

Factors influencing the implementation of clinical pharmacy services on paediatric patient care in hospital settings

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ABSTRACT

Objectives This systematic review (SR) was undertaken to identify and summarise any factors which influence the implementation of paediatric clinical pharmacy service (CPS) from service users' perspectives in hospital settings.

Methods Literature search from EMBASE, MEDLINE, Web of Science (Core Collection), Cochrane Library, Scopus and CINAHL databases were performed in order to identify any relevant peer-reviewed quantitative and qualitative studies from inception until October 2019 by following the inclusion criteria. Boolean search operators were used which consisted of service, patient subgroup and attribute domains. Studies were screened independently and included studies were quality assessed using Mixed Methods Appraisal Tool. The study was reported against the 'Enhancing Transparency in Reporting the Synthesis of Qualitative Research' statement.

Results 4199 citations were screened by title and abstract and 6 of 32 full publications screened were included. There were two studies that were graded as 'high' in quality, with four graded as 'moderate'. The analysis has led to the identification of seven factors categorised in five predetermined overarching themes. These were: other healthcare professionals' attitudes and acceptance; availability of clinical pharmacist on ward or outpatient settings; using drug-related knowledge to perform clinical activities; resources for service provision and coverage; involvement in a multidisciplinary team; training in the highly specialised areas and development of communication skills.

Conclusion Evidence for paediatric CPS was sparse in comparison to a similar SR conducted in the adult population. An extensive knowledge gap within this area of practice has therefore been identified. Nevertheless, majority of the factors identified were viewed as facilitators which enabled a successful implementation of CPS in paediatrics. Further research is needed to identify more factors and exploration of these would be necessary in order to provide a strong foundation for strategic planning for paediatric CPS implementation and development.

INTRODUCTION

Special attention needs to be paid in optimising medicines use in children as they are at high risk of harm as the result of medication errors, since such errors are potentially more hazardous to them than to adults.^{1–3} In 2014, the American Academy of Paediatrics has reported that paediatric medication orders resulted in a medication error with rates as high as 5%–27% in their systematic review.⁴ Factors that contribute to paediatric medication errors include the manipulation of formulations,

calculation according to children's weight or body surface area, the change in pharmacokinetics and off-label use of drugs with no standardised dosing.^{5,6}

A joint opinion of the Paediatric Pharmacy Advocacy Group and the Paediatrics Practice and Research Network has advocated the need for clinical pharmacy services (CPSs) in the paediatric population.⁷ Evidence on benefits of CPS were shown in literature across the wide array of clinical settings;^{8–10} however, most studies were conducted in a controlled setting. When the evidence is translated into the 'real world' situation, the results might not always be the same.¹¹ The difference may arise from the context of the interventions, which plays a key role in the uptake and sustainability of what are being tested.¹¹ For instance, a recent systematic review has evaluated the benefits of CPSs in paediatrics in comparison with adult patients in hospital settings.¹² The authors concluded that clinical pharmacist (CP) in paediatric wards may improve patient outcomes but have also highlighted that there are barriers to the involvement of pharmacists.¹² How these barriers affect the involvement of CPS was beyond the scope of their review and hence were not elaborated; however, the context of implementation plays a critical role because it includes various factors that could influence the process of the service, thus affecting the results of service outcome.¹³ Therefore, by identifying these factors that enable or hinder the implementation of CPS, solutions to overcome process barriers can be developed and the introduction of innovations in healthcare system can be promoted on a larger scale.¹⁴

Currently, there is no known systematic review that has examined the factors that influence the implementation of paediatric CPS in the hospital settings. The aim of this systematic review was to identify factors that influence paediatric hospital CPS implementation from service users' perspectives, which include healthcare professionals, children, parents or caregivers who had received any type of services provided by CPs. The objectives of this review were to identify:

- any facilitators that enable or
- any barriers that hinder a successful implementation of paediatric CPS in hospital setting.

