Effect of clinical pharmacists on care in the emergency department: A systematic review

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Purpose. A systematic literature review was conducted to ascertain the scope of involvement of clinical pharmacists in the emergency department (ED); summarize economic, humanistic, and clinical outcomes data; describe current limitations of these data; and identify areas for future research.

Methods. A search of MEDLINE, The Cochrane Library, International Pharmaceutical Abstracts, and CINAHL Plus databases was conducted. Articles were included in this review if the title and abstract indicated that the article's content addressed the scope of involvement of pharmacists in the ED or pharmacist interventions in the ED and their associated outcomes, such as humanistic outcomes, cost avoidance, or improved quality. Qualitative analyses were conducted to characterize pharmacists' activities and effects in the ED.

Results. Of the 533 returned citations, only 17 met the inclusion criteria. Each provided a description of clinical pharmacy services at 12 different institutions. Descriptions of these institutions and job responsibilities of the ED pharmacists are described. Six studies reported information about pharmacist interventions, including the number and types of interventions, time spent per intervention, and acceptance rate of interventions. Four studies reported cost-related outcomes data.

Conclusion. A review of the literature revealed that pharmacists have been involved in the ED for decades. Services provided by pharmacists in the ED included traditional clinical pharmacy services, responding to medical emergencies, providing consultations on medication issues, identifying and reducing medication errors, and conducting medication histories at hospital admission. Some services were shown to be cost saving or cost avoiding.

Index terms: Clinical pharmacists; Clinical pharmacy; Economics; Errors, medication; Hospitals; Outcomes; Pharmaceutical services

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An Institute of Medicine report published in 1999 revealed that the emergency department (ED) was one of the three hospital departments with the highest rates of preventable adverse drug reactions in the hospital.[1] Although systematic reviews and research reports describing the benefits of clinical pharmacy services in various areas such as the intensive care unit and ambulatory care clinics have been published,[2-6] only a heterogeneous group of articles describing the role or effect of clinical pharmacy services in the ED have been published.[7-23] This lack of data has led to great debate over the need to allocate resources for clinical pharmacy services in the ED and how to implement such services in a way that would improve quality and safety within the ED setting.[24-27] Recently, the American Society of Health-System Pharmacists (ASHP) convened a panel of emergency medicine providers and pharmacists that resulted in the release of a statement on pharmacy services to the ED.[28] ASHP believes that hospital pharmacy departments should provide EDs with pharmacy services that are necessary for safe and effective patient care. In addition to this statement, a systematic review of published data that describe the role and value of clinical pharmacy services in the ED is needed.

The purpose of this study was to conduct a systematic review of the literature to ascertain the scope of

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involvement of pharmacy practice or services provided in the ED; summarize and describe the limitations of the economic, humanistic, and clinical outcomes data; identify areas for future research; and propose a research agenda. These data can be used to justify current ED clinical pharmacy positions, used to identify gaps in information concerning the pharmacist's role in the ED, and used by regulatory bodies to better position the role of the pharmacist in the ED.

Methods

All English-language articles were included in this review if the title and abstract indicated that the article's content addressed (1) the scope of involvement of pharmacists in the ED or (2) pharmacist interventions in the ED and their associated economic, humanistic, and clinical outcomes.

Literature search. A search of MEDLINE, The Cochrane Library, International Pharmaceutical Abstracts (IPA), and CINAHL Plus databases was conducted using the keywords *ED or emergency department* and *clinical pharmacist or clinical pharmacy services.* Manual searches of the bibliographies of included articles were performed. Articles were excluded if the pharmacist providing services to ED patients did not routinely practice in the ED but provided consultations for ED patients. A single pharmacist performed the initial systematic search, with subsequent review by a second pharmacist of all included and excluded studies. The primary author reviewed the final selection of articles for completeness.

Data analysis. Qualitative analyses were conducted to characterize pharmacists' activities and effects in the ED. The articles were categorized by the description of services, the various activities of the ED pharmacists, the interventions reported, analysis of cost savings and cost avoidance, analysis of medication error reduction and involvement in conducting medication histories, and outcome measures or satisfaction data associated with the ED pharmacist or the pharmacy service.

