Vitamin B1 Injection

Biological Therapies Thiamine Hydrochloride 100 mg in 1 mL Injection

Available as single vial or box of 10 vials

Each 1 mL solution contains:
- thiamine hydrochloride.. 100 mg
- disodium edetate... 1 mg
- benzyl alcohol .... 16 mg
- water for injection... qs

PBS Information:
This product is not listed on the PBS.

Please review full product information before prescribing.
Further information can be obtained from Biological Therapies.
Phone 1800 063 948 (Toll Free) or Email orders@biol.com.au.

INDICATIONS – Used for the prevention and treatment of Vitamin B1 deficiency. **CONTRAINDICATIONS** – Known hypersensitivity to thiamine hydrochloride, benzyl alcohol or disodium edetate; Do not use in children < 2 years due to benzyl alcohol content. **PRECAUTIONS** – Serious hypersensitivity reactions to thiamine including feelings of warmth, tingling, pruritus, pain, urticaria, weakness, sweating, nausea, restlessness, tightness of the throat, angioedema, respiratory distress, cyanosis, pulmonary oedema, gastrointestinal bleeding, transient vasodilatation and hypotension, vascular collapse, and death reported following parenteral administration. Obtain a sensitivity history from patient prior to administration. Administer an intradermal diluted test dose of thiamine to patients with suspected sensitivity (e.g. a history of an allergic response such as itching, sneezing, wheezing or frank anaphylactic shock with a previous injection) before parenteral administration. Multiple vitamin deficiencies should be suspected in any case of dietary inadequacy. Intravenous glucose loading may precipitate or worsen the condition of Wernicke's encephalopathy in thiamine-deficient patients: administer prior to glucose. Problems in geriatrics not documented with intake of normal daily recommended amounts. Elderly may have impaired thiamine status, thereby requiring thiamine supplementation. Information on large doses not available for use in elderly and children > 2 years. **INTERACTIONS** – Although the clinical importance is unknown, thiamine reportedly may enhance the effect of neuromuscular blocking agents. *In vitro* thiamine hydrochloride at a concentration of 0.1% significantly reduces the activity of Kanamycin sulfate and Streptomycin sulfate at 25 °C. **ADVERSE EFFECTS** – Feelings of warmth, tingling, pruritis, pain, urticaria, erythema, scaling of the facial skin, severe rash, weakness, sweating, nausea, vomiting, restlessness, tightness of the throat, angioedema, respiratory distress, cyanosis, pulmonary oedema, dyspnoea, respiratory failure, gastrointestinal bleeding, abdominal pain, precordial pain, palpitations, tachycardia, transient vasodilation and hypotension, shock, vascular collapse, semi-comatose state and death have occurred. Pain on injection, local irritation. Tenderness and induration reported following IM injection. **DOSAGE AND ADMINISTRATION** – Administer by IM injection or slow IV injection over a period of >10 minutes. Refer to full Product Information for dosage. Review full Product Information (PI) before prescribing. PI is available from TGA's website: https://www.ebs.tga.gov.au/ or request from Biological Therapies. Min PI V1.0, Date of preparation: 6 October 2020.

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REVIEW

Attitudes, barriers and facilitators of hospital pharmacists conducting practice-based research: a systematic review

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Abstract

Introduction: Practice-based research is essential in enhancing medication knowledge, quality use of medicines, the scope of the pharmacy profession and improving patient outcomes. This systematic review aims to uncover the attitudes of hospital pharmacists towards practice-based research and their perceptions of the barriers and facilitators to undertaking practice-based research.

Methods: A systematic search of MEDLINE, Embase, International Pharmaceutical Abstracts and Cumulative Index to Nursing and Allied Health Literature databases from 1 January 2000 to 11 March 2021 was conducted. Peer-reviewed empirical studies exploring hospital pharmacists' perceptions of – as well as barriers and facilitators to – practice-based research were included and a descriptive synthesis used to identify common themes.

Results: Nine studies were included in this review. Barriers and facilitators across four broad themes were related to pharmacist capacity and capability, workplace environment, research resources, and research culture. Hospital pharmacists had a high interest in conducting research, but limited research experience. Common barriers identified were lack of time, workplace support, funding, research culture, and competing priorities. Having a post-graduate qualification and a positive attitude towards research facilitated research participation. Departmental support, designated research time and creation of research networks and forums were seen as facilitators for practice-based research.