METHODS

Search strategy

The identifying and screening process were reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)



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Table 1 Search strategies for MEDLINE and other selected databases

	Service domain	Patient subgroup domain	Attribute domain
MeSH terms	<ul style="list-style-type: none"> ► Pharmaceutical Services ► Pharmacist ► Pharmacy Services, Hospital 	<ul style="list-style-type: none"> ► Adolescent ► Child ► Infant ► Paediatrics 	<ul style="list-style-type: none"> ► Attitude ► Attitude of Health Personnel
Text words	<ul style="list-style-type: none"> ► Exp clinical pharmac*/ ► Exp hospital pharmac*/ 	<ul style="list-style-type: none"> ► Exp adolescent*/ ► Exp child*/ ► Exp infant*/ ► Exp paediatric*/ 	<ul style="list-style-type: none"> ► Exp attitude*/ ► Exp belief*/ ► Exp experience*/ ► Exp opinion*/ ► Exp satisfaction*/

flow diagram.¹⁵ EMBASE, MEDLINE, Web of Science (Core Collection), Cochrane Library, Scopus and Cumulative Index to Nursing and Allied Health Literature (CINAHL) were searched for studies published from inception up until October 2019. Search strategy consisted of domains of service involved, patient subgroup and attributes, with the use of Boolean logic to combine the search (see online supplemental appendix 1). **Table 1** outlines the search strategies. The searched results were exported to EndNote Web (Clarivate Analytics, USA) to facilitate screening with duplications identified and removed.

Study selection

Inclusion criteria were peer-reviewed quantitative and qualitative studies on CPSs with the participants, interventions and outcomes addressed below. Only English-language publications or articles in other languages with full English translation were included in this review. Any studies not meeting the following inclusion criteria were excluded in this review.

- I. Participants: Hospitalised children from 0 to 18 years of age. When both adults and children participants were recruited in a study, only data that explicitly referred to the paediatric population were included.
- II. Interventions: Any CPs' interventions, activities or duties.
- III. Outcome measures: Direct or indirect findings which report factors that influence the implementation of paediatric CPS.

Data collection

A list was created for all identified studies from all the databases searched. Citation search for included articles was performed. CS and DD assessed the titles of the studies, and if the title seemed relevant to the objective of this review, the abstract was retrieved. CS and DD independently assessed these abstracts to evaluate their potential eligibility. The full-text of all articles identified as potentially inclusive studies by both researchers were retrieved. These studies were then assessed independently by CD and DD based on the inclusion criteria, with CH checked against the selected full-text articles for relevancy and appropriateness. IM oversaw the data analysis process and acted as an impartial evaluator for making consensus decisions in disagreements that arose. Finally, all four reviewers were met and key concepts emerged from data analysis were discussed.

A standardised form (Microsoft Excel 2010, Microsoft, USA) was used to extract data from the included studies for quality assessment and evidence syntheses. **Table 2** outlines the categories from the data extracted.

Table 2 Data extraction categories

General information	Methodologies	Study findings
1. Main author	5. Study design	12. Study results or any relevant findings
2. Year published	6. Nature of study	
3. Study location	7. Study population	
4. Study objective(s)	8. Recruitment method	
	9. Inclusion/exclusion criteria	
	10. Data collection	
	11. Data analysis	

Data analysis and synthesis

The Enhancing Transparency in Reporting the Synthesis of Qualitative Research (ENTREQ) checklist was followed on the reporting of the synthesis.¹⁶ An integrated convergent synthesis approach, as adopted from Jennings *et al*, was performed in this systematic review.¹⁷ Rather than segregating the qualitative and quantitative synthesis, the findings were assimilated to each other during the same phase of the process in a parallel manner. Once transformed and merged, all data were subject to thematic synthesis using the steps described by Braun and Clarke.¹⁸ The software package QSR NVivo v11 (QSR International, Australia) was used to facilitate data analysis and synthesis.

