

# Cost-benefit and cost-effectiveness of the incorporation of the pneumococcal 7-valent conjugated vaccine in the routine vaccination schedule of Catalonia (Spain)

E. Navas<sup>a,\*</sup>, L. Salleras<sup>b,c</sup>, R. Gisbert<sup>d</sup>, A. Domínguez<sup>a,b</sup>, E. Timoner<sup>a</sup>, D. Ibáñez<sup>a</sup>, A. Prat<sup>b,c</sup>

<sup>a</sup> General-Directorate of Public Health, Department of Health, Generalitat of Catalonia, Travessera de les Corts, 131-159, 08028 Barcelona, Spain

<sup>b</sup> Department of Public Health, School of Medicine, University of Barcelona, Spain

<sup>c</sup> Service of Preventive Medicine, Hospital Clínic, Barcelona, Spain

<sup>d</sup> School of Economics, University of Vic, Spain

Available online 13 January 2005

## Abstract

The health and economic costs and benefits of vaccinating a cohort of 60,000 children born in Catalonia in the year 2000 with the pneumococcal 7-valent conjugated vaccine were compared with the alternative of not implementing the vaccination programme. The time horizon fixed for the programme was 10 years for invasive disease, 2 years for all episodes of pneumonia and otitis media and 3.5 years for the placement of tympanostomy tubes. In the base case (incidence rate of invasive disease of 160 per 100,000 and price of the vaccine 50 euros) the net present value was negative, both from the societal perspective (−5.1 million euros) and from the provider's perspective (−9.2 million euros). The benefit-cost ratio was 0.59 euros from the societal perspective. The cost per disability adjusted life year (DALY) gained was 44,307 euros from the societal perspective and 80,291 euros from the provider's perspective.

© 2005 Elsevier Ltd. All rights reserved.

**Keywords:** Pneumococcal 7-valent conjugate vaccine; Cost-benefit analysis; Cost-effectiveness analysis; Costs; Economic Evaluation

## 1. Introduction

The pneumococcal 7-valent conjugated vaccine has a potentially important impact in reducing the disease burden generated by invasive pneumococcal disease in children from countries where the disease incidence is high and the distribution of disease-causing pneumococcal serotypes is similar to that of the United States [1]. This is true of Catalonia, since the proportion of invasive disease-causing serotypes included in the vaccine and the magnitude of the health problem generated by the disease is similar to that of the United States [2,3]. In addition, Catalonia has one of the highest levels of pneumococcal resistance to antibiotics in the world [4].

The objective of this study was to estimate the costs and benefits (cost-effectiveness analysis and cost-benefit

analysis) of the inclusion of the pneumococcal 7-valent conjugated vaccine in the routine vaccination schedule of Catalonia.

## 2. Methods

### 2.1. Description of the model

The costs and benefits (health and economic) of vaccinating a cohort of 60,000 children born in Catalonia in the year 2000 were compared with the current strategy of no routine vaccination.

The economic analysis was carried out from the societal perspective (cost-effectiveness analysis and cost-benefit) and from the healthcare provider's perspective (cost-effectiveness analysis) [5].

The time horizon of the programme was established at 10 years for invasive forms, 2 years for all episodes of

\* Corresponding author. Tel.: +34 93 5566418; fax: +34 93 2272921.  
E-mail address: [e.navas@gencat.net](mailto:e.navas@gencat.net) (E. Navas).

pneumonia and otitis media and at 3.5 years for the placement of tympanostomy tubes.

To analyze disease evolution with and without the vaccination programme, a decision tree [5] was designed to include all possible events. The incidence rates and probabilities of occurrence were calculated according to the estimated incidence of pneumococcal-related disease, complications and deaths in the 0–10 years age group in Catalonia and the estimated effectiveness of vaccination in preventing these pathologies. We also considered the children who leave the model each year due to deaths from all causes, independently of the programme.

The economic and health costs and benefits of the vaccination programme were updated to the year 2000 at a discount rate of 5%. All costs were expressed in euros.