Conclusion: Hospital pharmacists recognise the importance of practice-based research in improving knowledge, patient care and advancing pharmacy practice. However, large variation has been reported for their confidence and experience in practice-based research. Building research capacity and capability by supporting post-graduate research qualification, providing designated time and creating research networks may strengthen the research culture amongst hospital pharmacists.

Keywords: hospital pharmacist, perceptions, barriers, facilitators, research, systematic review, workforce.

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INTRODUCTION

Pharmacist involvement in research is vital for initiating change in service delivery, promoting optimal use of

medicines, advancing the profession and providing the highest calibre of patient care.[1] Practice-based research has been identified as a core component of the pharmacy profession globally with The International Pharmaceutical Federation (FIP) Global Competency Framework stating that pharmacists should 'identify, investigate, conduct, supervise and support research in the workplace'.[2] Similarly, the National Competency Standards Framework for Pharmacists in Australia states that all advanced practitioner pharmacists are expected to 'participate in research'.[3] As the medication experts within the healthcare team, pharmacists are in an ideal position to undertake practice-based research to ensure optimal medicine use and provision of pharmacy services. Despite strong evidence that pharmacists recognise the importance of research, it is well documented that few pharmacists actively participate in practice-based research.[4,5]

In 2017, the Society of Hospital Pharmacists of Australia (SHPA) established the National Translational Research Collaborative (NTRC) to promote practice-based research in hospital pharmacy, and in 2019 the NTRC was incorporated as a Research Stream within the SHPA Specialty Practice program, acknowledging research as a core hospital pharmacist role.[6] As part of the Research Leadership Committee of the SHPA Research Specialty Practice group, we were interested in perceptions held by hospital pharmacists towards research. A previous systematic review found that pharmacists recognise the importance of research and desire to be involved, but are limited by lack of time, opportunity, funding and training.[5] This study had a high proportion of papers relating to community pharmacists; therefore, the focus of this review was to identify papers relating specifically to hospital pharmacists. This systematic review aims to understand the attitudes of hospital pharmacists towards practice-based research and identify barriers and facilitators towards practice-based research among hospital pharmacists. To our knowledge, this is the first systematic review focusing specifically on hospital pharmacists' attitudes and perceptions towards barriers and facilitators to practice-based research.

MATERIALS AND METHODS

Ethics statement

As this is a systematic review, no ethical approval was sought.

This review was performed in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines.[7] The protocol for this review was published on the Center for Open Science (ID: YFZ5Q) prior to initiation.

Data Sources and Search Strategy

A systematic search was conducted using MEDLINE, Embase, International Pharmaceutical Abstracts (IPA) and Cumulative Index to Nursing and Allied Health Literature (CINAHL). All data sources were searched from 1 January 2000 to 11 March 2021 to ensure findings reflected contemporary practice. The search strategy integrated four key concepts: hospital pharmacists, attitudes, perceptions and research. These terms were searched with relevant subject headings, then searched again as their respective keywords and synonyms. Appropriate syntax and subject headings were applied to the same key terms across all databases. The full MEDLINE search strategy is available in the supplementary material. References of relevant studies were screened to identify other potential studies not identified by the search strategy.

Inclusion and Exclusion Criteria

Included in this review were original peer-reviewed research exploring barriers, facilitators, attitudes or perceptions by hospital pharmacists towards practice-based research. Studies involving both hospital and community pharmacists were excluded unless results for hospital pharmacists were reported separately. Studies focusing on pharmacists involved in clinical trials of investigation drugs, studies without original data and those written in languages other than English were excluded from the review.

Study Selection, Data Extraction and Analysis

After the removal of duplicates, each citation was screened independently by two reviewers (TL, JP, JB, SM, JJ, EM and JH) against the inclusion/exclusion criteria in Covidence (Veritas Health Innovation).[8] Covidence allows multiple authors to work simultaneously so each citation is screened by two reviewers without conflict. All reviewers were briefed on the inclusion and exclusion criteria to ensure consistency. Discrepancies were reviewed independently by a third reviewer (SR) and discussed by all three reviewers until consensus reached. Data on study characteristics, perceptions, and barriers and facilitators towards practice-based research were extracted (SR and JP). As considerable heterogeneity of study contexts, designs and outcome measures was anticipated a priori, a meta-analysis was not considered feasible and therefore a descriptive data synthesis used to identify common themes across the included studies.

