Vaccine 31 (2013) 1656–1665

Contents lists available at SciVerse ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

Review

Systematic review of economic evaluation studies: Are vaccination programs efficient in Spain?

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ARTICLE INFO

Article history:
Received 4 October 2012
Received in revised form 10 January 2013
Accepted 15 January 2013
Available online 29 January 2013

Keywords:
Vaccination programs
Economic evaluation
Public health
Decision making

ABSTRACT

Introduction: During the twentieth century, vaccination has been one of the measures of greatest public health impact. Vaccine administration has helped reduce the burden of disease and mortality from infectious diseases. At present, there is increasing concern about infectious diseases and the ability of health systems to control them, highlighting the need for evaluation of vaccination programs. The aim of this study was to conduct a systematic review of economic evaluation studies carried out regarding Spain on vaccines.

Methods: Systematic review. Search of articles in major bibliographic databases available online from January 1983 to June 2011. References identified were limited to full economic evaluations carried out regarding Spain that evaluated vaccination programs. For each of the selected papers, a set of predefined variables were extracted.

Results: A total of 46 studies met inclusion criteria. The topics studied were pneumococcal vaccination, influenza vaccination, Hepatitis B vaccination and varicella vaccination. Cost-minimization analysis, perspective of society, long time horizon, use of modeling techniques, and the inclusion of direct and indirect costs were the most common methodological characteristics. The results of the studies reviewed showed, in most cases, net savings or cost-effectiveness ratios below €30,000/QALY.

Conclusions: Although there has been an improvement in the methodological quality of studies, they still show shortcomings that should be addressed. From a public health perspective, it would be relevant to evaluate vaccines targeted to major health problems in Spain, including all relevant costs and benefits. In order to obtain a more efficient use of health resources, economic evaluation methods should be applied more rigorously and results should be used consistently in decision-making processes.

Contents

1. Introduction

Infectious diseases are a major cause of morbidity and mortality in Spain, representing about 7400 deaths and 113,700 years of disability-adjusted life year (DALY) in 2006 [1].

During the twentieth century, vaccination has been one of the measures of greatest public health impact because its administration has reduced the burden of disease and mortality from infectious diseases, especially in childhood. Thanks to vaccination, the global eradication of smallpox was achieved for the first time in history in 1980. The circulation of wild poliovirus was stopped in the Region of the Americas in 1990, in the Western Pacific Region in 2000, and in the European Region in 2002 [2]. Currently, there are more than 40 vaccines available for the prevention of 25 vaccine-preventable diseases [2].

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0264-410X/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.vaccine.2013.01.029

Improved sanitation, nutrition, and the widespread use of vaccines and antibiotics have decreased the incidence and mortality of numerous diseases. The contribution of vaccination has been fundamental. It is estimated that with the introduction of vaccines in the world, 5 million deaths caused by smallpox deaths, 2.7 million cases of measles, 2 million cases of neonatal tetanus, 1 million cases of pertussis, 600,000 cases of paralytic poliomyelitis and 300,000 cases of diphtheria have been avoided annually [2]. These health effects translate into positive economic results. It has been estimated that in the time period between 2011 and 2020, under the "Decade of Vaccines" collaboration project, there will be $6.2 billion savings in treatment costs, $145 billion in productivity losses, and $231 in lives saved [3,4].

At present, there is increasing concern about infectious diseases and the ability of health systems to control them, not only for the health burden attributed to these diseases, but also by the threat posed by the resurgence of diseases thought to be controlled and the increase in antimicrobial resistance due to inappropriate use of prophylactic antibiotics and chemotherapy. In a context of limited resources, these concerns highlight the need for evaluation of vaccination programs. In this scenario, economic evaluation appears as an additional tool that can help allocate health resources in an efficient manner [5].

Economic evaluation is an instrument which, by measuring costs and health effects, reports on the comparative efficiency of services and health interventions (drugs, technologies, procedures, public health interventions, etc.). Economic evaluation studies of public health interventions are less frequent than in other specialties. However, because of their budgetary impact and the fact that vaccination programs are provided by the public sector, vaccination programs are among the most frequently studied public health interventions [6,7].

