PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Clinical and economic outcomes of hospital pharmaceutical care: A systematic review and meta-analysis	1
ABSTRACT			
Structured summary	2	Background: Hospital clinical pharmacists have been working in many countries for many years and clinical pharmaceutical care have a positive effect on the recovery of patients. In order to evaluate the clinical effectiveness and economic outcomes of clinical pharmaceutical care, relevant clinical trial studies were reviewed and analysed. Methods: Two researchers searched literatures published from January 1992 to October 2019, and screened them by keywords like pharmaceutical care, pharmaceutical services, pharmacist interventions, outcomes, effects, impact, etc. Then, duplicate literatures were removed and the titles, abstracts and texts were read to screen literatures according to inclusion and exclusion criteria. Key data in the literature were extracted, and Meta-analysis was conducted using the literature with common outcome indicators. Results: A total of 3299 articles were retrieved, and 42 studies were finally included. Twelve of them were used for meta-analysis. Among the 42 studies included, the main results of pharmaceutical care showed positive effects, 36 experimental groups were significantly better than the control group, and the remaining 6 studies showed mixed or no effects. Meta-analysis showed that clinical pharmacists had significant effects on reducing systolic blood pressure and diastolic blood pressure and shortening hospitalization days ($P<0.05$), but no statistical significance in reducing medical costs ($P>0.05$). Conclusion: clinical pharmacists' pharmaceutical care has a significant positive effect on patients' clinical effects, but has no significant economic effect.	2
INTRODUCTION			
Rationale	3	Studies have shown that hospital pharmaceutical care had great value in clinical and economic aspects. In a diabetes management team, participation of clinical pharmacists led to the reduction of hemoglobin, cholesterol and blood pressure in patients as well as the significantly lower cost of medication for each patient. A study showed the implementation of antifungal practice guidelines by a clinical pharmacist, member of an ICU team, resulted in a 50% cost reduction in expenditure on antifungal agents. However, whether there was a direct connection between this service and the improvement of patient health had been discussed. Meanwhile, costs of running pharmacy service and its economic benefits were at issue in some countries. These worries impeded the development of hospital clinical pharmacy and its universal implement. Among factors mentioned above, lack of strong, direct evidence is one potential barrier. Although many studies noticed the clinical and economic outcomes of hospital pharmaceutical care, few systematically demonstrated and validated the effectiveness of hospital pharmaceutical care. Due to flaws in experimental design and source of literature, non-randomized controlled trials, low methodological quality of included studies or unconvincing experimental data, evidence on effectiveness and validity are still insufficient. Therefore, it is necessary to explore its clinical and economic outcomes from the scope of a more general perspective. In the present study, a systematic review and meta-analysis for pooling statistical power was conducted to systematically evaluate the clinical and economic outcomes of hospital pharmaceutical care.	3