Risk of Bias Assessment

The risk of bias for each included study was independently assessed by two reviewers (SR and JP) using the Newcastle–Ottawa Quality Assessment Scale (adapted for cross-sectional studies by Modesti *et al.*).[9] The Newcastle–Ottawa Scale adapted for cross-sectional studies provides a star rating across three criteria: selection (maximum five stars), comparability (maximum two stars) and outcome (maximum three stars). Any disagreements were resolved by discussion.

RESULTS

The search strategy identified a total of 4390 studies. Nine studies met the inclusion/exclusion criteria and were included in this review (Figure 1).[10–18] The studies included a total of 1193 hospital pharmacists from six countries (Table 1). Eight of the nine studies utilised a cross-sectional survey design and one study was a pre–post survey of hospital pharmacists' attitudes towards pharmacy practice-based research before and after a two-day introductory research workshop.

All included studies in this review were at high risk of bias (Table S1). None compared characteristics of respondents and non-respondents, and only two studies controlled for confounders.[14,16] Three studies were purely descriptive and did not include any statistical analyses.[11–13]

Pharmacist Perceptions of Practice Based-Research

Five main perceptions toward practice-based research were evident: strong research interest, low research confidence, core pharmacist role, improved patient care and enhancing the pharmacy profession (Table 1).

Identification of studies via databases

Identification

Records identified:
(n = 4,390) → Records removed *before screening*:
Duplicate records removed
(n = 795)

Screening

Records screened
(n = 3,595) → Records excluded**
(n = 3,555)

Reports sought for retrieval
(n = 40)

Reports assessed for eligibility
(n = 40) → Reports excluded:
Did not focus on hospital pharmacists (n = 8)
Opinion piece or conference abstract (n = 10)
Did not address the research question (n = 13)

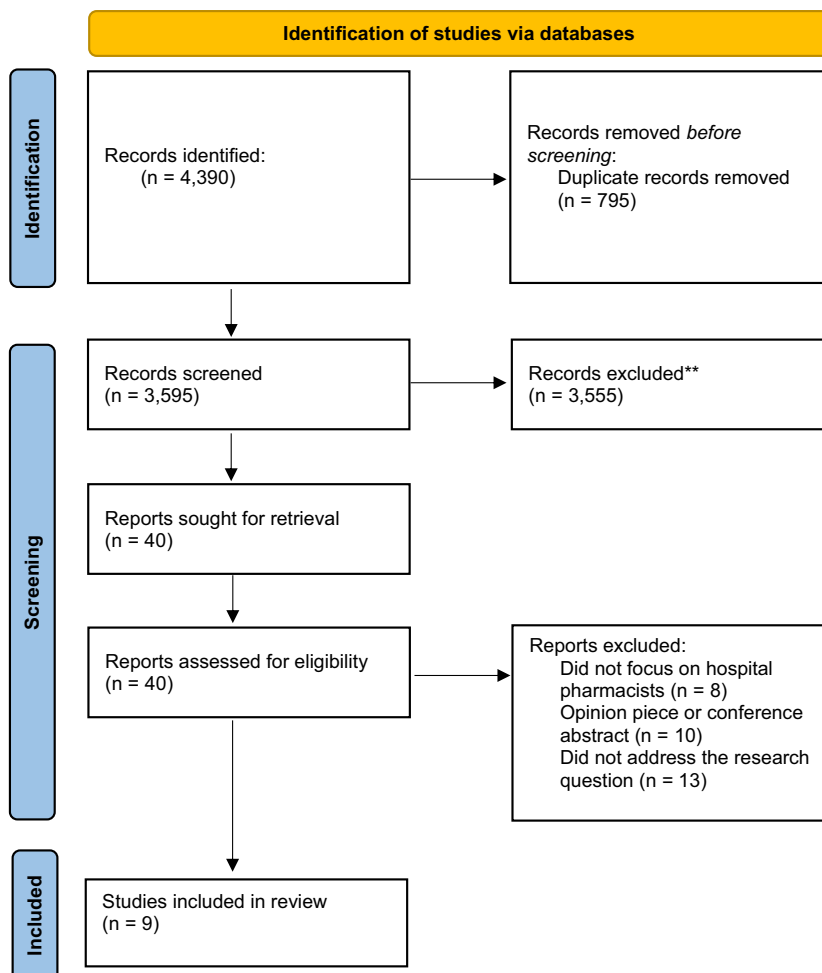**Included**

Studies included in review
(n = 9)

Figure 1 PRISMA flow diagram of included studies.

