

**BIBLIOGRAPHICAL REVIEW ON COST OF
"PATIENT SAFETY FAILINGS" IN
ADMINISTRATION OF DRUGS.
SUMMARY.**



GOBIERNO
DE ESPAÑA

MINISTERIO
DE SANIDAD
Y CONSUMO

Plan de **Calidad**
para el **Sistema Nacional**
de Salud



Bibliographical review on cost of “Patient Safety Failings” in administration of drugs. Summary

This study has been conducted by ANTARES Consulting through a contract with the Spanish Ministry of Health and Consumer Affairs.

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1 Introduction

In the last two decades a large number of reports have been published in different countries on the incidence of adverse events in hospitals and the impact of these events on patients, hospitals and the public. As a result, clinical safety has become an indispensable part of healthcare quality in all countries.

According to a nationwide adverse events study (ENEAS) conducted in Spain, the main cause of these events in Spanish hospitals is connected with patient medication (MSC, 2006). Specifically, medication was the source of 37.4% of all adverse events detected in the study. These events are the result of an inappropriate use of medication, causing harm to a patient, and are generally preventable.

Medication handling comprises four stages: prescription, transcription, dispensation and administration, as depicted in Figure 1.

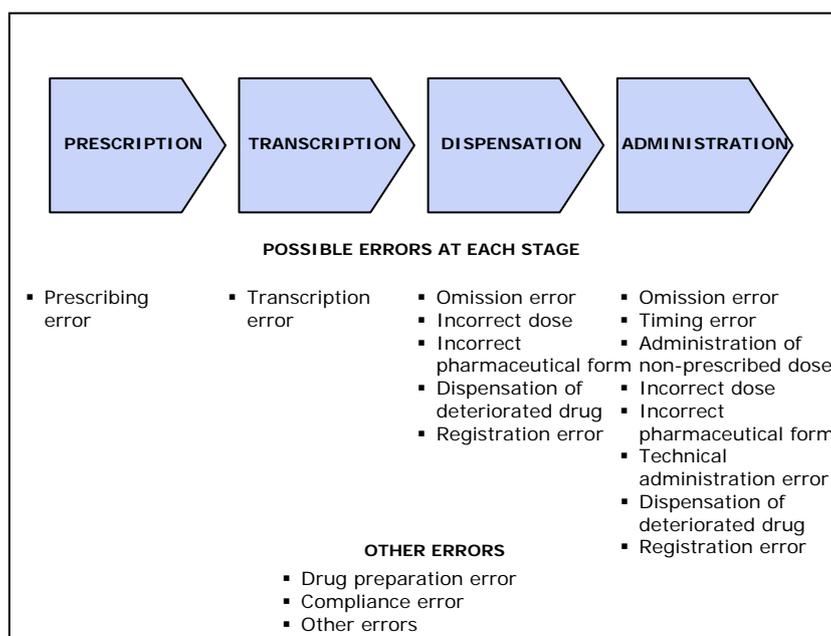


Figure 1. Possible errors in medication handling process

Figure 1 also depicts different errors that may occur at each stage. These errors are based on the medication error classification proposed by Blasco Segura *et al* (2001), based on the Barker & McConnell classification (1962).

Medication-related adverse events have an important impact in both economic and non-economic terms; according to the ENEAS study, 34.8% of these adverse events are avoidable.

2 Objectives

The key objective of this bibliographical review was to determine the economic costs and consequences of medication-related adverse events and to present the methods used to determine these costs.

3 Methodology

The methodology comprised two different stages: location and selection of studies and their subsequent evaluation.

3.1 Location and selection of studies

Location of articles via a search strategy in three databases: MEDLINE, EMBASE (*Excerpta Medica Database*) and EconLit. Primarily databases of scientific articles in medicine and economics. Search limited to the period 2000 to 2007.

Selection of articles: based on type of study, context, independent variable and result measures.

Figure 2 depicts the process followed and the selection results obtained.

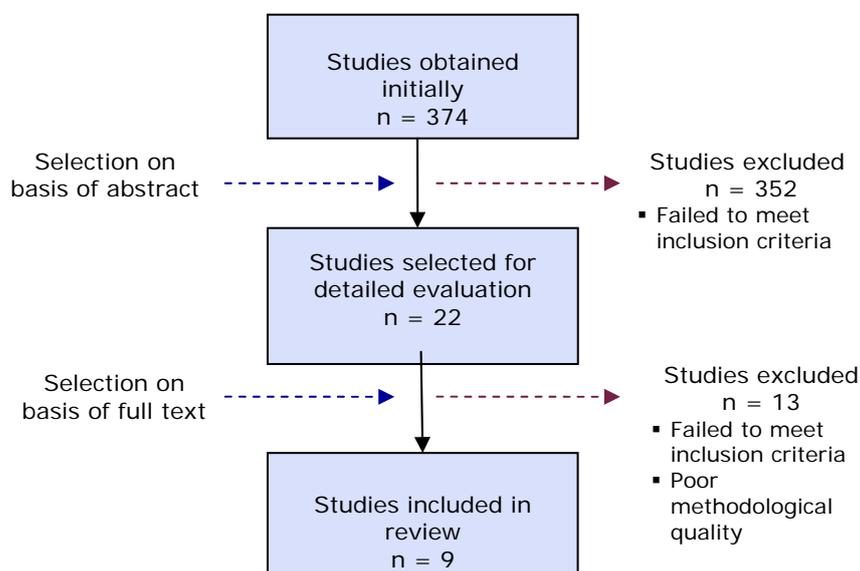


Figure 2. Selection of studies

3.2 Evaluation of studies

The studies were classified according to their scientific evidence and in line with the following criteria:

- I. Evidence from at least one clinical trial with random allocation.
- II-1. Evidence from clinical trials without random allocation.

- II-2. Evidence from case-control cohort studies.
- II-3. Evidence from multiple time series, with or without intervention.
- III. Opinions of respected authorities, based on their clinical experience, descriptive studies or reports of committees of experts.

4 Results

The results obtained from the studies selected are presented in three separate sections: description of the studies that form part of the review; results on costs attributed to medication-related adverse events; and results relating to cost analysis methods used in the studies.

4.1 Description of studies

Table 1 contains a summary of the key characteristics of the methodology used by the different authors.

Study	Objective	Context	Results	Design	Sample
Bates <i>et al</i> , 1997	Medication-related adverse events	Two tertiary hospitals (726 and 846 beds), USA.	Cost and hospital stay	Case-control study	n = 190 cases and 190 controls
Classen <i>et al</i> , 1997	Medication-related adverse events	Tertiary 520-bed teaching hospital, USA.	Cost and hospital stay	Case-control study	n = 1,580 cases and 20,197 controls
Cullen <i>et al</i> , 1997	Preventable medication-related adverse events	Two tertiary hospitals. Five ICUs and six medical and surgical units.	Cost and hospital stay	Cross sectional study	n = 190
Easton <i>et al</i> , 2004	Medication-related adverse events	Two tertiary hospitals, Australia.	Admission numbers and costs	Cross sectional study	n = 127
Ernst & Grizzle, 2001	Medication-related adverse events	USA	Costs	Committee of experts	
Field <i>et al</i> , 2006	Medication-related adverse events	30 outpatient clinics (patients over 65), USA.	Use of health services and costs	Case-control study	n = 1,225 cases and 1,225 controls
Pinilla <i>et al</i> , 2006	Medication errors	Medical and surgical units and ICU. Private 337-bed tertiary hospital, Spain.	Cost and hospital stay	Case-control study	n = 86 cases and 86 controls
Rothschild <i>et al</i> , 2002	Medication-related adverse events	23 hospitals with a total of 4,700 beds, USA.	Cost and hospital stay	Cross sectional study	n = 95
Zhan & Miller, 2003	Anaesthesia-derived complications	994 general acute-care hospitals in 20 US states.	Cost and hospital stay	Case-control study	n = 7.5 million patients

Table 1. Study methodologies

4.2 Results of studies

The results obtained may be divided into three sections: economic costs attributed to adverse events and medication errors, increase in hospital stay and mortality as a result of medication-related adverse events and medication errors.

4.2.1 Cost of medication-related adverse events and medication errors

According to the results of the studies selected, the cost attributed to the emergence of a medication-related adverse event ranges between USD2,013 (Classen *et al*, 1997) and USD3,244 (Bates *et al*, 1997) per patient.

Table 2 shows the results obtained in all the studies selected and the costs of the corresponding adverse events.