Results

The literature search returned 533 citations, 16 of which met the inclusion criteria. Each of these reports provided a description of clinical pharmacy services at 12 different institutions.[7-21,23] The characteristics of these institutions are listed in Table 1. Reports of clinical pharmacy services in the ED began to emerge in 1977.[7] Teaching hospitals were the type of institutions reported in 11 (91.7%) of 12 articles that have deployed pharmacists to the ED, with a mean ± S.D. rate of 65,898 ± 30,431 annual admissions (range, 21,000 to over 120,000 admissions), serving large metropolitan areas. The hours of operation varied from routine 8-hour shifts to 24-hour services provided seven days a week. Hours of operation did not appear to be correlated with annual admission rates.[7-21,23] Only 3 (25%) of the 12 institutions described having a satellite pharmacy.[9,11,15]

Pharmacist activities. Table 2 lists over 50 elements of job responsibilities or tasks reported in the 17 articles, with various articles reporting multiple tasks performed by ED clinical pharmacists. The scope of involvement varied among institutions due to the various needs of the ED, the pharmacist's training, and the allocation of resources. The time spent performing each activity also varied and depended on the presence of an ED satellite pharmacy, the availability of pharmacy technicians, and the technology of the ED (e.g., automated dispensing machines, computerized physician order entry). The most common role for the ED pharmacist, reported in 73.3% of the articles, was conducting consultations.[7,8,10-15,17,18,21]

Several institutions reported unique pharmacists' activities or job responsibilities in their ED. Kasuya et al.[10] described the emergency services provided by pharmacy residents at the University of Illinois at Chicago. These services included obtaining emergency serum drug levels for theophylline, phenytoin, phenobarbital, and primidone using an enzyme-mediated immunoassay technique in a pharmacy laboratory within the ED. Residents interpreted results and provided a written pharmacotherapeutic consultation, including an interpretation of the level and appropriate patient management. Pharmacy residents provided clinical pharmacy services to the ED between 5 p.m. and 7 a.m. on weekdays and round-the-clock services on weekends and holidays through use of an on-call pager.

Mialon et al.[13] described ED clinical pharmacy services provided at Children's Medical Center in Dallas, Texas. One of the main goals of their ED pharmacy program was to decrease the potential for medication errors. This was done in a number of ways, including tracking "due times" for repeat medications, completing medication histories, and documenting all patient weights, heights, and allergies. They reported an 80% reduction in medication errors after implementation of ED clinical pharmacy services and a projected cost saving of over $800,000 annually. Pharmacists also provided discharge counseling for all patients with newly diagnosed epilepsy, diabetes, asthma, and other diseases, as appropriate. The pharmacists also provided the patients with a website link for more information if they had questions once they were discharged.

Wymore et al.[20] described the ED pharmacist's follow-up on culture and susceptibility results. The pharmacist reviewed a report of the culture and susceptibility results of patients seen in the ED daily and adjusted or discontinued therapy as

Table 1.
Description of ED and Pharmacy Services at Time of Publication[a]