Table 1 Characteristics and hospital pharmacists' attitude towards research in included studies

Author (year)	Country	Setting	Study design	Population and response rate	Positive attitude towards practice-based research, % agreement or median					Has research experience, %
					Interest in conducting research	Research confidence	Core pharmacist role	Improved patient care	Enhance profession	
Awaisu et al. (2014)[10]	Qatar	Seven public hospitals	Cross-sectional survey	120 hospital pharmacists Response rate: 67%	75.8% were very or extremely interested	44.2% very good or excellent	NR	NR	NR	30%
Elkassem et al. (2013)[11]	Qatar	Eight hospitals from a large national not for profit healthcare organisation	Pre–post survey	47 hospital pharmacists attending a two-day introductory pharmacy research workshop Response rate: 100% pre-course and 93% post-course	NR	34%	97.9%	NR	100%	40.4%
Fakeye et al. (2017)[12]	Nigeria	Three public hospitals	Cross-sectional survey	65 hospital pharmacists with at least five years post-qualification experience Response rate: 100%	NR	NR	NR	NR	98.5%	NR
Lee et al. (2018)[13]	Canada	26 hospitals across four health authorities	Cross-sectional survey	85 hospital pharmacists Response rate: 16%	87%	48%	NR	78%	88%	77%
Perreault et al. (2012)[14]	Canada	Intensive care unit pharmacists across all provinces in Canada	Cross-sectional survey	215 critical care pharmacists Response rate: 66.2%	80.4%	NR	97.2%	95.8%	NR	41.4% (15.7% highly involved and 25.7% moderately involved)
Sarwar et al. (2018)[15]	Pakistan	41 private and public hospitals in Lahore, Pakistan	Cross-sectional survey	130 hospital pharmacists Response rate: 92%	73.8%	71.5%	73.8%	86.9%	93.1%	NR
Stewart et al. (2015)[16]	Qatar	Hospital pharmacies from a large national not for profit healthcare organisation	Cross-sectional survey	213 hospital pharmacists Response rate: 53.1%	71.8%	72.8%	75.2%	NR	NR	NR

Table 1 (continued)

Author (year)	Country	Setting	Study design	Population and response rate	Positive attitude towards practice-based research, % agreement or median					Has research experience, %
					Interest in conducting research	Research confidence	Core pharmacist role	Improved patient care	Enhance profession	
Sultana et al. (2016)[17]	Saudi Arabia	Large government national health care organisation across three cities	Cross sectional survey	166 hospital pharmacists Response rate: 84%	~70%	Median: 4/5 (IQR: 3–4)	Median: 4/5 (IQR: 3–4)	Median: 5/5 (IQR: 4–5)	Median: 5/5 (IQR: 4–5)	59%
Waddell and Semciw (2019)[18]	Australia	Five hospitals across Queensland, Australia	Cross sectional; survey	67 hospital pharmacists and hospital pharmacy interns Response rate: 34%	NR	Median: 2/5 for writing research proposal	NR	NR	NR	NR

IQR = interquartile range; NR = not reported, where medians are reported 5 is high confidence/agreement.

Strong Interest but Low Confidence in Research Participation

Six studies explored pharmacist interest in practice-based research. Across all six studies, there was strong interest, with 70–87% of pharmacists indicating that they were interested in research participation.[10,13–17] While interest in participating in research was consistently high, there was much greater variation in the proportion of pharmacists who had experience with practice-based research and were confident they could conduct practice-based research, ranging 30–77% and 34–73%, respectively (Table 1).[10,11,13–16]

Sex and years of experience did not appear to impact pharmacist participation in research. Although the studies by Sarwar et al.[15] and Waddell and Semciw[18] found male sex and years of experience to be significantly associated with increased research confidence and motivation, neither of them adjusted for potential confounders, such as post-graduate qualifications. When Stewart et al.[16] and Perreault et al.[14] adjusted for such confounders, both sex and years of experience were no longer significantly associated with pharmacists' involvement in research.