Quality assessment

CS and DD independently assessed the study quality of included studies using the Mixed Methods Appraisal Tool (MMAT).¹⁹ The quality rating approach was adopted from Wranik *et al*, with studies ranked from 0 to 5 points based on meeting the five-item MMAT criteria.²⁰ Studies scoring between 0–2 points were rated as low, 3–4 points as moderate and 5 points as high in terms of quality. CS, DD and CH discussed and agreed on the final quality rating for each study.

This systematic review was registered with PROSPERO database (registration number: CRD42019137123).

RESULTS

Search results and characteristics

A total of 4199 citations were identified from the initial literature search and 32 full-texts articles were assessed for eligibility. At the end of the selection process, six studies were included. **Figure 1** describes the steps involved for the selection process.

Of the six included studies, two were qualitative, three were quantitative and one was mixed methods. The study characteristics of the included studies are listed in **table 3** (see online supplemental appendix 2 for full version).

Quality appraisal

There were two studies that were graded as 'high' in quality,^{21 22} with four graded as 'moderate'.^{23–26} Common areas of weakness were lack of sample representativeness of the target population,²³ questionnaires were not tested nor piloted for validity or reliability²⁴ and lack of clarity on minimising biases such as socially desirable and nonresponse bias (see online supplemental appendix 3 for full appraisal).^{23 26}

A framework approach was employed with themes derived from studies which have analysed indicators that address implementation quality in healthcare services.²⁷ These indicators have been successfully adopted into pharmacy settings by Garcia-Cardenas *et al*.²⁸ **Table 4** shows these adopted themes with their definitions for the purpose of results reporting in this systematic review.

Systematic review

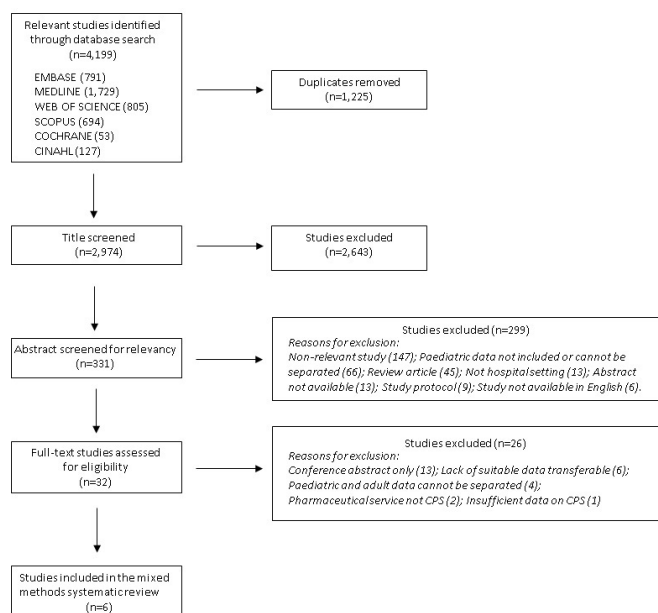


Figure 1 Flowchart of study selection process adapted from PRISMA. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

The analysis led to the identification of seven implementation factors which fell within five of the predetermined overarching themes. [Figure 2](#) shows a thematic map presenting the themes and implementation factors identified from the included studies.

Acceptability of clinical pharmacist

Other healthcare professionals' attitudes and acceptance

There was generally a positive attitude towards the role of CP from both physicians and nurses.^{22–26} Our data have showed that healthcare professionals' attitudes were found to be a prominent facilitator which interrelated to other implementation factors such as penetration into the institution and CP's self-efficacy:

... junior doctors valued pharmacists' information... the strength of medications, the amounts per bottle or box, their possible adverse effects, and their paediatric application when doctors had mostly prescribed for adults.²²

Physician and nurses in our study considered medication preparation by hospital pharmacy staff and involvement of clinical pharmacists at the NICU as potential benefit...²¹

However, some physicians felt the involvement of CP might affect their prescribing which would in effect pose as a barrier to CPS implementation, as illustrated by the quote below:

...study also reported some perception of loss of physician autonomy, interference in decision making, and even a feeling of being threatened by ASP (Antimicrobial Stewardship Programme) interventions.²⁴

Feasibility of the clinical pharmacy service model in the setting

Availability of clinical pharmacist on ward and outpatient settings

The availability of CPs was found to be a strong facilitator which enables CPS implementation.^{21–22–26} Studies described the benefits which physicians and nurses perceived when CPs were readily available to perform their duties:

The proximity of the pharmacist to the department (Emergency Department) allows for direct consultation and medication review by the pharmacist.²⁶

Using drug-related knowledge to perform clinical activities

Another subtheme that has submerged was that CPs can exert their expert knowledge in paediatric pharmacotherapy when performing activities which were more relevant to their roles.^{23–26} Evidence suggested that with CP performing drug-related activities, other healthcare professionals could redirect their energies into performing other clinical activities.²⁶ Furthermore, with CP performing these activities, it was found that healthcare professionals' felt more confident in improving patient outcomes, such as medication safety:

It is nice that you can just go out and pick it up without having to worry about looking for someone to perform double check... I also think that it is safer that way.²¹

Implementation costs of CPS

Resources for service provision and coverage

We found that the scarcity in financial resource was a barrier to CPS implementation, which has a subsequent negative effect on other factors such as the availability of CPs and training provided for them.^{21–23} The lack of resources was reflected by the constraint in manpower or time that CPs face:

Pharmacists' capacity for daily review of case notes was inhibited by the large volume of discharge interviews, admission reconciliation and discharge dispensing.²²

Despite the limitation in resources, we found that the service users' expectation of CPS remained high, and this has caused enormous pressure on CPs who provided these services.²²

Penetration into the institution

Involvement in a multidisciplinary team

The collaboration between CPs and other healthcare professionals was found to be a factor that facilitates the integration of CPS.^{22–24–26} The level of collaboration was reflected by the philosophy of teamwork, which plays a key role in influencing a successful implementation.²² The integration of hospital pharmacist into the multidisciplinary team was found to be highly desirable by healthcare professionals, especially in managing chronic illnesses.^{23–25} Moreover, the recognition of multidisciplinary approach created an opportunity to implement new services, which is also interrelated to the availability of CPs:

Many young people with chronic illnesses such as arthritis are seen in hospital outpatient rather than inpatient wards. The pharmacist is not traditionally involved in these clinics beyond the dispensing task, but there was openness to include them.²⁵

Clinical pharmacist's self-efficacy

Training in the highly specialised areas

One of the core skill identified which was fundamental to the service implementation was the expert knowledge of pharmacotherapy that CPs possess for this specific population. Examples from the literature have showed the need of skill development in areas such as neonatology and managing children with chronic illnesses.^{21–25} Appropriate training was perceived as a necessity from service users prior to service implementation:

However, clinical pharmacists are currently not involved in general in the medication treatment at the Danish NICUs and should

