned with audit, SE, and QI, than with research itself, and the finding that few pharmacists had written a research protocol or acted as a principal investigator, aligns with international findings that pharmacists lack competence in designing and implementing research [17].

Of the five research learning outcomes (one from the PRFC and four from the CAC), pharmacists were least confident with CAC Outcome 5.2: identifying gaps in the evidence base and using appropriate methods to generate new evidence to address them, suggesting that the greatest learning development needs are thorough evaluation of the literature, knowledge, and application of research methods, and leading the research process. As predictors were analysed at the level of PRFC and CAC research domains, any differences between predictors for confidence meeting individual research learning outcomes were not identified. Future research could examine whether different research learning outcomes require distinct development strategies.

The two most important predictors of confidence with the PRFC research learning outcome (recent research experience and postgraduate research qualifications), were the same for CAC, in reverse order. The importance of recent experience for confidence with the PRFC may reflect the focus of this learning outcome on understanding underpinning principles through exposure to a variety of research activities. In the CAC, when research learning outcomes require application rather than understanding, a postgraduate research qualification becomes the most important variable tested, suggesting formal education may be instrumental in developing and utilizing knowledge of research methods. The importance of these two variables has previously been highlighted in a study of pharmacists in Saudi Arabia [20], who had higher levels of experience, postgraduate research qualifications, and research confidence compared to the global average [17].

Practicing in the hospital sector, hypothesized to be a predictor for confidence due to the inclusion of research in NHS job descriptions and greater MDT working, positively contributed to both LgRs, although other sectors were underrepresented. In contrast to previous findings regarding confidence meeting all five domains of the CPC [15], male gender was not correlated with confidence in the present study.

The lack of correlation between years of experience and confidence suggests that research skills are not typically developed during career progression. This is supported by the low confidence in the PRFC research domain, despite 93% (233/253) being qualified beyond the three-year early career period for which this curriculum is designed. This may reflect the relative dearth of structured post-registration learning opportunities and, in more recent years, prioritization of independent prescribing ahead of initial education and training reforms that will see pharmacists awarded prescribing rights upon qualification [32].

The finding that protected time did not predict confidence in meeting research learning outcomes was unexpected, given that lack of time is consistently the most frequently reported barrier in the literature [17, 19, 20, 23]. This may be due to pharmacists undertaking research outside of working hours, which was not captured in this survey but has been evidenced in previous studies [23]. Alternatively, protected time may predict research confidence, but at a minimum threshold greater than 10% WTE. It is also possible that the impact of protected time is only seen in the presence of other confounding factors not measured in the present study, for example, mentorship, funding, and positive research culture [17, 23, 33].

Few survey respondents had gained or were working towards the new RPS credentials; however, as the curricula continue

to be embedded in the career progression of UK pharmacists, future work could aim to understand the impact of being awarded these credentials on pharmacists' research confidence. Further work is needed to explore and identify the most appropriate strategies to increase pharmacists' opportunities to gain research experience across all sectors, such as funded mentorship programmes, structured experiential learning led by clinical academic pharmacists, multidisciplinary team collaboration, job planning to include time allocated to acquire research knowledge and experience, and alignment of research objectives to key organizational interests.

Conclusion

Self-reported confidence across the PRFC and CAC research learning outcomes was low amongst the self-selecting sample of pharmacists surveyed. The most important predictors differed between curricula, suggesting that strategic planning to build research capability and capacity should comprise an arsenal of initiatives tailored to career stage and sector. The research learning outcomes with which pharmacists were least confident, such as conducting research, dissemination of findings, change implementation, and collaboration, may provide target development needs to be prioritized.

Supplementary Material

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

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Author contributions

F.W.: lead author, concept/design of study, content of survey, design of electronic survey, data collection, analysis plan, statistical analysis, manuscript production, full access to data; R.P.: analysis plan, statistical analysis, key manuscript revision, full access to data; M.H.: concept/design of study, content of survey, key manuscript revision, full access to data; H.J.: concept/design of study, content of survey, key manuscript revision, full access to data; J.B.: concept/design of study, key manuscript revision; and P.F.: concept/design of study, content of survey, analysis plan, key manuscript revision, supervising author.

Conflict of interest

M.H., H.J., and J.B. are NHS England Workforce Training and Education (NHSE WT&E) direct employees or secondees. F.W. was seconded to NHSE WT&E at the time the work was conducted. NHSE WT&E commissions an e-portfolio programme to support pharmacists to credential at advanced level.

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Data accessibility

F.W., R.P., M.H., and H.J. had full access to data.

Data availability

The data underlying this article will be shared on reasonable request to the corresponding author.

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