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Objectives	4	Two researchers searched for relevant articles published in databases including Pubmed by Medline, Embase, Cochrane and CINAH (January 1992 to October 2019). Mesh terms are listed as followes. Group A: pharmaceutical care or pharmaceutical services or clinical pharmacist or pharmacist intervent. Group B: outcome or effect or impact. Combined with Group A and Group B in hospitals, studies on hospital pharmaceutical care were searched. The retained researches were supplemented by access to monographs, reviews, references to published articles, and recently published Chinese and English journal articles.	4
METHODS			
Protocol and registration	5	None.	
Eligibility criteria	6	study object: clinical and economic outcomes of hospital pharmaceutical care; intervention and comparison: hospital pharmaceutical care of pharmacists; outcome: systolic blood pressure, diastolic blood pressure, medical cost, and hospitalization days; study design: Meta analysis; language: English	5
Information sources	7	databases: Pubmed by Medline, Embase, Cochrane and CINAH retrieval time limit: January 1992 to October 2019 date last searched: October 2019	4
Search	8	Mesh terms are listed as followes. Group A: pharmaceutical care or pharmaceutical services or clinical pharmacist or pharmacist intervent. Group B: outcome or effect or impact. Combined with Group A and Group B in hospitals, studies on hospital pharmaceutical care were searched.	4
Study selection	9	Studies would be included when interventions or participation of clinical pharmacists were considered with detailed descriptions of services they provided. The research setting should be conducted in hospitals. The research conducted should involve intervention groups and control groups who received routine care or non-interventions from clinical pharmacists. The clinical outcomes or economic outcomes of the interventions should be evaluated. Studies only abstracts available were excluded.	4
Data collection process	10	The data extraction was independently carried out by the researchers using a standard electronic form Microsoft Excel 2016 and the extracted data was checked by two researchers. According to the Cochrane systematic review guidelines, combined with the aim of this study and quality assessment requirements, extracted data in the feature tables included: (1) For numbered lists Literature charactersitics (Table 1): author, publication year, country, sample source, interventions, primary outcomes and effects. (2) Methodological quality assessment table: correct randomization method, hidden allocation scheme, blindness method, whether there is bias due to missing data. When comparing the main outcomes of experimental groups and control groups, $p<0.05$ was viewed statistically significant. When the primary outcomes of the experimental group were significantly better than the control group, it was marked as “positive”; and when there were no significant difference between the two groups, it was viewed as “no effect”. For studies evaluating multiple primary outcomes and not positive outcomes, those who presented at least one major positive outcome were considered as “mixed”.	5

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Data items	11	systolic blood pressure: the side pressure on the blood vessel wall caused by the blood injected from the ventricle when the heart contracts diastolic blood pressure: At the end of diastolic period, the blood that has flowed into the artery still has pressure on the blood vessel wall by the elasticity and tension of the blood vessel wall. At this time, the blood pressure is called diastolic pressure. medical cost: the product of collecting medical expenses according to certain objects. hospitalization days: time the patient spent in the hospital	5
Risk of bias in individual studies	12	According to the Cochrane systematic review guidelines, methodological quality assessment included correct randomization method, hidden allocation scheme, blindness method, whether there is bias due to missing data.	5
Summary measures	13	The standard mean difference (SMD) was used as the effect quantity, the significance level (or) of the combined effect quantity test was 0.05, the significance level of the heterogeneity test was 0.1, and the overall estimate was expressed by the point estimate and 95% confidence interval (95% CI). Statistical consistency was assessed using chi-square tests and I^2 statistics for heterogeneity. If $p>0.1$, no heterogeneity was considered. If $p<0.1$, heterogeneity between studies was considered.	5
Synthesis of results	14	If there is significant heterogeneity such as research subjects and interventions in the studies used to perform meta-analysis, these studies would not be directly combined. Statistical consistency was assessed using chi-square tests and I^2 statistics for heterogeneity. If $p>0.1$, no heterogeneity was considered. If $p<0.1$, heterogeneity between studies was considered.	5

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Risk of bias across studies	15	According to the Cochrane systematic review guidelines, methodological quality assessment included correct randomization method, hidden allocation scheme, blindness method, whether there is bias due to missing data.	5
Additional analyses	16	Stata 15 was used for meta-analysis	5
RESULTS			
Study selection	17	3,238 documents were obtained through database searching with a manual search of 61 added references related to empirical researches on hospital pharmaceutical care. After removing duplicate articles, 2284 articles remained. Through reviewing titles and abstracts, 1634 irrelevant articles were excluded. After reading full texts, 577 articles inconsistent with this study were excluded. And 73 studies deemed suitable were assessed and excluded after screening (Figure1). Finally, 42 studies were included for the meta-analysis.	6
Study characteristics	18	Table 1	21
Risk of bias within studies	19	Present data on r5isk of bias of each study and, if available, any outcome level assessment.	21
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	7-11

Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	7-11
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	7
Additional analysis	23		None
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	11
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	11
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	13
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	None

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