The *cost-benefit analysis* was carried out only from the societal perspective, including both the direct and indirect costs.

The *net present value* of the programme was calculated by subtracting the discounted costs of the vaccination programme from the discounted benefits [5].

The *benefit-cost ratio* of the programme was calculated by dividing the discounted benefits of the programme by the discounted cost [5].

The *cost-effectiveness ratio* was calculated by dividing the net present value of the programme by the effectiveness of the programme [5].

When the cost-effectiveness analysis was carried out from the societal perspective, the net present value is the same as that of the cost-benefit analysis (direct and indirect costs). When the perspective of the analysis was the provider, only direct costs were included.

The effectiveness was measured in physical units of health: deaths avoided, years of life saved, disability adjusted life years (DALY) gained, cases of invasive disease avoided, episodes of pneumonia avoided and episodes of otitis media avoided.

## 2.2. Estimated incidence of pneumococcal disease in Catalonia

### 2.2.1. Invasive pneumococcal disease

The incidence of invasive pneumococcal disease in Catalonia was estimated according to the results of the study by Domínguez et al. [3].

Comparison of the incidence of invasive pneumococcal disease by ages and clinical types in the United States (Robinson et al.) [6] and Catalonia (Domínguez et al.) [3] shows that in children under 2 years of age, where disease incidence is highest, the differences in the incidence of invasive disease between the two countries is due to the lower incidence of non-focal bacteremia in Catalonia, since the incidence of meningitis and pneumonia is similar.

These differences are probably not real but are due to different clinical practises. In Catalonia, routine blood cultures are not made for children with fever attended in pri-

mary health care or hospital emergency units, whereas in the United States, this diagnostic test is commonly made. However, it does not seem that there are differences in the clinical diagnosis of meningitis and pneumonia in the two countries. Thus, it is probable, that the incidence of invasive pneumococcal disease in Catalonia is similar to that of the United States.

For these reasons, the estimated incidence of non-focal bacteremia used to calculate the base case was the incidence observed in the United States [6].

### 2.2.2. Pneumonia

It was not possible to evaluate the protective efficacy of the pneumococcal 7-valent conjugated vaccine in the prevention of non-invasive pneumococcal pneumonia due to the difficulty of diagnosing the etiology of pneumonia in daily clinical practise. Black et al. [7] evaluated the protective efficacy of the vaccine against all episodes of pneumonia and found that it avoided 22.7% of clinically and radiologically confirmed episodes of pneumonia in children under 2 years of age.

There are no reliable population data on the incidence of all episodes of pneumonia in children in Catalonia. Since the incidence of invasive disease is similar in Catalonia and the United States, the incidence data on clinically and radiologically diagnosed pneumonia in the control group of the study by Black et al. were used (10.6 cases per 1000 persons per year in children under 2 years of age) [7].

### 2.2.3. Otitis media

The incidence of otitis media was estimated using the results of the same study. This gave an incidence of otitis media of 1.18 episodes per child per year in children under 2 years of age and of the placement of tympanostomy tubes of 3.8 per 100 children during the first 3.5 years of life [8].

A recent study in Valencia by Garcés Sanchez et al. [9] found an accumulated incidence of otitis media of 106.2 episodes per 100 children during the first 2 years of life, lower than that observed in the United States. Although the incidence of invasive pneumococcal disease found in Valencia seems to be lower than that of Catalonia [10], in order to consider all possibilities, a sensitivity analysis was made reducing the incidence of otitis media by half and by 75%, to include the incidence observed by Garcés Sanchez et al.

## 2.3. Estimated deaths, complications and disability caused by *Streptococcus pneumoniae*-related disease

There are no reliable data on the case-fatality rate of invasive pneumococcal disease in Catalonia. In the United States, Robinson et al. found a global case-fatality rate of 1.4% in invasive types in the second half of the 1990s [6]. This rate was used in the present study.

In the last 50 years, a substantial reduction in mortality due to all episodes of pneumonia in children in developed coun-

متن کامل مقاله

دریافت فوری ←

**ISI**Articles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات