REVIEW ARTICLE

Review of the cost-effectiveness of interventions to improve seamless care focusing on medication

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Abstract Aim of the review This review of the international literature aims to assess the evidence and its methodological quality relating to the cost-effectiveness of interventions to improve seamless care focusing on medication. Method Studies were identified by searching Medline, EMBASE, Centre for Reviews and Dissemination databases, Cochrane Database of Systematic Reviews, and EconLit up to March 2011 using search terms related to health economics and to seamless care. To be included, economic evaluations had to explore the costs and consequences of an intervention to improve seamless care focusing on medication as compared with usual care. Methodological quality of studies was assessed by considering perspective; design; source of clinical and economic data; cost and consequence measures; allowance for uncertainty; and incremental analysis. Costs were actualized to 2007 values. Results Eight studies on medication interventions for hospitalized patients in the transition between ambulatory and hospital care were included in the review. A variety of types of medication interventions and target populations have been assessed, but the evidence is limited to one economic evaluation for each particular intervention type and each specific target population. Most

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studies demonstrated an impact of interventions on compliance and (re)hospitalization rates and costs. The studies did not find an impact on quality of life or symptoms. Economic evaluations suffered from methodological limitations related to the narrow perspective; restriction to health care costs only; exclusion of costs of the intervention; use of intermediate consequence measures; no allowance for uncertainty; and absence of incremental analysis. *Conclusion* In light of the small number of economic evaluations and their methodological limitations, it is not possible to recommend a specific intervention to improve seamless care focusing on medication on health economic grounds.

Impacts of article on practice

- Medication management is an essential component of seamless care and patients often experience drug-related problems at the transition between hospital and home.
- Some interventions to improve seamless care focusing on medication are likely to improve compliance and reduce (re)hospitalization rates, but the impact on quality of life and symptoms has not been demonstrated in the selected economic evaluations.
- Interventions to improve seamless care focusing on medication are likely to reduce health care costs.
- Due to the paucity and limitations of existing evidence, it is not possible to recommend a specific intervention to improve seamless care focusing on medication on health economic grounds.

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Introduction

Seamless care can be defined as the continuity of care delivered to the patient in the health care system across the spectrum of caregivers and health care settings [1]. Medication management is an essential component of seamless care [2] given that patients often experience drug-related problems at the transition between hospital and home. A recent literature review detected at least one error in medication history for 27–54% of patients admitted to hospital [3]. Another study estimated that approximately 64% of patients discharged from hospital experienced drug-related problems [4]. Drug-related problems may reduce quality of life, have an impact on patient morbidity and mortality [5], and may also impose an economic burden on patients, on the health care system and society [6, 7].

Aim of the review

In summer 2009, the Belgian Healthcare Knowledge Centre launched a study of seamless care focusing on medication between hospital and home [8]. The aim of this study is to review the international literature and to assess the evidence and its methodological quality relating to the cost-effectiveness of interventions to improve seamless care focusing on medication. In addition to the study reported here, the seamless care project summarized Belgian data on drug-related problems related to discontinuity of care, examined the effectiveness of initiatives aiming to improve continuity of care between health care settings, measured the extent of generic and therapeutic substitution associated with a hospital stay, and conducted focus groups to identify and evaluate systems to improve seamless care in Belgium.

Method

Search strategy

Studies were identified by searching Medline, EMBASE, Centre for Reviews and Dissemination databases, Cochrane Database of Systematic Reviews, CINAHL, International Pharmacy Abstracts and EconLit up to March 2011. The keyword search included the following MeSH terms: 'economics, medical', 'economics, pharmaceutical', 'costs and cost analysis', 'cost-benefit analysis', 'health care costs', 'hospital costs', 'drug costs' in combination with terms describing seamless care focusing on medication, i.e. 'continuity of patient care', 'delivery of health care, integrated', 'interprofessional relations', 'seamless care' or 'transmural care'. The bibliography of included studies was also checked for relevant studies.

Inclusion criteria

Evidence was derived from economic evaluations, i.e. studies contrasting an intervention with a comparator in terms of both costs and consequences [9]. Studies had to compare an intervention to improve seamless care focusing on medication with usual care. The population had to be related to patients in transition between ambulatory care (including nursing homes) and hospital care.

Assessment of methodological quality

The quality of economic evaluations was assessed by considering the perspective; study design; source of clinical and economic data; cost and consequence measures; allowance for uncertainty; and incremental analysis of costs and consequences [9].

Data analysis

To compare costs between studies, costs were actualized to 2007 values using a rate of inflation based on the evolution of the Consumer Price Index. Costs were converted using purchasing power parities for Belgium, i.e. market exchange rates adjusted for differences in purchasing power between countries and Belgium.

Results

Search results

The literature search identified 393 papers (see Fig. 1). Four articles from the literature on integrated health care related to interventions that, amongst other things, included medication management [10-13]. These four articles showed that integrated health care including medication management generated better compliance, fewer hospital re-admissions, shorter length of stay, lower costs and similar clinical status than usual care [10-13]. However, as general integrated health care interventions consist of multiple components, these studies did not attribute results to individual components such as medication management. Therefore, these articles were not included in this review.

Eight articles were selected for the review. Seven articles specifically explored approaches to improve seamless care focusing on medication [14–18, 20]. In addition, one study described the study protocol for an economic evaluation, but did not present any results [21].





Evidence

The characteristics of the eight economic evaluations are displayed in Table 1. A variety of intervention types and target populations have been assessed. As a consequence, the body of evidence is limited to one economic evaluation for a particular intervention type in a specific target population.

Counselling by pharmacist at discharge

A British cost-effectiveness analysis investigated the impact of discharge counselling for geriatric patients who were likely to experience difficulties with their medication [20]. In addition to the usual discharge information, intervention patients were counselled by a pharmacist on details on their medication regimen and could be visited by the pharmacist at home 7–10 days after discharge. The economic evaluation had a small sample size, enrolling 28 and 25 patients in the intervention and control groups, respectively. Effectiveness data on compliance and the need for counselling were derived from patient questionnaires and expert opinion. The scope of costs was limited to savings arising from the prevention of hospital admissions and did not include medicine or ambulatory care costs.

The analysis demonstrated better compliance levels (P < 0.01) and less counselling (P < 0.01) required for the

intervention group. A pharmaceutical domiciliary visit was necessary for 75 and 96% of intervention and control patients, respectively. The domiciliary visit prevented hospital admission in three intervention patients (saving $250 \in$ per patient) and in four control patients (saving $374 \in$ per patient).

Phone call by pharmacist after discharge

A US cost-effectiveness analysis examined the impact of providing telephone follow-up to patients who were discharged from hospital to home [16]. Pharmacists called patients 2 days following discharge to counsel them on discharge medications and to assist them in obtaining medications. This intervention was not fully standardised: some variability in phone call discussions occurred between patients. There may have been selection bias as well, given that some differences were noted in discharge diagnosis between intervention and control groups.

More patients in the phone call than the control group were satisfied with discharge medication instructions (86% vs. 61%; P = 0.007). Fewer patients in the phone call group returned to the emergency department within 30 days (10% vs. 24%; P = 0.005). Comparing the costs of the pharmacist intervention with the savings arising from the prevention of emergency department visits, the

Table	e 1 Characteristi	cs of economic evaluation	ons to improve seamless care focusing on medication		
Ref	Type	Study sample	Intervention	Comparator	Costs and consequences
Ξ	Cost- effectiveness analysis	53 geriatric patients likely to experience difficulties with their medication UK	Patient discharge counselling about their medicines and information about their pharmaceutical care plan. When required, patients received domiciliary visit 7–10 days after discharge ($n = 28$)	Normal discharge information. Patients received domiciliary visit 7-10 days after discharge (n = 25)	Analysis demonstrated better compliance levels and less counselling required for the study group. A pharmaceutical domiciliary visit was necessary for 75 and 96% of study and control patients, respectively. The domiciliary visit prevented hospital admission in 3 study patients (saving 250 ε per patient) and in 4 control patients (saving 374 ε per patient)
[2]	Cost- effectiveness analysis	221 patients discharged from hospital to home USA	Pharmacist phone call 2 days after discharge counselling patients about medications, such as whether they obtained and understood how to take them $(n = 110)$	Usual care $(n = 111)$	More patients in the phone call than the no phone call group were satisfied with medication instructions (86% vs. 61%). Fewer patients in the phone call group returned to the emergency department within 30 days (10% vs. 24%). Total savings of the phone call intervention amounted to $11,992$ €
[3]	Cost- effectiveness analysis	134 patients with heart failure Spain	Information about disease, diet and medication at discharge and telephone follow-up by pharmacist $(n = 70)$	Usual care $(n = 64)$	Patients in the intervention group had higher level of treatment compliance (85% vs. 73.9\%), fewer hospital re-admissions (0.56 vs. 1.13), fewer days of hospital stay (5.9 vs. 9.6), higher satisfaction score (9.0 vs. 8.2), similar quality of life, lower costs ($1,206 \ $ vs. $1,905 \ $ e).
[4]	Cost- effectiveness analysis	749 English- speaking adults admitted to a general medical service USA	Patient education and discharge planning in hospital by a nurse and post-discharge reinforcement by a pharmacist $(n = 370)$	Usual care $(n = 368)$	Patients in the intervention group had fewer hospital visits than patients receiving usual care (0.314 vs. 0.451 visit per person per month), a higher primary care follow-up visit rate $(62\% \text{ vs. } 44\%)$, were more prepared for discharge, and had lower hospital and outpatient costs (-348 e per person)
[2]	Cost- effectiveness analysis	715 patients using at least five prescribed medicines The Netherlands	An extensive medication review and drug counselling at the patient's home following discharge ($n = 379$)	Usual care $(n = 336)$	More patients in the intervention group indicated that they were (very) satisfied with drug counselling by the community pharmacist upon delivery of discharge medication (87% vs. 50%). The intervention did not influence discontinuation of drugs prescribed at discharge or mortality. Medication costs were reduced by 20.7 ε per patient
[9]	Cost- effectiveness analysis	99 patients with major depressive episode Belgium	Medication information (un)differentiated according to patient information desire $(n = 7 0)$	Usual care $(n = 29)$	No differences were found between study groups in terms of compliance, anxiety symptoms, depressive symptoms, somatic symptoms, the number of side- effects, or patient satisfaction. Control patients had higher costs of hospital medicines and more hospital readmissions than patients in the undifferentiated group. Control patients had higher costs of primary care consultations and higher productivity loss than patients in the differentiated group

Ref	Type	Study sample	Intervention	Comparator	Costs and consequences
[2]	Cost-utility analysis	Patients admitted to hospital UK	Pharmacist-led reconciliation; standardised forms, pharmacy technicians, hospital policy; nurses taking histories with standardised form; computerised assessment and feedback by pharmacist; current medication faxed from the general practice.	Usual care	The five interventions were cost-effective when compared with the baseline scenario. Three interventions dominated the baseline scenario. Pharmacist-led reconciliation intervention has the highest expected net benefits, with a probability of being cost-effective of over 60% at a value of 13,000 € per quality-adjusted life year
8	Cost- effectiveness analysis, cost-utility analysis	Patients admitted to hospital Netherlands	Pharmaceutical consultants performing: medication reconcilitation at admission and discharge, patient counselling at discharge, communication of medication information to next health care providers (n = 180)	Usual care $(n = 180)$	1

Table 1 continued

total savings of the phone call intervention amounted to $11,992 \in (\text{or } 109 \in \text{per patient}).$

Counselling heart failure patients at discharge and telephone follow-up

A Spanish cost-effectiveness analysis assessed the impact of providing information about the disease, medication therapy and diet to patients with heart failure at hospital discharge, including a follow-up phone call [14]. Data on treatment compliance, hospital admissions, length of hospital stay, quality of life and patient satisfaction were collected during follow-up visits to a cardiologist at 2, 6 and 12 months following discharge. These follow-up visits may have had an effect on effectiveness results (e.g. treatment compliance).

Patients in the intervention group had a higher level of treatment compliance (85% vs. 73.9%), fewer hospital readmissions (0.56 vs. 1.13), fewer days of hospital stay (5.9 vs. 9.6), a higher satisfaction score (9.0 vs. 8.2), and similar quality of life than patients in the control group. Comparing intervention costs with the costs of hospital stay during 1 year following hospital discharge, the intervention generated savings of 699 \in per patient.

Patient education at discharge with subsequent reinforcement by pharmacist

A US cost-effectiveness analysis enrolled 749 adults admitted to a general medical service to examine the impact of an intervention designed to minimise hospital utilisation within 30 days after discharge [18]. The intervention involved patient education and discharge planning in hospital by a nurse and post-discharge reinforcement by a pharmacist. Some effectiveness and cost data were derived from patient questionnaires, thus raising the potential for recall bias.

Patients in the intervention group had fewer hospital visits than patients receiving usual care (0.314 vs. 0.451 visit per person per month; P = 0.009), a higher primary care follow-up visit rate (62% vs. 44%; P < 0.001), and were more prepared for discharge at 30 days. With respect to costs of hospital and outpatient visits, the intervention saved an average of 348 \in per person.

Counselling visit at discharge

A Dutch cost-effectiveness analysis evaluated an intervention targeted at patients using at least five prescribed medicines [17]. The intervention consisted of an extensive medication review and drug counselling at the patient's home following discharge. As pharmacies were able to choose their assignment to intervention or control group, there was a risk of selection bias. The authors measured changes in medication, mortality and medication costs.

More patients in the intervention group were (very) satisfied with drug counselling by the community pharmacist upon delivery of discharge medication (87% vs. 50%; P < 0.001). The intervention did not influence discontinuation of drugs prescribed at discharge or mortality. Medication costs were reduced by 20.7 \in per patient. The authors attributed the small impact of the intervention to the unstructured character of the medication review and to the fact that the intervention consisted of only one home visit.

Tailored counselling for depressive patients at discharge

A Belgian cost-effectiveness analysis explored the impact of pharmacists providing differentiated medication information depending on the information desire of patients with a major depressive episode at hospital discharge [15]. Three interventions were compared: (a) undifferentiated information, with patients receiving a counselling session with the pharmacist on anti-depressants; (b) differentiated information, with patients with a high information desire receiving a counselling session with the pharmacist on antidepressants and patients with a low information desire receiving usual care; and (c) usual care. The study examined the impact of medication information on clinical, humanistic and economic parameters at 1 month, 3 months and 1 year following hospital discharge.

The analysis failed to demonstrate any impact of medication information on clinical and quality of life parameters. Patients receiving usual care tended to have higher costs for some parameters as compared to patients receiving (un)differentiated information. The authors suggested that the medication information intervention may have been too weak to measure changes in clinical and quality of life parameters. Also, as the researchers contacted patients by telephone to collect data on parameters, they in fact carried out a reinforcement intervention, which may have influenced results.

Intervention to prevent medication errors at admission

A British cost-utility analysis conducted a model-based economic evaluation of five interventions aimed at preventing medication errors at hospital admission from the health care system perspective [19]. The five interventions were: (a) pharmacist-led reconciliation; (b) medicines reconciliation involving the development of a standardised medication form and IT-based information transfer; (c) nurses taking histories with standardised form; (d) computerised assessment and feedback by pharmacist; and (e) current medication faxed from the general practice. Data on probabilities, costs and consequences were derived from a variety of sources from different countries, from a literature review of non-randomised studies or were based on assumptions.

The five interventions were cost-effective when compared with the baseline scenario: the intervention based on the standardised forms and the intervention of nurses taking histories had additional costs of $241 \in$ and $181 \in$ per quality-adjusted life year gained, respectively. The three other interventions dominated the baseline scenario. The pharmacist-led reconciliation intervention had the highest expected net benefits, with a probability of being costeffective of over 60% at a value of 13,000 \in per qualityadjusted life year.