Study	Variable	Increase in cost per patient suffering adverse event
Bates <i>et al</i> , 1997	<ul style="list-style-type: none"> Medication-related adverse events 	<ul style="list-style-type: none"> USD3,244
Classen <i>et al</i> , 1997	<ul style="list-style-type: none"> Medication-related adverse events 	<ul style="list-style-type: none"> USD2,013
Cullen <i>et al</i> , 1997	<ul style="list-style-type: none"> Preventable adverse events 	<ul style="list-style-type: none"> ICU: USD19,685* (SD: USD3,065) Unit: USD13,994* (SD: USD1,659)
Easton <i>et al</i> , 2004	<ul style="list-style-type: none"> Medication-related adverse events Avoidable adverse events 	<ul style="list-style-type: none"> GBP100,707 GBP61,543
Field <i>et al</i> , 2006	<ul style="list-style-type: none"> Medication-related adverse events Preventable adverse events 	<ul style="list-style-type: none"> USD1,310 (95% CI: USD625-1,995) USD1,983 (95% CI: USD193-3,773)
Pinilla <i>et al</i> , 2006	<ul style="list-style-type: none"> Medication errors 	<ul style="list-style-type: none"> EUR1,641 (median EUR1,134; third quartile EUR2,798)
Rothschild <i>et al</i> , 2002	<ul style="list-style-type: none"> Avoidable adverse events Unavoidable adverse events 	<ul style="list-style-type: none"> USD15,438 USD742
Zhan & Miller, 2003	<ul style="list-style-type: none"> Anaesthesia-derived complications 	<ul style="list-style-type: none"> USD1,598 (SD: USD660)

Table 2. Cost of medication-related adverse events

* Total cost of care post-adverse event. SD: standard deviation.

4.2.2 Increase in hospital stay

In accordance with the studies selected, hospital stays increase in the case of patients who suffer medication-related adverse events.

Table 3 summarises the results obtained in the studies selected.

Study	Variable	Increase in patient hospital stay
Bates <i>et al</i> , 1997	Medication-related adverse events	2.2 days
Classen <i>et al</i> , 1997	Medication-related adverse events	1.74 days
Cullen <i>et al</i> , 1997	Preventable adverse events	<ul style="list-style-type: none"> ▪ ICU: 13 days* (SD: 2.1) ▪ Unit: 11.4 days* (SD: 1.1)
Pinilla <i>et al</i> , 2006	Medication errors	6.93 days

a

Table 3. Increase in length of hospital stay associated with medication-related adverse events

* Total number of days post-adverse event. SD: standard deviation.

4.2.3 Increase in mortality rate

According to the results of the studies, the emergence of a medication-related adverse event is associated with an increased mortality risk. Expressed in the form of an *odds ratio*, the mortality risk is 1.88, with a 95% confidence interval of between 1.54 and 2.22. That is, a patient who has suffered a medication-related adverse event is 1.88 times more likely to die than if the adverse event had not occurred.

4.3 Methodology used

All the studies selected analyse the **direct costs** of adverse events or medication errors. These direct costs derive from the medical care that patients require as a result of the adverse event: primarily the care provided in a hospital ward or ICU, the diagnostic tests necessary to detect and control the problem and the treatment prescribed to solve the problem.

All the studies selected analyse this financial impact from the **point of view of the healthcare organisations**, save for the Rothschild *et al* study (2002) which is conducted from the point of view of health insurance companies.

5 Conclusion

The cost of a medication-related adverse event derives primarily from the increased length of hospital stay, the diagnostic tests required to detect and control the problem and the treatment prescribed to solve the problem.

The studies analysed chiefly use two methodologies to assess these costs. The results obtained underestimate the real cost of medication-related adverse events, as essentially they analyse the direct costs from the point of view of hospitalisation, without entering into assessment of other potential costs that these adverse events may entail.

6 Contributions

Below we present an estimate of the possible economic impact of medication-related adverse events on the Spanish national health system (NHS).

The costs reported in the studies selected were adapted and then converted from US dollars into Euros, at the 2005 exchange rate corresponding to the month in question.

This gives an estimated cost of medication-related adverse events in 2005 of between Euros 3,315 and Euros 5,584; the cost of medication errors amounted to Euros 1,849.

These costs in Euros were then applied to the real figures reported by the Spanish NHS, with a view to establishing the overall cost for the health system of medication-related adverse events and medication errors.

The results show that medication-related adverse events may represent **a cost** for the health service **of between Euros 469 and Euros 790 million per year**. If the medication errors that affect 4% of all patients admitted to Spanish hospitals every year could be prevented, the health system could **save more than Euros 91 million per year**.

To conclude, we note that medication errors also imply a high opportunity cost, as the time and money spent on additional diagnostic tests and treatment could be spent elsewhere.

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