Original Article

Mahidol University Journal of Pharmaceutical Science 2012; 39 (1), 38-43

Systematic Review of Economic Evaluation of Pharmacist Intervention Related to Adverse Drug Event Prevention among Patients with Hospitalization

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Abstract

The involvement of a pharmacist intervention is one the most common techniques for reducing ADE. The cost-effectiveness information of pharmacist interventions related to ADE prevention would be very important and useful for healthcare administrators and providers when making a decision. This study aimed to systematically review previous economic evaluation studies of pharmacist intervention related to ADE prevention. A systematic review of studies reporting both costs and outcomes of pharmacist intervention related to ADE prevention during 1990-2010 was performed through four electronic databases. The studies published in English language and related to humans were included. The total of 73 articles was retrieved and 68 articles were excluded. Finally, five articles were included. All selected studies were different in terms of intervention, time horizon, methodology, and outcome measurement. From the review, pharmacist intervention tended to provide economic benefits due to saved treatment cost of preventable ADEs (pADEs). It was shown that over a 5-year time frame pharmacist intervention could provide mean net benefits of £27.25 million because it could reduce medication errors. In addition, when compared to nurse-based intervention, computerized assessment approach, and medication faxed from physicians, pharmacist intervention was predicted to prevent medication errors the most. Pharmacist intervention would be a cost-saving strategy that may not utilize many resources and large amount of budget. It is worth to be implemented in healthcare settings in order to prevent the preventable ADEs and may be improve patient outcomes.

Key words: Adverse drug event, Pharmacist intervention, Systematic review, Hospitalized patient, Prevention

INTRODUCTION

An adverse drug event (ADE) is an injury due to a medication usage which caused by medication error (ME) and adverse drug reaction (ADR)[1-2]. ADE is the clinically significant medication related problems. In 1994, ADE was the fifth leading cause of death of hospitalized patients in the United States[3]. Severe ADE occurred in about 3% of patients per course of drug treatment and 10% of severe ADE resulted in death[4]. The consequences of ADE were hospital admission, extended hospital stay, lower patient satisfaction, and an increase in cost of patient management [1-2]. Therefore, prevention of ADE helps not only improving patient's clinical outcomes but also saving cost of treatment.

In Thailand, ADE is also a major health problem in hospitals. Most medication related problem studies were due to ADR. Panrong A found that the

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incidence of ADR at Queen Sirikit National Institute of Child Health was 3.7%, nearly all were ADR after admission[5]. ADR associated with extended length of stay was 3.91-5.92 days. Moreover, the average additional costs in patients with ADR were 506.56 baht per case.

A pharmacist intervention is one of the most common techniques for reducing ADE[7]. However, there are several methods to detect ADE. Questions remain about which method for ADE prevention in patients should be used. In addition, there is a very limited budget to conduct healthcare programs related to ADE prevention. Therefore, healthcare decision makers and providers need to know the cost-effectiveness and cost-benefit information of the pharmacist intervention related to ADE prevention before making a decision. The objective of the study was to systematically review and summarize the previous published economic evaluation studies of pharmacist intervention related to ADE prevention.

MATERIALS AND METHODS

A systematic search of electronic databases including NCBI Pubmed, the Cochrane Library, CRD database and CEA Registry was conducted to identify economic evaluation studies of pharmacist intervention related to ADE prevention published from January 1990 to November 2010. Searching terms used were as follows: "Drug Toxicity" [Mesh] OR adverse drug event* OR adverse drug reaction* OR drug relate* problem* OR medication* error* OR ADE OR ADR OR DRP) AND ("Cost-Benefit Analysis"[Mesh] OR cost benefit OR cost effective* OR cost utilit* OR cost evaluation* OR economic evaluation* OR CBA OR CEA OR CUA) AND ("Pharmacists"[Mesh] OR pharmacist*. In addition, searching strategy was tagged in the field of title or abstract.

Inclusion and exclusion criteria

Studies were included in this review if they fulfilled all of the following criteria. Inclusion criteria were the studies reporting both costs and outcomes with the results of studies comparing pharmacist interventions with control group or others interventions that related to ADE prevention in inpatients, articles published in English, and original research with full-text article. Studies were excluded if they were evaluated only costs or outcomes of the interventions.

Assessment

Titles and abstracts of studies identified by the electronic search were screened by the authors based on the inclusion criteria. After title and abstract screening, an electronic copy of each article was obtained for full review. In the full review process, data of each study were recorded in data extraction form in Microsoft Office Excel 2007. The sections included in the form were as follows: citation, publication year, objective, perspective, setting, interventions, comparator, methods, costs (direct/indirect cost), outcomes, time horizon, discounting, sensitivity analysis, and results.

RESULTS AND DISCUSSION

Figured 1 demonstrates the systematic review process used in this study. Based on the searching strategies as described above, 73 articles were initially identified from the electronic databases. After considering inclusion and exclusion criteria, five articles were included in the final review. There is no an additional study through the bibliography searches. Table 1 describes five articles in details.

The results of five studies were heterogeneity due to the differences in intervention, time horizon, methodology, and outcome measurement. Four articles were conducted based on healthcare provider perspective. There was one article that did not specify perspective, but from the costing method, it indicated that healthcare provider perspective was used. Indirect cost was not included in all studies. There were two studies that used a model-based approach, whereas the others used a prospective approach. Two studies reported both cost and outcome but did not calculate incremental cost-effectiveness ratio (ICER). A sensitivity analysis was performed in two studies.

From overall results of studies, pharmacist intervention tended to gain economic benefits and reduce preventable ADEs. It was shown that over a 5-year time

frame pharmacist intervention could provide mean net benefits of £27.25 million because it could reduce medication errors. In addition, from Karnon et al's study in 2009, all interventions including nurse - based intervention, computerized assessment approach, medication faxed from physicians and pharmacist intervention led to economic benefits. However, pharmacist intervention was predicted to prevent medication errors the most and could provide the largest net benefits. Smythe et al's study indicated that the projected annual drug therapy cost saving from the provision of pharmaceutical care was $42,474.45. Although an increase in SF-36 score of patients receiving intervention was not significant different compared to those without receiving intervention, pharmacist interventions related to ADE prevention could also contributed to patient's quality of life due to an increase in quality adjusted life year gained.

