



## Review article

# Economic impact of electronic prescribing in the hospital setting: A systematic review



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## ABSTRACT

**Objective:** To examine evidence on the economic impact of electronic prescribing (EP) systems in the hospital setting.

**Method:** We conducted a systematic search of MEDLINE, EMBASE, PsycINFO, International Pharmaceutical Abstracts, the NHS Economic Evaluation Database, the European Network of Health Economic Evaluation Database and Web of Science from inception to October 2013. Full and partial economic evaluations of EP or computerized provider order entry were included. We excluded studies assessing prescribing packages for specific drugs, and monetary outcomes that were not related to medicines. A checklist was used to evaluate risk of bias and evidence quality.

**Results:** The search yielded 1160 articles of which three met the inclusion criteria. Two were full economic evaluations and one a partial economic evaluation. A meta-analysis was not appropriate as studies were heterogeneous in design, economic evaluation method, interventions and outcome measures. Two studies investigated the financial impact of reducing preventable adverse drug events. The third measured savings related to various aspects of the system including those related to medication. Two studies reported positive financial effects. However the overall quality of the economic evidence was low and key details often not reported.

**Discussion:** There seems to be some evidence of financial benefits of EP in the hospital setting. However, it is not clear if evidence is transferable to other settings. Research is scarce and limited in quality, and reported methods are not always transparent. Further robust, high quality research is required to establish if hospital EP is cost effective and thus inform policy makers' decisions.

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## 1. Introduction

Government policies are increasingly promoting the use of technology in healthcare. In May 2013, the English Health Secretary announced a £250 million “safer hospitals, safer wards” technology fund for English NHS trusts, aiming for technology delivery in 2015 [1]. This fund was doubled in September 2013 with the goal of facilitating greater access to information for healthcare professionals. These steps mirror US government legislation to spread meaningful use of healthcare information technology through the Medicare and Medicaid incentive program [2].

The use of electronic prescribing (EP) systems in English hospital is expanding [3]. EP systems can reduce medication errors [4–8] and increase efficiency [9]. However, similar to most technologies, they are also associated with substantial acquisition costs and on-going support costs; enormous organizational change is also likely to be required [10]. Estimates of up to \$8 million for implementation of computerized provider order entry (CPOE) in a 500-bed US hospital have been reported [11], where CPOE may be used for ordering other investigations and treatments as well as medication. The challenge that most healthcare organizations face under the current financial climate is reducing costs and increasing productivity while improving quality. Therefore, many healthcare institutions are seeking evidence about the economic impact of technology adoption to better inform decisions about the optimal choice and implementation strategy.

There are limited data about the cost effectiveness of adopting technology in healthcare settings [9]. This may be due to the complexity of estimating and identifying factors contributing to direct and intangible costs and benefits of technology use. Moreover, variations in study designs and systems used in the literature make it difficult to extrapolate data to other settings. Previous reviews in this area have explored the economic effects of a wide range of technological interventions in various healthcare settings [12–14]. In contrast, our review specifically focuses on EP and the medication-related aspects of CPOE in the hospital setting.

## 2. Objective

To examine the available evidence about the economic impact of EP systems in the hospital setting.

## 3. Methods

### 3.1. Search strategy

We followed the PRISMA guidelines for reporting systematic reviews and meta-analyses [15]. A review protocol guide was developed. A structured electronic search strategy was developed and carried out in the following databases: the Cochrane

Library, MEDLINE, EMBASE, PsycINFO, International Pharmaceutical Abstracts, the NHS Economic Evaluation Database, the European Network of Health Economic Evaluation Database and the Web of Science for conference proceedings up to October 2013. We searched for facets relating to (1) EP/CPOE and (2) economic evaluation. Details of the MEDLINE search strategy are available as Supplementary material. References in relevant previous reviews were screened [12–14]. Five key journals were screened manually for papers published between 2006 and 2013: International Journal of Technology Assessment in Health Care, International Journal of Healthcare Technology and Management, Journal of the American Medical Informatics Association, Journal of Evaluation in Clinical Practice and Journal of Health Economics.

### 3.2. Inclusion and exclusion criteria

We included any full or partial economic evaluation studies of EP and/or CPOE in hospitals published in English. Full economic evaluation was defined as the comparative analysis of alternative courses of action in terms of both costs and consequences [16]. Full economic evaluations thus included cost effectiveness analysis (CEA), cost utility analysis (CUA) and cost benefit analysis (CBA). Studies that reported costs (resource use) and/or monetary consequences but did not make explicit comparisons between alternative interventions in terms of both costs and consequences were considered partial economic evaluations [17].

To be included, studies had to assess electronic systems that allow healthcare professionals to order or prescribe medication orders electronically. We were interested in systems used for prescribing a wide range of drugs for either general hospital populations or specific populations such as paediatrics. Therefore, we excluded studies assessing prescribing packages aimed at specific group(s) of drugs. Where a system was used to order more than just medicines, monetary outcome measures unrelated to medicines were excluded. Inclusion and exclusion criteria are summarised in Table 1.

### 3.3. Study selection and data extraction

Article abstracts and titles were initially screened by one researcher (ZA) and assessed against our criteria. For all papers which potentially met the inclusion criteria, or if there was any doubt, the full text was obtained and evaluated using an assessment sheet. A 10% random sample of the abstracts and titles screened, and of the full text articles screened, were reviewed by a second researcher (SG). Data extraction from included papers was conducted independently by two researchers (ZA & YJ) using an extraction template. Extracted data included setting, design, intervention, comparator, population, outcome measures, and type of economic evaluation. For both study selection and data extraction,

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