Table 3 Characteristics of the included studies (n=6) for the systematic review

Reference	Main author	Year of publication	Country	Site information	Study design	Participants	Study objectives	Data analysis	CPS involved	Quality rating
23	Chen	2013	Singapore	A 830 bed hospital that provides specialised paediatric and women's healthcare services	Quantitative (survey)	Caregivers who accompanied epileptic patients on neurology follow-up visits	To evaluate the utility of tailored educational pharmacist counselling in improving knowledge and self-reported confidence in patient care by caregivers of children with epilepsy.	Descriptive statistics	Medication counselling	4 (Moderate)
24	Flannery	2014	USA	A 180-bed tertiary care academic paediatric hospital	Quantitative (survey)	Physicians including paediatric fellows and advanced practice nurses	To assess prescribers attitudes about the Antibiotic Stewardship Programme, aimed to identify perceived strengths and weaknesses of the service, with the ultimate goal of maximising its effect on future prescribing behaviours.	Descriptive statistics	Antibiotic Stewardship Programme	4 (Moderate)
25	Grey	2017	UK	Nationwide	Mixed methods (focus groups, semistructured interviews and survey)	two pharmacy policy makers, three service commissioners, two pharmacy staff, five rheumatology professionals and three lay advocates	There were three phases of the study. The objective of the stakeholder interviews (phase 2) was to share ideas of practicing pharmacists about their current and future roles in the support of young people who take medication for chronic illness with stakeholders to devise a list of roles for prioritisation.	A 'middle-ordered' thematic approach	Pharmaceutical care	4 (Moderate)
26	Moadebi	2013	Canada	Lions Gate Hospital, a 335-bed acute care community teaching hospital	Quantitative (survey)	All nurses working in the site's Emergency Department	To measure the impact of the interprofessional collaboration and educational sessions conducted by the clinical pharmacist on ED nurses' level of comfort and satisfaction with intranasal fentanyl for children.	Descriptive statistics	Education sessions	3 (Moderate)
21	Rishoej	2018	Denmark	Three largest tertiary NICUs	Qualitative (focus groups)	Physicians and nurses who practiced at NICUs	To explore current and potential future practices to prevent medication errors experienced by physicians and nurses.	Qualitative content analysis	Clinical pharmacy services	5 (High)
22	Rosenfeld	2018	Australia	A major Australian paediatric teaching hospital	Qualitative (ethnographic study, focus groups and semistructured interviews)	Pharmacists, registered nurses and doctors from diverse clinical wards	To examine interdisciplinary medication decision making by pharmacists in paediatric hospital settings.	Thematic analysis according to the 'framework' approach	Ward service, medication decision making	5 (High)

Table 4 Themes used for this systematic review

Overarching themes	Operational definition
Acceptability	The perception among implementation stakeholders that CPS is agreeable, palatable or satisfactory.
Appropriateness	The extent to which CPS is suitable, fitting or proper for the hospital.
Feasibility	The extent to which CPS can be successfully used or carried out within the hospital.
Fidelity	The degree to which CPS is implemented and provided as it was described.
Implementation costs	Cost impact of CPS implementation effort.
Penetration	Level of integration of CPS within the hospital and its subsystems.
Service Implementation Efficiency (self-efficacy)	The degree to which clinical pharmacist improves his/her skills and abilities to provide it

CPS, clinical pharmacy service.

receive training before involvement, as these units are highly specialised.²¹

The attainment of the required knowledge in these specialised areas facilitates the acceptability of CPS, and the following quote illustrate how these factors were interrelated:

Pharmacists were viewed by staff as primary authorities about medication issues, particularly in making complex (medication) decisions...²²

Development of communication skills

Evidence showed that good communication between CP and nurses helped to develop a strong relationship, thus enabling the use of the service;²² however, similar findings cannot be identified between physicians and CPs. CPs were often found to work as a bridge between doctors and nurses for resolving pharmaceutical issues:

Communication informing medication decisions were principally dyadic... The ease with which nurses communicated with ward pharmacists and junior doctors, however, seemed more a matter of propinquity than hierarchy...²²

Our review has also revealed that pharmacist's face-to-face interaction with parents or caregivers has increased their confidence in managing children's conditions.²³ This experience extended to adolescents who seek help from pharmacists directly, as data suggested adolescents were more likely than other age groups to consider pharmacist a trustworthy source of information, thus showing how communication enables CPS implementation from their point of view.²⁵

DISCUSSION

With only six studies included in this review, the lack of research in this area seemed apparent. Heterogeneity of the service provided was shown across the inclusive studies. The difference in the characters of each service might have variable factors which influence the implementation. However, due to the limited evidence available, analysis of individual service was not possible; as a result, the data were analysed collectively as a whole.