Barriers and Facilitators to Pharmacist Participation in Practice-based Research

Across the studies included in the review, several barriers and facilitators to participation in practice-based research were identified. These barriers and facilitators were considered across four key themes: pharmacist capacity and capability; workplace environment, access to research resources and research culture (Table 2).

Pharmacist Capacity and Capability

Research training was identified to have an important role in pharmacist participation in practice-based research in all nine studies included in this review. Poor confidence and a lack of research training was seen as a barrier to research participation while research training, post-graduate or research qualifications, and previous research experience facilitated research participation (Table 3). In Nigeria, 84.3% of respondents agreed that 'acquisition of additional training in research is essential for effective pharmacy practice research'.[12] Among Canadian critical care pharmacists, having a PharmD, PhD or completing a speciality residency was associated with an 11-fold increase in the odds of participating in research.[14] Similar findings were reported among Australian hospital pharmacists with post-graduate qualifications more likely to be involved in research,[18] and in Qatar where after adjusting for sex and time since completion of undergraduate degree, post-graduate

Table 2 Key themes of perceived barriers and facilitators to hospital pharmacist participation in practice-based research

Key themes	Barriers	Facilitators
Pharmacist capacity and capability	Poor confidence and lack of research training[10,11,13,14,16]	Research training[10,11,13,14,16] Post-graduate or research qualification[10,12,14,16,18] Previous research experience[18] Self-improvement and contribution to patient care, clinical practice and profession[13,14,16,18]
Workplace environment	Lack of time[10–15,17,18] Lack of workplace support[10,11,13–18] Competing workload priorities[13]	Dedicated research time[11,18]
Access to research resources	Lack of funding[12,13,15] Lack of administrative and information technology support[11,16,17] Lack of access to statistical support[16] Perceived bureaucratic barriers related to ethics and governance processes[18]	Access to administrative and technical support[11,17]
Research culture	Lack of research culture within the workplace[17,18] Unaware of research opportunities[13,15,17]	Support from fellow pharmacists, employer and line managers[13,16] Research networks and communities[13,14]

qualification was associated with readiness to be engaged in research.[16]

Previous research experience was observed to facilitate ongoing research participation across a number of studies. In Saudi Arabia, previous research experience was significantly associated with increased perception of having the required skills for research, and those with previous research experience reported requiring less research supervision.[17] In the same study, pharmacists with previous research experience were more likely to enjoy reading research papers, be confident in evaluating research findings, designing a research study, acknowledge the opportunities available for them to participate in research, and indicate they have the necessary skills to do research.[17] Lack of prior research experience was perceived as a barrier to research participation by 35% of pharmacists in Waddell and Semciw's study.[18]

Workplace Environment

Within the work environment, lack of time and workplace support were key barriers identified across most of the studies included in this review. Lack of time was identified as a barrier to practice-based research by 23.8–80.8% of pharmacists across seven of the nine studies included in this review.[10,11,13–15,17,18] Competing workload priorities were identified as a barrier in the study from Canada.[13] Studies in Qatar and Australia identified having dedicated research time facilitated practice-based research.[11,18]

Lack of support was identified as an additional workplace-related factor impacting research participation, relating to administrative, information technology (IT) and managerial support.[10,12–15,17,18] While lack of workplace support was a common theme across many studies in this review, there was limited detail provided in most studies to indicate what workplace support was required.[10,12–15,17,18] Perreault et al.[14] identified that working at a university hospital and having medical team support were positively associated with research involvement when adjusting for other confounders. This study also found that pharmacy administration support did not appear to impact research engagement.[14]

Research Resources and Research Culture

Access to research resources, awareness of research opportunities and participation in research networks were discussed as factors influencing research participation across a number of studies. Four studies reported research funding and access to additional research resources such as administrative, technical, statistical and IT support as impacting pharmacy research participation.[13–17] A lack of awareness of research opportunities and never having been asked to participate in research was reported in three studies. Sultana et al.[17] reported that 50% of pharmacists were unaware of research opportunities and 46% had never been asked to do research. Similar findings were reported in Canada with 30% of respondents indicating they were unaware of research opportunities,[13] and in Pakistan where 8.5% of respondents reported not having been asked to participate in research.[15] Sultana et al.[17] also reported that previous research experience increased