The aim of this study was to conduct a systematic review of economic evaluation studies carried out regarding Spain on vaccines, regardless of whether or not such vaccines are included in the current recommended immunization schedule.

2. Methods

Studies from 1983 to 2008 were identified from systematic searches carried out in two previous publications by the same author, with the same keywords, and the same inclusion criteria:

- 1983–1999: Ref. [55].
- 2000–2008: Ref. [57].

From these systematic reviews, those studies referring to the economic evaluation of vaccination programs were selected.

Studies from January 2009 to June 2011 were selected from a search of papers in major bibliographic databases available online: PubMed/MEDLINE, SCOPUS, ISI Web of Knowledge, databases of the Center for Reviews and Dissemination, as well as in the Spanish Medical Index (IME) and the Spanish Bibliographic Index of Health Sciences (IBECS).

To search PubMed/MEDLINE, 3 groups of MeSH descriptors were used: vaccination programs, economic evaluation, and geographical area. In the economic evaluation group, terms referring to types of economic evaluation and general terms of health economics were included. For the geographical group, the proposed geographic filter of Valderas et al. was applied [8]. Annex 1 shows the details of the keywords used in the literature search conducted in each of the databases.

To complement the data collected as stated above, a manual search of health technology assessment reports was performed, and publications in specialized Spanish journals not included (or partially included) in the previously mentioned databases: Platform AUnETS Agencies Units and Health Technology Assessment (http://aunets.isciii.es/), Spanish Journal of Pharmacoeconomics (until 2000), Spanish Journal of Health Economics (from 2002 onwards) and PharmacoEconomics – Spanish Research Articles (from 2004 onwards).

References identified were limited to full economic evaluations (i.e., those comparing costs and health effects) conducted regarding Spain that evaluated vaccination programs. Review papers, editorials, and conference papers were not included. Exclusion criteria were studies that came up in different search engines, studies that did not address vaccination programs, those that were not full economic evaluations, those that did not analyze phenomena occurring in Spain, and those that were not original research papers or were duplicate publications. In case of duplicate publication, the journal with the highest impact factor or the most recently published was included.

The following variables were extracted from each of the studies:

- Journal and year of publication.
- Autonomous region of the author.
- First author affiliation: Primary care, hospital, healthcare administration, private, university or not specified.
- Topic studied.
- Disease category: Leading cause of the disease that the vaccine is targeting, as classified by the study of Global Burden of Disease of the World Health Organization, based on the 10th version of the International Classification of Diseases (ICD-10) [9].
- Study population: 0–14 years, 11–14 years, 15–65 years, less than 5 years, more than 5 years, over 60 years, massive, specific risk groups, and various age groups.
- Type of economic evaluation study: Cost-minimization analysis, cost-effectiveness analysis, cost-utility analysis or cost-benefit analysis.
- Perspective of analysis: Healthcare system, society, hospital, other or not specified.
- Temporal horizon: Hospital stay, less than 1 year, 1 year, 4–10 years, 15–30 years, life expectancy or not specified.
- Use of discount rates: Yes, no or not specified.
- Use of models: Decision analysis, Markov models, mathematical models or not used.
- Source of effectiveness data: Estimation, observational study, literature or not specified.
- Unit of effectiveness: Cases avoided, life years gained (LYG), or quality-adjusted life years (QALY).
- Source of utility data: Official statistics, literature, not specified or not applicable.
- Instrument used for measuring utilities: Time trade-off, Health Utilities Index-2 (HUI-2), Roser-Kind matrix or not specified.
- Type of costs included: Direct, indirect or both.
- Sources of cost data: Specified or not specified.
- Included costs: Operating costs of the vaccination program, vaccine, vaccine administration, diagnostic tests, treatment of the disease, treatment of the adverse effects of the vaccine, transportation expenses, sick leave and death.
- Sensitivity analysis performed: Performed or not performed
- Type of sensitivity analysis: Deterministic, probabilistic or not applicable.
- Recommendations aimed at decision-making processes: Available or unavailable.
- Study funding: Non-profit, for profit or not specified.

Most of the results were expressed in counts and percentage terms, and presented as frequency tables and descriptive graphics. The number of studies addressing each disease category was compared with the disease burden that each of these