Ref(s).	Hospital Name (Location)	Pharmacy Services Offered	Type of Hospital	Annual No. ED Admissions	No. ED Beds	Year CPS Implemented
7, 8	Truman Medical Center (Kansas City, MO)	NR	Teaching	30,000[7] and 40,000[8]	NR	1974
9, 12	Detroit Receiving Hospital (Detroit, MI)	Satellite pharmacy, 24/7 pharmacist coverage	Teaching	72,000[9] and 75,782[12]	NR	1980
10, 18	University of Illinois at Chicago (Chicago, IL)	24/7 coverage, pharmacist available weekdays 7 a.m.–5 p.m., pharmacy residents available all other times	Teaching	21,000[10] and NR[18]	NR	1979
11	Toronto East General and Orthopaedic Hospital (Toronto, Ontario)	Day shifts Monday–Friday and as requested during satellite pharmacy hours of 7:30 a.m.–7:30 p.m.	Community with teaching affiliation	New ED built with capacity for 65,000	NR	1989
13	Children's Medical Center (Dallas, TX)	24/7 pharmacist coverage	Teaching	Over 120,000	NR	2002
14, 23	University of Rochester (Rochester, NY)	Pharmacist available weekdays 10 a.m.–6 p.m.[14] and NR[23]	Teaching	90,000[14] and 93,000[23]	120[14] and NR[23]	2000[14] and NR[23]
15	Grady Health System (Atlanta, GA)	Satellite pharmacy, 3 p.m.–11 p.m. daily; pharmacist available 10 a.m.–7 p.m. weekdays	Teaching	Over 100,000	120[b]	2001[b]
16	University of Kentucky, Chandler Medical Center (Louisville, KY)	Critical care pharmacy residents available Monday–Saturday 4 p.m.–12 a.m.	Teaching	NR	NR	NR
17	Detroit Receiving Hospital (Detroit, MI)	Satellite pharmacy, 24/7 coverage	Teaching	Over 84,000	100	1980
19	University of Kansas Hospital (Olathe, KS)	Pharmacist completed ED medication histories 9 a.m.–11 p.m. for 3 mo	Teaching	Over 40,000	NR	NR
20	Saint Joseph Medical Center (Tacoma, WA)	Pharmacist available 10 a.m.–8:30 p.m. daily	Tertiary care; teaching	50,000	35	2005[b]
21	Cape Fear Valley Medical Center (Durham, NC)	Pharmacist completed medication histories 9 a.m.–11 p.m. for 3 mo	Community	Over 91,000	44 adult beds, 13 pediatric beds	2006[b]

[a]ED = emergency department, CPS = clinical pharmacy services, NR = not reported, 24/7 = 24 hours a day, 7 days a week.
[b]Results obtained from personal correspondence with author.

needed. If a patient had been discharged and the laboratory results would require a change in therapy, the patient was contacted, and necessary arrangements were made for the patient to receive an appropriate antibiotic prescription. These measures prevented patient readmission to the ED.

Outcomes. Various studies reported outcomes data, including intervention analysis, cost analysis, medication error prevention, and medication histories and survey data.

Six studies reported information about pharmacist interventions, including the number and types of interventions, time spent per intervention, and acceptance rate.[10,15-18,21] The results of these studies are described in Table 3. The mean ± S.D. duration of observation for these studies was 10.8 ± 12.8 months (range, 1–30 months). The mean ± S.D. number of interventions was 1500 ± 1476.2 (range, 183–3787 interventions), with a mean ± S.D. acceptance rate of 93% ± 4.98% (range, 89–98.6%). Of the six reports, 5 (83%) were retrospective, with a mean ± S.D. duration of observation of 12.2 ± 13.8 months (range, 1–30 months). The mean ± S.D. number of interventions was 1371 ± 1611.7 (range,183–3787 interventions), with a mean ± S.D. acceptance rate of 93% ± 4.98 (range, 89–98.6%).[10,15,16,18,21] Categories of interventions reported were within the normal scope of a generalist-trained clinical pharmacist, suggesting similar process and quality improvements with interventions conducted by pharmacists in other settings. However, the various intervention categories differed among institutions, suggesting a need for standardization. Documentation methods differed among institutions and included paper cards, personal digital assistants, and computer programs.

Four studies reported cost-related outcomes (Table 4). The mean ± S.D. duration of observation reported

Table 2.
Summary of Pharmacist Activities in the ED Reported in the Literature Between 1976 and 2008 (*n* = 17)[a]

Activity	Ref(s). (% of All Articles)
Aid in poisoning/toxicology cases	10–14,16–18 (53)
Answer drug information questions	9–13,15–18, 20 (67)
Anticoagulation services	17 (7)
Assist nurses with calculating drip rates	9, 13, 20 (20)
Compounding	16 (7)
Conduct chart reviews	11, 12, 14, 20 (27)
Conduct drug-use evaluations	11–13 (20)
Conduct quality assurance	12, 13 (13)
Conduct research	7, 8, 12, 13, 17, 20 (40)
Coordinate ambulatory health services	8 (7)
Counsel patients on inpatient and outpatient therapy	7, 8, 11, 13–16, 21 (53)
Discuss patient compliance with provider	12, 13 (13)
Document interventions	11–16, 19 (47)
Ensure compliance with CMS and JC standards	20 (7)
Facilitate patient transfer to the floor and ensure continuity of care once patient is transferred	11, 13, 14, 20 (27)
Fill ED outpatient prescriptions for difficult to find, after-hours, emergent prescriptions	13 (7)
Follow up on microbiology culture data	20 (7)
Identify drugs	11–13, 20 (27)
Maintain ED compliance with pharmacy procedures	7–9 (20)
Maintain formulary compliance of medications in ED	7–9, 15, 17 (33)
Maintain inventory of all drug supplies in ED	9, 11, 14 (20)
Manage disease state and drug therapy	7, 8, 20 (20)
Manage prescriptions for indigent care and outpatients	13, 17 (13)
Monitor and inform providers about medication's adverse effects and interactions	12, 13 (13)
Monitor and report adverse drug reactions	11–13 (20)
Monitor clinical outcomes	12, 13, 20 (20)
Obtain allergy histories	12, 13, 15, 17, 19 (33)
Obtain immunization histories	19 (7)
Obtain medication histories	11, 13, 14, 16, 18–20 (47)
Participate in drug distribution activities	9, 11–15, 17, 20 (53)
Participate in emergency-preparedness efforts	14, 21 (13)
Participate in resuscitation or trauma teams or both	9, 12–14, 18, 20 (40)
Participate in the acute MI and STEMI team	20 (7)
Participate on hospital committees	7, 8, 20 (20)
Participate on rounds	9, 11-14, 20 (40)
Perform consultations	7, 8, 10–15, 17, 18, 21 (73)
Perform emergency serum drug levels	10, 18 (13)
Prepare i.v.'s	9, 15, 17, 20 (27)
Prepare medications trays and CPR kits for ambulance units	9 (7)
Prospectively review medication orders	9, 14, 20 (20)
Provide pharmacokinetic monitoring	10–14,16–18 (53)
Provide staff education	7, 8, 11–17, 21 (67)
Provide 24/7 pharmacy services	13, 17 (13)
Recommend alternative drugs if there is a shortage	13 (7)
Recommend alternative routes of administration	12, 13, 17 (20)
Recommend appropriate pharmacotherapy	13, 14, 16, 17 (27)
Recommend dosage adjustments	12–15, 17, 20 (40)
Recommend drug compatibility analysis	12–14, 17, 20 (33)

Continued on next page

Table 2 *(continued)*

Activity	Ref(s). (% of All Articles)
Recommend and monitor serum drug concentrations	8, 10, 11, 13, 18 (33)
Screen patients and order pneumococcal and influenza vaccinations	20 (7)
Serve as preceptor to fellows	13 (7)
Serve as preceptor to residents	7–10, 13, 14, 20 (47)
Serve as preceptor to students	7–9, 11–14, 20 (53)
Transcribe orders	13, 15, 17, 20 (27)

[a]CMS = Centers for Medicare and Medicaid Services, JC = Joint Commission, ED = emergency department, MI = myocardial infarction, STEMI = ST segment elevation myocardial infarction, CPR = cardiopulmonary resuscitation, 24/7 = 24 hours a day, 7 days a week.

in these articles was 11.4 ± 16.5 months (range, 0.5–36 months). The mean reported costs avoidance was $355,021.[12,14,15,17] Three studies used a retrospective study design. The mean ± S.D. duration of observation for these articles was 13.8 ± 19.3 months (0.5–36 months), with a reported mean cost avoidance of $130,103.[12,14,15]

In a prospective study of 252 medication histories, those histories taken by ED providers were 78% incomplete, and 18% contained immunization histories.[19] Medication histories taken by a pharmacist were 100% complete, and 100% contained immunization histories. In addition, pharmacists documented 7% more medication allergies than did ED providers. In a retrospective study of 490 medication errors that occurred in 198 patients, there was a 66% relative risk reduction in the number of medication errors ($p = 0.0001$) when a clinical pharmacist was present in the ED.[21] Further, the acceptance rate of pharmacist recommendations was 98.6%. These data suggest that a pharmacist in the ED can reduce medication errors.[16,19,21] These data also contribute to the achievement of various ASHP 2015 Health-System Pharmacist initiatives, such as increasing the number of hospitals that will have pharmacists involved in obtaining medication histories on admission and involved in medication safety within the institution.[28]

Lastly, two studies reported results of surveys.[7,22] Both of these studies administered internal surveys to assess staff perception of clinical pharmacy services in the ED. In the first study, a 14-item questionnaire was administered to determine staff attitudes toward the pharmacist and clinical pharmacy services in the ED.[7] Fifty-four questionnaires were distributed to 17 ED physicians (residents and attending physicians), 20 residents who had completed a rotation of one month or longer in the ED in the previous year, and 17 ED nursing staff. Medical students on rotation and nonprofessional personnel in the ED were excluded. The response rate was 72% ($n = 39$). All respondents agreed that the pharmacist was a benefit to patient care and an important component of the department, 95% felt the pharmacy role was transferable to other EDs, 87% of physicians agreed that the pharmacist is capable of providing primary care to select patients once a diagnosis has been made, and 83% of physicians were willing to have their patients charged for these services.

In the second study, a 26-item survey was administered to medical and nursing staff to determine staff perceptions of ED pharmacy services.[22] Fifty percent of ED staff members (91 of 182) were randomly selected to receive an e-mail request to complete the Web-based survey. Staff members included all attending physicians, fellows, residents, and midlevel providers (nurse practitioners and physician assistants). A total of 75 staff members responded (82%). Of the respondents, 99% agreed that the pharmacist improved the quality of care, 96% felt the pharmacist was an integral part of the team, and 93% had contacted the pharmacist at least a few times during their past five shifts.

Discussion

ED clinical pharmacy services have been established for over 30 years and are predominantly deployed in teaching institutions and in larger metropolitan areas where dense populations are served. Pharmacy hours of operation vary significantly, and few hospitals have satellite pharmacies in the ED, suggesting that pharmacists and pharmacy services within the ED are patient-care focused and require visibility to provide services.

The summary of the data implies that ED pharmacists are already conducting a form of prospective review of medication orders in various institutions. Standards for methods for prospective review based on models used by these organizations should be described, made transferable to other institutions, and used as best practices to meet the Joint Commission's MM 4.10 standard for prospective review of medication orders. Variations in the standard should be based on the unique characteristics of each ED; as long as they are rational, acceptance of these unique entities should be permitted.[29]

The data suggest a voluntary demand for pharmacy services provided by pharmacists in the ED derived not from regulatory requirements but from acknowledgment of a unique set of skills and on-the-job training acquisition best suited to and delivered by a pharmacist. As novel ED activities were highlighted in the articles reviewed, it appears that the ED is a setting fertile for novel programs and unique practices developed to

Table 3.
Summary of Studies of Pharmacy Service Interventions Provided in Emergency Department

Ref.	Study Design and Duration	No. Interventions Reported	Type of Intervention (%)[a]	Time Per Intervention (Acceptance Rate, %)
10	Retrospective, 2 yr	2283[b]	Therapeutic consultation (90), drug information (10)	68 min for year 1, 134 min for year 2 (91.5)
15[c]	Retrospective, 5 mo	401	Dose and frequency adjustments (29), formulary interchange (16), professional services (13), allergy documentation (9)	21–30 min for 52% (89)
16	Retrospective, 1 mo	201	Pharmacotherapy (36), patient counseling (23), dosage (20), pharmacy clarifications (6), pediatric questions (5), toxicology (5), resuscitation events (2), compounding (1), pharmaceutics (1)	NR[d]
17	Prospective, 4 mo	2150	Drug information (16.8), dosage adjustment (16.4), nursing questions (14.7), formulary interchange (8.4), pharmacotherapy (8.4), order clarifications (7.6), change to alternative drug therapy (7.3), compatibility issues (6.7), patient information (3.6)	NR
18	Retrospective, 2.5 yr	3787	Change route of administration (3.1), discontinue drug therapy (2.7), toxicology (2), allergy notification (1.9), drug therapy duplication (0.4), drug interaction (0.09), asthma or chronic obstructive pulmonary disease (33), toxicology (22), seizures (17.5), cardiology (11), miscellaneous (9), pharmacokinetics (7.5)	Mean ± S.D. time, 100 ± 83 min (NR)
21	Retrospective, 1 mo	183	Dose calculation (29), inappropriate dosage, drug, route, or schedule (26), order clarification (16), allergy documentation (12), miscellaneous or unspecified (8), approval of nonformulary medication (4), identification of duplicate therapy (4), clarification of medication history (1), identification of drug interaction (1)	NR (98.6)

[a]Calculated using the number of interventions as the denominator.
[b]Reported as number of consultations.
[c]Only top four interventions reported.
[d]NR = not reported.

meet the demand and need of the patients and the community.

The cost-avoidance data reported in the articles reviewed lack formal structured pharmacoeconomic analysis. Despite this limitation, the implications of these data are that hiring a pharmacist deployed to the ED pays for itself through cost-avoidance data. Whether this is sufficient for hospital administrators to support funding is still unknown. However, these data suggest that at a minimum, an ED pharmacist may improve processes, reduce errors, and improve the quality of services demanded by ED staff at no additional cost to the institution. The summarization of these data may be limited because each institution used a different method to calculate cost savings and cost avoidance; however, each method was consistent within the institution. In most cases, these figures were calculated to justify ED services and pharmacy service expansion.

There are obvious limitations of applicability of internal surveys; however, a common positive theme toward the role of the pharmacist in the ED expressed by nursing and medical staff suggests that the pharmacist will not intrude on or disrupt the emergency care process.

Limitations to this systematic review include publication bias, as pharmacists who have unsuccessfully implemented services within the ED setting may not have pursued full publication of their data. Furthermore, many of the articles were published as descriptive reports, and the pharmacist authors may have had a positive bias regarding their efforts.

Selection bias may have occurred as our search strategy selected articles that reported on the benefits of pharmacists in the ED. We did not include "gray literature," which may include anecdotal commentary from some people in the emergency medicine and nursing societies who do not agree with the clinical benefit of a pharmacist in the ED. For example,

in a 2007 issue of *Emergency Medicine News*,[25] Dr. Tom Scaletta, the Director of the American Association of Emergency Medicine, stated that “Prospective pharmacy review of ED prescriptions was likely unnecessary especially when a doctor-nurse team was capable of making a good decision about when to give a medication” and that “It would slow things down and force hospitals to use resources for something that wasn’t necessary. That means something else wouldn’t get the resources it needed.” Despite this contention, medication errors are not uncommon in the ED, the majority of which are preventable and directly related to negligence.[30] Furthermore, there are no randomized, controlled trials supporting the contention that a pharmacist added to the emergency care team would slow things down. As illustrated in Table 4, annual cost-avoidance data suggest a return-on-investment cost, justifying the ED pharmacist position and avoiding the assumed opportunity cost suggested.[25]

To reduce publication bias, we conducted multiple searches from various databases; however, no data suggesting a negative effect of the ED pharmacist were reported. However, clinical pharmacists may not detect all errors and may be involved in drug-related morbidity, which must be considered in the tradeoff of employing such an intervention in the ED.

What would be of greatest interest would be descriptions of how organizations first decided to deploy a pharmacist into the ED, as this insight may provide an understanding of organizational gaps in care or processes that were resolved with deployment of a pharmacist in the ED. For example, was it economic, humanistic, or clinical forces that incorporated the pharmacist within these ED settings? Most of the studies published were not of high quality compared to the gold standard of randomized controlled trials.

Table 4.
Summary of Studies That Analyzed Cost Avoidance Resulting from Emergency Department Pharmacy Services

Ref.	Study Design and Duration	Analysis	Outcome
12[a]	Retrospective, 3 yr	Analysis of clinical interventions, cost savings primarily based on material cost savings resulting from the costs of the drug plus necessary equipment; cost of pharmacist and nursing time for drug preparation not included	Annual cost avoidance = $41,571.20 in 1989, $54,007.09 in 1990, $93,561.22 in 1991
14[a]	Retrospective, 2 wk	Informal cost analysis using 14 randomly selected days during the CPS phase-in period. Data from quality-assurance logs, maintained using ASHP’s CliniTrend software, used to calculate cost savings based on changing medication, dosage, or route of administration and avoiding inappropriate medication choices	Reported average cost avoidance/day = $589.00, projected annual cost avoidance = $214,985
15	Retrospective, 5 mo	Pharmacist interventions characterized as events avoided due to intervention and further divided by cost avoidance, based on an internally validated model	Reported total cost avoidance = $192,923, projected annual cost avoidance = $385,846
17	Prospective, 4 mo	Analysis of interventions based on cost and probability of harm if the intervention had not taken place. Interventions reviewed by physician and pharmacist; pharmacist’s wage and supplies incorporated into calculation	Reported total cost avoidance = $1,029,776, projected annual cost avoidance = $3,089,328