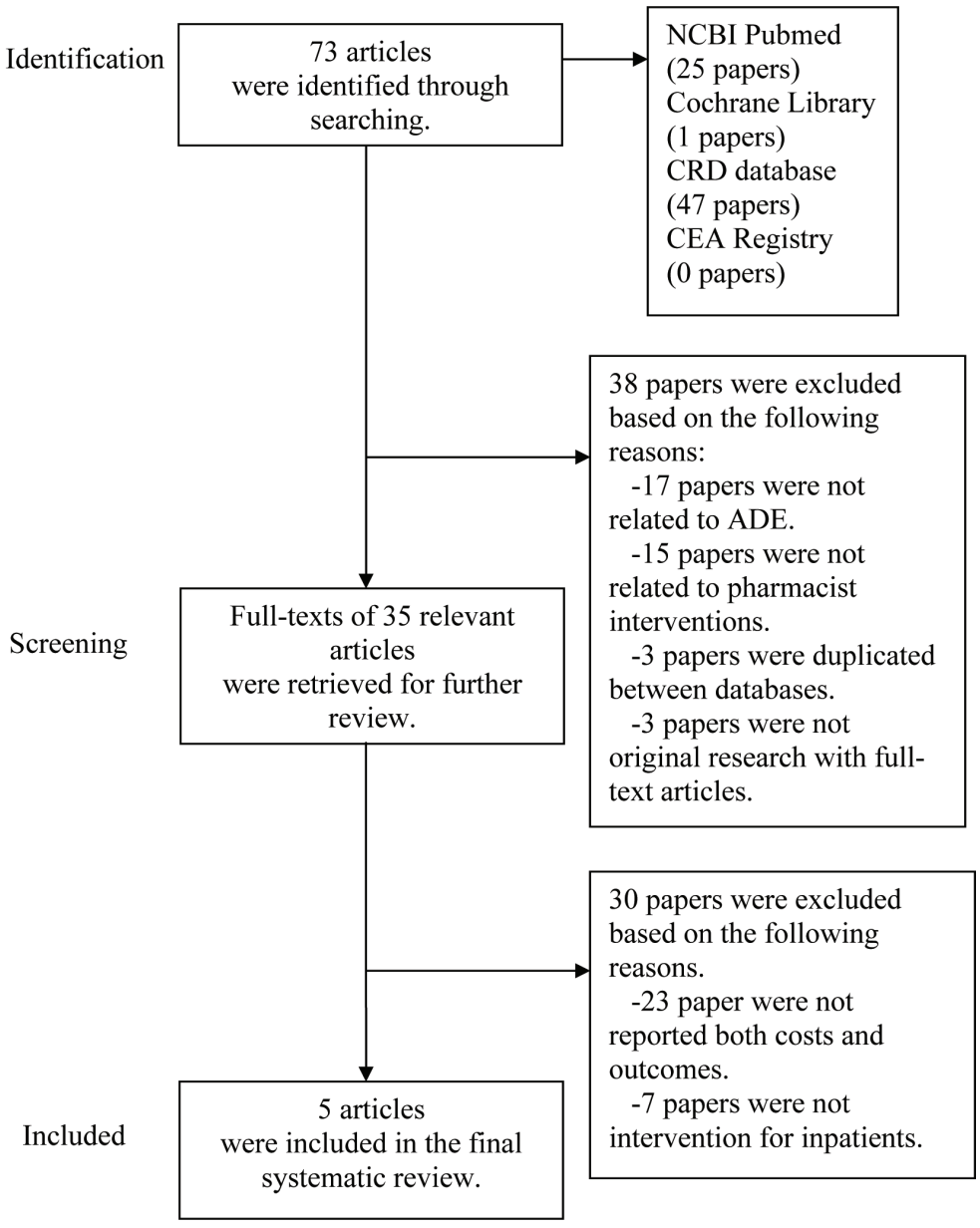

Figure 1. The systematic review process used in this study.

Table 1. Results of systematic review

Data	Karnon J et al. (2009)[8]	Karnon J et al. (2008)[9]	Smythe MA et al.[10]	Lee KL et al.[11]	van den Bemt PM et al.[12]
Publication Year	2009	2008	1998	2000	2002
Setting	UK hospital	UK hospital	USA hospital	Taiwan hospital	Dutch hospitals
Perspective	Healthcare provider	Healthcare provider	N/A	Healthcare provider	Healthcare provider
Intervention	1. Pharmacist-led reconciliation 2. Standardized forms 3. Nurses taking histories 4. Computerized assessment 5. Medication faxed from the GP	1. CPOE* 2. Pharmacists participating on ward rounds 3. bar coding system	Pharmaceutical care system	TDM** program for CsA	Detection prescribing error by hospital pharmacist
Method	CUA (decision tree model)	CBA (decision tree model)	CEA	CEA	CBA

Data	Karnon J et al. (2009)[8]	Karnon J et al. (2008)[9]	Smythe MA et al.[10]	Lee KL et al.[11]	van den Bemt PM et al.[12]
Direct medical cost	√	√	√	√	√
Indirect cost	-	-	-	-	-
Outcome	QALYs gained	Monetary value from QALYs gained	No. ADRs, pharmacotherapy recommendations, and readmissions	SF-36 scores, No. DRPs, and No. ADRs	Monetary value of the consequences of averting a prescribing error
Sensitivity analysis	N/A	PSA***	N/A	N/A	One-way sensitivity analysis
Results	• A pharmacist-led medicines reconciliation provided the largest net benefits (ICER = -£502.27 /QALY).	• Mean net benefits were £31.5, £27.25, and £13.1 million over a 5-year timeframe for CPOE, ward pharmacists and bar coding, respectively.	• Significantly fewer ADRs received treatment during the intervention period. • The overall net drug therapy cost was –$6,534.	• SF-36 scores for the intervention group tended to be increased (not significantly). • Cost per intervention was 133.9 NT$	• During the 1-week period, time-investigated of the pharmacist had estimated net costs of EUR 285. • The associated net benefits when the errors are prevented were EUR 9,867.

*CPOE = Computerized physician order entry; **TDM = Therapeutic drug monitoring; ***PSA = Probabilistic sensitivity analysis

CONCLUSION

Pharmacist intervention, one of a common method to prevent ADEs of hospitalized patients, would be a cost-saving strategy that may not utilize many resources and large amount of budget. It is worth to be implemented in healthcare settings in order to prevent the preventable ADEs and may improve patient outcomes. However, there are a variety of methods to conduct the intervention for ADEs prevention and there is still no standard methodology for detecting ADEs. If a standard program is conducted, the cost-effectiveness information of such program will be required by healthcare decision makers and providers before making a decision

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