Table 3 Barriers and facilitators for hospital pharmacists' participation in research from included studies

Author (year), Country, Number of participants	Perceptions		Statistically significant findings
	Facilitators to support research (%)[a]	Barriers preventing research (%)	
Awaisu *et al.* (2014)[10] Qatar, *n* = 120	NR	Lack of time (71%) Lack of job support (39%) Lack of adequate training (60%) Inadequate knowledge (28%)	Pharmacists with higher self-assessed competence in research had: • Higher level of education (p < 0.05) • Place of work (p < 0.05)
Elkassem *et al.* (2013)[11] Qatar, *n* = 47	Time (36.2%) Research training (34%) Administrative (51%) IT support (46.8%)	Time (19.1%) Research training (38.3%) Administrative (6.4%) IT support (8.5%)	NA
Fakeye *et al.* (2017)[12] Nigeria, *n* = 65	Skills to be involved (87.7%) Financial commitment (40%) Time (55.4%) Staff (40%) Lay-out of practice setting (72.3%) Patient data access (36.9%) Additional research training (84.3%)	Skills to be involved (10.8%) Financial commitment (58.5%) Time (26.2%) Staff (50.8%) Lay-out of practice setting (20%) Patient data access (50.8%) Additional research training (84.3%)	Feasibility of conducting practice-based research on routine patient care activities: More years of experience in practice (p = 0.03)
Lee *et al.* (2018)[13] Canada, *n* = 85	Personal satisfaction (82%) Opportunity to learn about a disease state (78%) Opportunities to join existing teams (73%) Mentorship programs (70%) Research training/workshops (53%)	Lack of time (92%) Competing workload priorities (88%) Lack of support from management (42%) Lack of skills (52%) Lack of resources to conduct higher-level studies (62%) Lack of awareness of research opportunities (30%)	NA
Perreault *et al.* (2012)[14] Canada, *n* = 215	Creation of research forums (97.6%) Networks of pharmacists interested in research (96.2%) University support (20.6%)	Lack of time (80.8%) Understaffed work environment (69.5%)	Adjusted odds ratios for factors associated with being moderately or highly involved in research:[b] • PharmD, PhD or speciality residency (aOR = 11.23, 95% CI = 3.27–38.50) • University hospital (aOR = 3.68, 95% CI = 1.52–8.95) • Strong personal interest in research (aOR = 7.44, 95% CI = 3.00–18.46) • Perceived adequate level of training (aOR = 2.23, 95% CI = 1.01–4.90) • ICU team support (aOR = 5.61, 95% CI = 2.17–14.55)
Sarwar *et al.* (2018)[15] Pakistan, *n* = 130	Replacement for research time (52.3%) Financial incentive (41.5%)	Lack of time (23.8%) Lack of support (14.6%) Lack of knowledge (11.5%) Lack of incentives (16.2%) Never been asked to participate (8.5%) No personal interest (7.7%)	Pharmacists had more positive attitudes towards research if: Male (OR = 8.86, 95% CI = 1.15–53.74) Worked in the inpatient settings (OR = 4.56, 95% CI = 1.07–19.42)

Table 3 (*continued*)