Ongoing study in multicultural population at hospital discharge

A Dutch team of researchers published the protocol of a study investigating the cost-effectiveness and cost-utility of the COACH (Continuity of Appropriate pharmacotherapy, patient Counselling and information transfer in Healthcare) program as compared to usual care [21]. This mono-centric study focuses on a multicultural population discharged from a teaching hospital. The intervention consists of medication reconciliation at admission and discharge, patient counselling at discharge, communication of medication information to the next health care providers. The intervention will be evaluated in terms of clinical, quality of life and economic outcomes from the societal perspective.

Methodological quality

Economic evaluations suffered from several methodological limitations (see Table 2).

Perspective

Six economic evaluations were conducted from the hospital perspective or (part of) the health care system perspective. The hospital perspective is too restrictive as interventions to improve seamless care focusing on medication have wider implications on other parts of the health care system, such as ambulatory care. Two economic evaluations with a societal perspective measured indirect costs of productivity loss [15, 21]. Who will pay for the intervention should determine the choice of the study perspective. For instance, a societal perspective, which considers indirect costs of productivity loss in addition to health care costs, may not be appropriate if an intervention is to be funded by a public health care system, where a third-party payer or National Health Service pays for health care costs only.

Table 2 Methodological quality of economic evaluations to improve seamless care focusing on medication

Ref	Perspective	Design	Source of data	Cost measures	Consequence measure	Allowance for uncertainty	Incrementa analysis
[1]	Health care system	Evaluation based on prospective randomised controlled trial	Effectiveness data were derived from patient questionnaires and expert opinion. Cost data were derived from local hospital	Costs of prevented hospital admission	Compliance, counselling required, need for pharmaceutical domiciliary visit	No	No
[2]	Hospital	Evaluation based on prospective randomised controlled trial	Effectiveness data were derived from patient questionnaires. Cost data were derived from hospital records	Costs of pharmacist time and prevented emergency department visits	Patient satisfaction	No	No
[3]	Hospital	Evaluation based on prospective randomised controlled trial	Effectiveness data were derived from follow-up visits by a cardiologist at 2, 6 and 12 months after discharge. Cost data were derived from hospital records	Costs of intervention and costs of hospital stay during 1 year after discharge	Treatment compliance, hospital admissions, length of hospital stay, quality of life (EuroQol), patient satisfaction	No	No
[4]	Health care system	Evaluation based on prospective randomised controlled trial	Effectiveness and cost data were derived from patient questionnaires and hospital records	Costs of hospital and outpatient visits during 30 days following discharge	Number of hospital visits, self-reported preparedness for discharge, rate of primary care follow-up visits	No	No
[5]	Outpatient setting	Evaluation based on prospective cohort study	Effectiveness and cost data were derived from pharmacy information systems and patient questionnaires	Medication costs	Medication changes, patient satisfaction	No	No
[6]	Society	Evaluation based on cohort study	Hospital and patient self-report	Hospital and ambulatory care costs, costs of productivity loss	Compliance, anxiety symptoms, depressive symptoms, somatic symptoms, the number of side-effects, quality of life, patient satisfaction	No	No
[7]	Health care system	Evaluation based on decision- analytic model	Effectiveness data were derived from systematic literature review. Error detection rates and cost data were derived from various sources from various countries	Costs of pharmacist time, nursing time, forms, computerised assessment, dissemination of forms	Medication errors prevented, quality- adjusted life years	Yes	Yes
[8]	Society	Evaluation based on before-and- after study	Effectiveness and cost data were derived from hospital databases and questionnaires	Health care costs (including OTC medication), informal care, alternative treatments, productivity loss	Re-admissions within 6 months, adherence, attitude towards medicines, satisfaction with medication information, quality of life, satisfaction of next health care providers	Yes	Yes

Study design

All but one study carried out an economic evaluation based on a randomized controlled trial [14, 16, 18, 20] or an observational study [15, 17, 21]. Investigating the costeffectiveness of treatment alternatives in a trial setting provides a degree of internal validity. However, it is challenging to carry out a randomized controlled trial in this domain, and blinding of patients and health care professionals is difficult to achieve. Economic evaluations based on observational studies were designed to reflect real-world practices, but may be subject to a number of biases. One study used a modeling approach to assess the cost-effectiveness of treatment alternatives [19]. However, this economic evaluation derived model inputs from a variety of sources from different countries and made multiple assumptions. To address uncertainty surrounding model inputs, the authors conducted extensive sensitivity analyses.

