Impact of infant pneumococcal vaccination on pneumococcal pneumonia hospitalizations in older adults

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Introduction

Pneumonia is an important cause of morbidity, mortality and expenditure of health resources. Globally, lower respiratory tract infections, including pneumonia, rank as the fifth most common cause of death worldwide, behind Alzheimer disease and other dementias, with an estimated incidence of 36.8 per 100,000 inhabitants[1]. However, even in higher income countries, pneumonia remains the leading cause of death by infectious diseases[2]. In 2014, it ranked fourth amongst the causes of death in Portugal[3]. Given the high frequency of *Streptococcus pneumoniae* among all pneumonia, it is reasonable to expect that a wide use of pneumococcal vaccines would reduce the pneumonia burden in the population due to a direct and indirect effect.

In Portugal, the 7-valent conjugated pneumococcal vaccine (PCV7) was commercialized in 2001. The 13-valent conjugated pneumococcal vaccine (PCV13) is in use since 2010 up to now and it was included in the National Immunization Program in 2015 for infants. Currently, the PCV13 is also recommended for risk groups and elderly people.

Since the introduction of conjugated pneumococcal vaccines (PCV) in infant immunization programs in 2000s there is consistent evidence of pneumonia reduction in vaccinated children worldwide[4]. However, limited data are available on indirect effect of infant immunization on pneumonia burden in unvaccinated population subgroups[5].

This study aims to assess the indirect effect of the introduction of infant PCV7 and PCV13 on the pneumonia burden among adults aged 65 or more years in Portugal, comparing trends in Pneumococcal Pneumonia (PP) hospitalization rates before and after the introduction of the PCV7/PCV13.

Methods

We performed an ecological study using the national hospital discharge registry data from 1 July 1998 to 30 June 2016. PP hospitalization was defined as having a primary discharge diagnosis coded as 481 (International Classification for Diseases-9th version) or J13 (International Classification for Diseases-10th version).

To assess trends in PP hospitalization rates before and after the PCV7/PCV13 introduction, interrupted time series analysis was used. Poisson regression models with monthly count of PP hospitalizations as outcome variable, adjusted for seasonality, influenza like illness and accounting for overdispersion were fitted separately for 65-74, 75-84 and 85+ age groups, for both women and men. To evaluate the public health impact of immunization programs, rates of pneumonia hospitalizations observed after each PCV introduction (February 2002 to June 2005 for PCV7 and January 2011 to June 2016 for PCV13) were compared with projected hospitalization rates based on pre-vaccination period trends.

Results

During the study period, the PP annual hospitalization rate varied between 10.2 and 4.0 per 10,000 inhabitants. In the pre-PCV7 period (July 1998—January 2001) the PP hospitalization rate increased 16% per year. After the PCV7 introduction (February 2002 to June 2005) a statistically significant decline in the PP hospitalization rates was observed in two population subgroups: women aged 65–74 years old (RR=0.76, CI95%: 0.64; 0.90) and men aged 75–84 years old (RR=0.84, CI95%: 0.70; 0.99), resulting in 4.6 fewer PP hospitalizations per 10,000 inhabitants, during 2004/05.

The decreasing trend continued after the PCV13 introduction (January 2011 - June 2016), with an 11% decline per year (RR=0.89; IC95%: 0.86 to 0.91) in the PP hospitalization rate. The largest PP rate reduction after the PCV13 introduction was observed in the 65-74 years old group: 14% per year (RR=0.86; CI95%: 0.79, 0.93) for men and 19% per year (RR=0.81; CI95%: 0.72, 0.92) for women. In 2015/16, 2.9 hospitalizations per 10,000 inhabitants were prevented in adults aged 65 years or more by the PCV13 introduction in infants.

Conclusion

Our study suggests a considerable decrease in the PP hospitalization rates in adults aged 65 or more years after the infant PCV7/PCV13 vaccine introduction in Portugal. The ageing of the population highlights the importance of this indirect effect on PP prevention. The possibility of a pneumococcal serotype replacement reinforces the need for continuous monitoring of this health problem along time.

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