Author (year), Country, Number of participants	Perceptions		Statistically significant findings
	Facilitators to support research (%)[a]	Barriers preventing research (%)	
Stewart *et al.* (2015)[16] Qatar, n = 213	Administrative support (56.9%) IT support (58.7%) Statistical support (31.9%) Research training courses (46.9%) Supportive research environment (43.2%) Research seminars and discussions (54.9%)	Administrative support (9.4%) IT support (15.1%) Statistical support (28.2%) Research training courses (28.6%) Supportive research environment (22%) Research seminars and discussions (23.4%)	aOR for factors associated with being ready to be involved in research:[c] • Post-graduate qualification (aOR = 3.48, 95% CI = 1.73–6.99) • Positive general attitude to research (aOR = 3.24, 95% CI = 1.62–4.67)
Sultana *et al.* (2016)[17] Saudi Arabia, n = 166	Financial reward (~50%) Adequate time (>70%) Administrative support (>70%)	Lack of time (63%) Lack of support (48%) Not being aware of research opportunities (50%) Never been asked to do research (46%)	Pharmacists with previous research experience were more likely to: • Indicate they have the necessary skills to do research (p = 0.003) • Require less supervision to conduct research (p = 0.001)
Waddell and Semciw (2019)[18] Australia, n = 67	Support from department (>40%)	Lack of time (80%) Lack of support (30%) Lack of research experience (35%) Perceived bureaucratic barriers related to ethics and governance processes (% NR) Lack of research culture (% NR)	Higher levels of research confidence: • Males (p < 0.01) • Post-graduate qualification (p < 0.01)Higher levels of research experiences: • More years of practice (p < 0.05) • Research qualification (p < 0.05)Higher levels of research interest: • Pharmacists who believed research could influence practice (p < 0.05) • Research qualification (p < 0.05)

aOR = adjusted odds ratio; CI = confidence interval; IT = Information Technology; NA = not applicable; NR= not reported; OR = odds ratio; PBR = practice-based research.

[a]Difference between those agreeing and those disagreeing is due to neutral responses, e.g. neither agree nor disagree.

[b]Adjusted for sex, years of experience as a critical care pharmacist and pharmacy administration support.

[c]Adjusted for sex, years of experience, confidence, motivation, perceived resources, research culture and positive diffusion of innovation.

acknowledgement of opportunities to participate in research. Lack of research culture within the workplace was recognised as a barrier in the study from Australia.[18] In contrast, support from fellow pharmacists, employers and line managers were identified as facilitators for practice-based research.[13,16] In Canada, creation of research networks (96.2%) and research forums (97.6%),[14] the opportunity to join existing teams (73%), participation in mentorship programs (70%) and

research training opportunities (53%) facilitated pharmacist participation in practice-based research.[13]

DISCUSSION

The findings from this systematic review confirm that while interest in participating in practice-based research is high among hospital pharmacists, large variation in

their confidence and experience with practice-based research have been reported. Pharmacists perceive practice-based research as an important part of their role as pharmacists and is critical for patient care and enhancing the profession, yet they lack the confidence to participate in research. In this review, key barriers and facilitators to pharmacy practice-based research participation were identified across four areas: pharmacist capacity and capability, workplace environment, access to research resources and research culture.

We found that pharmacists had positive perceptions towards practice-based research. In this review, practice-based research was perceived as core part of the pharmacist role and pharmacists were interested in participating in practice-based research. Our results are consistent with those previously reported in Awaisu and Alsalimy's[5] 2015 systematic review exploring community and hospital pharmacists' attitudes and involvement in practice-based research. Up to 83% of pharmacists were interested in participating in research, but less than 50% of pharmacists were actually research active.[5] Since Awaisu and Alsalimy's[5] review was conducted, additional research in this area has been published and six studies have been included in our review that were not previously analysed.[12,13,15–18] These studies were conducted in Australia,[18] Canada,[13] Nigeria,[12] Pakistan,[15] Qatar[16] and Saudi Arabia,[17] creating a more global picture of the experiences of hospital pharmacists in practice-based research.

In this review, barriers and facilitators to pharmacist participation in practice-based research across four key areas were identified. These areas were pharmacist capacity and capability, the workplace environment, research resources and research culture. We found that research training and post-graduate qualifications facilitated research participation. Similar findings have been observed among nursing and allied health professionals where research training was seen to not only play a role in research participation but also in the use of research to promote evidence-based daily practice.[19,20] The importance of research training and improving pharmacist research confidence was a clear theme across the studies included in this review. It was noted that Lee et al.[13] and Awaisu et al.'s[10] studies reported similar levels of research confidence despite a greater number of pharmacists in Lee et al.'s study reporting prior research experience. Lee et al.[13] report the most common research experience of hospital pharmacists were data analysis and presentation of study findings. Research experience was not defined in Awaisu et al.'s[10] study. Future research to understand the specific research training needs of the hospital pharmacist profession as well as the development of profession-responsive

training opportunities appears to be an essential step in increasing hospital pharmacist participation in practice-based research.