[a]Reported cost savings, which are equivalent to cost avoidance. CPS = clinical pharmacy service.

As such, inference to the effect of a clinical pharmacist in the ED as a strategy for one specific element such as reducing medication errors, improving quality, or cost avoidance may not be generalized to all ED settings. Because of the broad mix of activities and patients, it is unlikely to accumulate sufficient effect size to show statistical significance of any individual element.

Higher level data such as randomized controlled trials are required. Most notably, studies of institutions with and without pharmacists at varying seasonal and peak time activities and with very explicit measurable outcomes that are standardized and accepted across disciplines would be the gold standard. However, employing gold standard scientific methodology may be difficult simply because the large variation in activity completed on a daily basis may not permit for consistent effects to be measured. Instead, an index that takes into consideration a cumulative average of performance quality indicators, safety measures, and other varying tasks as an overall assessment of benefit would better support a national movement toward having pharmacists in the ED and could better delineate where, when, and how the ED pharmacist can be best utilized to improve quality.

There were other limitations to this study. For example, the scope of involvement varied greatly among institutions. Differences in the scope of pharmacist involvement may also be due to a lack of an established framework or guidelines pertaining to ED clinical pharmacy. While job responsibilities can be classified into similar categories among institutions, there is a lot of variability in time allocation and in resources. This is necessary, to some degree, because the needs of each institution vary. However, more articles are needed describing how to implement clinical pharmacy services and standardizing practice. This will occur naturally as more governing bodies, such as ASHP and the Joint Commission, implement or clarify policies regarding ED practice. In the meantime, institutions with ED clinical pharmacy services should be encouraged to conduct studies and publish results of their efforts to provide a framework for institutions seeking to implement clinical pharmacy services and also as a means to justify these positions.

Also, though 17 studies were included in this review, they were mostly descriptive in nature. This review cited several studies that reported cost-avoidance and savings data and decreases in medication errors associated with clinical pharmacy services. These outcomes are often not the primary outcomes of the study. More data that describe these outcomes in detail are needed, and institutions with clinical pharmacy services in the ED are encouraged to conduct and publish their research efforts.

Studies documenting ED pharmacist involvement on patient-specific outcomes are needed. An example of such outcome data was recently reported by Zed and Filiatrault,[23] who conducted a prospective cohort study of Vancouver General Hospital's outpatient venous thromboembolism (VTE) treatment program over a seven-year period and measured recurrent rates of VTE at three and six months following discharge, bleeding complications, thrombocytopenia, and patient satisfaction associated with a pharmacist-managed ED-based outpatient VTE treatment program. The investigators reported that 305 patients were safely and effectively managed by a ED-based outpatient treatment program for VTE, and patient satisfaction was high.

Many institutions conduct internal pilot studies to determine cost savings and the effect of clinical pharmacy services in the ED. These pilot programs are often completed by a pharmacy resident and are used as justification for implementing permanent services in the ED. Many such studies are presented as posters or presentations at local and national meetings. This review included only abstracts that were searchable in IPA or descriptions published in pharmacy journals (in the form of letters to the editor or an article written in a monthly column). Individuals performing such studies should be encouraged to publish the results of their pilot programs in emergency medicine or pharmacy journals.

Conclusion

A review of the literature revealed that pharmacists have been involved in the ED for decades. Services provided by pharmacists in the ED included traditional clinical pharmacy services, responding to medical emergencies, providing consultations on medication issues, identifying and reducing medication errors, and conducting medication histories at hospital admission. Some services were shown to be cost saving or cost avoiding.

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