The year of publications for the included studies suggested a recent growth of interest in this area, which is comparable with a recent systematic review in the adult setting.²⁹ The majority of publications were countries with relatively high health expenditure,³⁰ reflecting the gap exposed in research in countries with lower health expenditure in this area.

Healthcare professionals' attitude can be a facilitator for the implementation of paediatric CPS. Its value in CPS implementation was supported by research which advocated that positive attitudes between healthcare professionals nurtured teamwork and trust, which improves the quality and safety of patient care as a result.³¹ Unfortunately, we were unable to identify factors which demonstrate how patients, parents or caregivers' attitudes

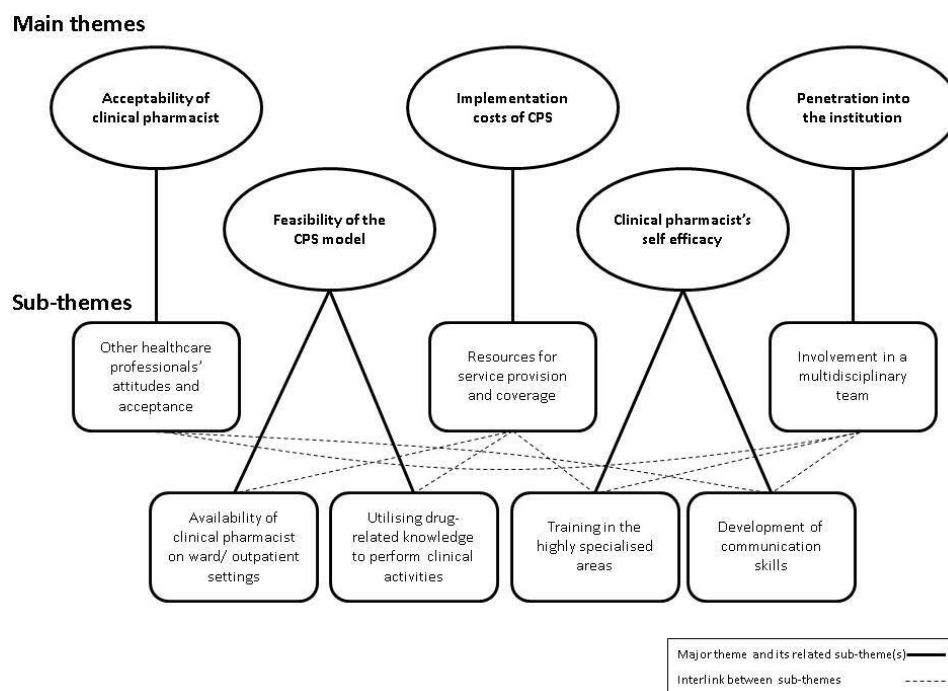


Figure 2 Thematic map showing the factors which influence the implementation of paediatric CPS in hospitals. The overarching themes were adopted from Garcia-Cardenas *et al*, with their subsequent subthemes derived from the data collected using thematic analysis. The broken lines illustrate the interrelationship between the subthemes identified from the analysis. CPS, clinical pharmacy service.

affect the implementation of CPS. Effort should be made in exploring how this can influence implementation, as evidence were apparent in other healthcare settings.^{32–34}

Studies have shown that the hierarchical structure within healthcare discourages interprofessional communication and collaboration.³⁵ Our findings suggested that CPs can help to mitigate this barrier, especially when they were available in real time situations such as ward round or impromptu conversations, acting as a bridge between physicians and nurses to solve any pharmaceutical-related issues.^{22–25} The benefits of having CPs available in the outpatient settings were also observed from patients' perspectives.³⁶ The benefits of such implementation were that long-term relationships could be developed which leads pharmacists to make individualistic, personalised interventions.³⁶ Our data suggested that similar perception was found in paediatric CPS.