Across all of the studies included in this review, the workplace environment was seen as critical to improving hospital pharmacist participation in research. Lack of research time as well as lack of workplace support were critical barriers to research participation. The need for protected time for research has been well documented across a wide range of health professions as a strategy to overcome workplace barriers.[21] While research has been acknowledged as a core role for Australian hospital pharmacy practice, until recently there has been limited support from the profession to facilitate the inclusion of research into practice. Both the introduction of the SHPA Australian Pharmacy Residency program across Australian hospitals in 2019, which includes research as a core practice element, and the recognition of Research as a Specialty Practice stream, are profession-based strategies to support pharmacists in the incorporation of research into their daily practice.[1,6] Pharmacy residency programs are well established in the United States of America (USA) under the administration of the American Society of Health-System Pharmacists; however, completion of a research project is not explicitly defined in their guidelines.[4] As such, research training is the responsibility of individual institutions, resulting in varied research training and experiences amongst US resident pharmacists.[4] Other programs have been implemented with the development of practice-based research networks by the Agency for Healthcare Research and Quality[22] in the USA and the World Hospital Pharmacy Research Consortium by the International Pharmaceutical Federation Hospital Pharmacy Section[23] to promote the development of research skills. Understanding how these strategies impact research participation can be used to further address barriers within the workplace environment.

The need for research resources and importance of research culture to facilitate research participation was a consistent theme. Engagement with national research networks such as the SHPA Specialty Practice Stream, as well as involvement in local research networks and communities may increase pharmacist research awareness and participation. In the USA, the development of a practice-based research training network was shown to better prepare resident pharmacists for involvement in future research and improve research outcomes.[24] In this review, a large proportion of pharmacists indicated that they were unaware of research opportunities or that they had not been asked to participate in research, and engagement with research networks and mentors had been proposed as an important enabler of clinical and

practice-based research.[25,26] Simply inviting pharmacists to participate in research may be a simple way to increase research engagement.

A major strength of this study was the rigorous article selection process using several different databases and peer review processes. However, studies were limited to those in the English language, which may have resulted in relevant studies being excluded. As all the studies included were survey-based studies, results may be influenced by social desirability bias as data is self-reported. Surprisingly, no qualitative studies were identified for inclusion in this review. This may have enriched data and added further insight into the perceived barriers and facilitators to practice-based research. Some studies had a low response rate, which may have influenced results as survey responders may intrinsically be more likely to conduct research or have positive attitudes towards it. This may limit the generalisability of results. Also, confounders and non-responders were not analysed, potentially skewing results. Additionally, findings from the individual studies may not be generalisable due to international differences in hospital pharmacy practice.

Pharmacy practice-based research is vital to elevate the pharmacy profession, enhance the quality use of medicines and ultimately improve patient outcomes. The benefits of research are well recognised by hospital pharmacists, and there is great interest in conducting practice-based research. However, experience in practice-based research is limited due to pharmacist-, workplace- and research-related factors. Providing designated research time, research training and changing culture through the generation of research networks and forums is likely to improve hospital pharmacist participation in practice-based research.

CONCLUSIONS

Hospital pharmacists recognise the importance of practice-based research in improving knowledge, patient care and advancing pharmacy practice. However, large variation has been reported for their confidence and experience in research. Although many barriers and facilitators were identified in this review, when adjusting for confounders, pharmacists were more likely to be involved in research if they had a post-graduate research degree/training and a positive attitude towards research.

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Conflicts of interest statement

The authors declare that they have no conflicts of interest. Amy Teresa Page is an Assitant Editor of the *Journal of Pharmacy Practice and Research*, while Jeffery Hughes is a member of the *Journal's* Editorial Advisory Board – both were excluded from the peer-review process and all editorial decisions related to the publication of this article. Peer-review was handled independently by a member of the editorial board in accordance with *Journal's* editorial policy on in-house submissions.

AUTHOR CONTRIBUTIONS

Conception and design of study: all. Screening and extraction of data: SR, TL, JP, JB, SM, JJ, EM and JH. Interpretation of data: all. Drafting the manuscript: SV, JP and LP. Revising the manuscript critically for important intellectual content: all.

Supporting information

Additional supporting information may be found in the online version of this article:
Table S1 Newcastle–Ottawa Scale Risk of Bias assessment for included studies.

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