Costs and consequences

Economic evaluations were limited in the scope of costs considered. Studies generally measured health care costs [15, 18–20], although some analyses were restricted to hospital costs only [14, 16]. Also, a number of studies did not take account of the costs of the intervention itself [15, 17, 18, 20].

A variety of consequence measures were used. Some measures were related to intermediate consequences (e.g. appropriateness of medicine regimens, treatment compliance) rather than final consequences (e.g. mortality rate). Studies analysed multiple consequence measures separately. Therefore, it is not possible to compare the costeffectiveness of the different interventions to improve seamless care focusing on medication. The exception was the two economic evaluations which expressed results using the same generic measure, i.e. the cost per qualityadjusted life year gained [19, 21].

In general, economic evaluations measured costs and consequences over a limited time horizon, with a maximum follow-up period of 1 year.

Allowance for uncertainty and incremental analysis

Only two economic evaluations allowed for uncertainty [19, 21]. Studies need to conduct a sensitivity analysis to account for uncertainty around key estimates and assumptions made during the identification, measurement and valuation of costs and consequences. Only two studies presented results in terms of an incremental cost-effectiveness ratio of patients participating in an intervention to improve seamless care focusing on medication as compared with patients who did not receive such an intervention [19, 21].

None of the economic evaluations discussed the transferability of results to other settings or countries. In four economic evaluations, cost estimates originated from a single center [16, 18, 20, 21]. As these costs were specific to the center, results were unlikely to be transferable to other centers or countries.

Discussion

This literature review has summarized the evidence about economic evaluations of interventions to improve seamless care focusing on medication. All studies focused on discharge interventions, mostly performed by (clinical) pharmacists. Three studies have detected higher or similar treatment compliance among intervention patients after hospital discharge. All but one study concluded that the intervention reduced hospital re-admissions. In general, patients in the intervention group were more satisfied than patients in the control group. In studies that analyzed an effect on clinical status, no impact of the intervention was recorded on depressive symptoms. Results on the impact on quality of life were conflicting. Studies indicated that interventions to improve seamless care focusing on medication were associated with cost savings, although the scope of cost analyses tended to be limited.

Economic evaluations of interventions to improve seamless care focusing on medication suffered from a number of methodological limitations relating to the narrow perspective; focus on health care costs only; exclusion of costs of the intervention; use of intermediate consequence measures; no allowance for uncertainty; and absence of incremental analysis. As these limitations are not inherent to the techniques of economic evaluation, but arise from the sub-optimal design of existing studies, more attention needs to be paid by researchers to the design of their studies.

There is a need for more, better-designed and comprehensive trial-based economic evaluations. Further studies need to collect primary data on cost-effectiveness. Additionally, this review has underlined the importance of considering all relevant consequences in a single index to compare the cost-effectiveness of different interventions. In that respect, a case can be made in favour of cost-utility analyses that account for the impact of the intervention on life expectancy and quality of life in the single measure of quality-adjusted life years.

Furthermore, there is scope to improve the description of the intervention by reporting more detailed information about the recipients of the intervention, the settings where the intervention is delivered, the content of the intervention, and the training of the person(s) who administer the intervention. Finally, further studies need to select their perspective in terms of who will pay for the intervention to improve seamless care focusing on medication and they need to identify, measure and value costs and consequences according to the chosen perspective.

Conclusion

In light of the small number of economic evaluations and their methodological limitations, it is not possible to recommend a specific intervention to improve seamless care focusing on medication on health economic grounds.

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