The employment of CPs' expertise in performing clinical duties helped other healthcare professionals to focus on their non-drug-related duties, and the belief of improved quality of patient care was also observed. This appealing factor could lead to successful implementation of CPs, but study found that this was highly variable which depends on individual's perception and experience towards CPS.³⁷

Studies have pointed out that a multidisciplinary team supports high-quality care, patient and staff engagement and organisational efficiency.³⁸ The impact of the involvement of CP in multidisciplinary team on patient outcomes was evidential.^{39–40} This was found to be a strong implementation facilitator and its importance was reflected by the principle of the 'medication optimisation' paradigm endorsed by National Institute for Health and Care Excellence (NICE).⁴¹

The lack of resources was found to be a barrier to implement paediatric CPS. Shortages of CPs prevent proper collaboration such that understaffed pharmacists were overloaded with responsibilities, thus affecting the quality of CPS.⁴² Previous studies have found that the initiation of CPS by healthcare bodies or government was a facilitator to implementation.²⁷ However, we did not find any governmental or institutional policies in place to provide funding to advocate the implementation of paediatric CPS within the included studies. The support could be hindered by the scarce human and technological resources, pressure on cost containment as well as the lack of a motivational professional and career pathway development.⁴³ Research into the impact of CPS on patient outcomes and health economic data could perhaps help to ascertain its value.

In an economic evaluation of CPS in USA, training was found to be an important factor within the CPS structure which renders a cost-effective pharmacy programme.⁴⁴ Apparently, strategies such as clinical training for pharmacists could help to enhance the pharmacists' confidence and motivation to implement CPS in hospitals;²⁹ however, this was hindered with the fiscal restraint as shown from the included studies.

Researchers showed that the identification of implementation factors is one of the most important strategies to implement change.⁴⁵ Although our review has identified number of factors which could influence paediatric CPS implementation, a large knowledge gap in this area was also identified. Researchers should therefore focus on conducting implementation studies to allow policy makers to appreciate the multifactorial considerations for paediatric CPS implementation in hospitals.

This is a first systematic review to identify the factors which influence the implementation of paediatric CPS in hospital settings. We have used robust and recognised methods to integrate qualitative and quantitative data, and reported the

synthesis against the ENTREQ. Nevertheless, there are limitations to this review. First, some studies included both paediatric and adult patients in their study design and we were not able to separate the data; therefore, these studies had to be excluded. Second, the limited number of studies and majority of studies being single-site limited their transferability and generalisability to other healthcare systems. Third, since grey literature was not considered, it is not clear how this can influence the review. Last, since there was no consensus on the literature to exclude studies based on quality assessment, the majority of included studies were moderate in quality; therefore, study designs which produce high quality evidence is warranted.

CONCLUSION

This systematic review has found six studies, with seven factors identified which either facilitate or hinder the implementation of paediatric CPS in hospitals. These factors were: healthcare professionals' attitude and acceptance; the availability of CP; resources for service provision; involvement in a multidisciplinary team; using expert knowledge to perform drug-related activities; training in the specialised areas and the development of communication skills. There was very little research on how to implement paediatric CPS in hospitals and an extensive knowledge gap within this area has been identified. Nevertheless, this review has lent insight into some factors which influence the implementation of paediatric CPS in hospital settings. Due to the heterogeneity of different CPS activities provided in the included studies, further research should focus on identifying the factors that influence each individual service. Further research should also focus on how the characteristics of the individual CP affect implementation. With the enriched content available, analysis can be performed to highlight the factors which affect the implementation of each CPS activity, thus providing a strong foundation for strategic planning for paediatric CPS implementation and development including the required personal training and development.

Contributors CM-HS wrote the manuscript. CM-HS and DD conducted the study selection process and CH reviewed for the appropriateness of the included studies. CM-HS, DD and CH participated in the critical appraisal process. IDM and CH supervised the project and contributed to the final version of the manuscript.

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