The Effect of PCV13 Vaccination and Demographic Changes on the Future Pneumococcal Disease Burden in Germany: An Integrated Probabilistic Differential Equation Approach

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Abstract

Pneumococcal disease is a significant cause of morbidity and mortality worldwide, including in Germany. The introduction of the 13-valent pneumococcal conjugate vaccine (PCV13) has led to a reduction in pneumococcal disease burden. However, demographic changes, such as an aging population, can influence the future disease burden. This study aims to assess the combined effect of PCV13 vaccination and demographic changes on the future pneumococcal disease burden in Germany using an integrated probabilistic differential equation approach.

Keywords: Vaccine • Pneumococcal disease • Demographic changes

Introduction

Pneumococcal disease is caused by the bacterium Streptococcus pneumoniae and can manifest as pneumonia, meningitis, or sepsis. The introduction of PCV13 has led to a significant reduction in pneumococcal disease incidence and mortality, particularly among children. However, the impact of PCV13 vaccination and demographic changes on the future disease burden in Germany remains uncertain [1]. An integrated probabilistic differential equation model was developed to simulate the impact of PCV13 vaccination and demographic changes on pneumococcal disease burden in Germany. The model incorporated data on vaccination coverage, vaccine effectiveness, demographic projections, and disease surveillance data. Uncertainty in the model parameters was accounted for through probabilistic sensitivity analysis. The model projections suggest that PCV13 vaccination will continue to reduce the overall pneumococcal disease burden in Germany over the next decade. However, the impact of vaccination is expected to be more pronounced among older adults, who are at higher risk of pneumococcal disease. Demographic changes, such as an aging population, are also expected to increase the overall disease burden, particularly among older adults [2].

Literature Review

PCV13 was introduced in Germany in 2009 for infants and young children, with a catch-up program for older individuals at high risk. The vaccine has been highly effective in reducing vaccine-type pneumococcal disease among vaccinated individuals. However, the overall impact of PCV13 on the population has been influenced by factors such as vaccine coverage, serotype replacement, and demographic changes [3,4].

Discussion

Our model predicts that, without further interventions, the overall burden of pneumococcal disease in Germany will decrease over time due to the continued impact of PCV13 vaccination. However, the burden among older adults and individuals with underlying medical conditions is expected to remain significant. Serotype replacement is projected to lead to an increase in non-vaccine-type pneumococcal disease, partially offsetting the reduction in vaccine-type disease. Our findings highlight the importance of maintaining high vaccine coverage and monitoring serotype dynamics to optimize vaccination strategies. Targeted vaccination programs for high-risk groups, such as older adults and individuals with underlying medical conditions, may be needed to further reduce the burden of pneumococcal disease in Germany [5,6].

Conclusion

In conclusion, the integrated probabilistic differential equation approach provides valuable insights into the potential impact of PCV13 vaccination and demographic changes on the future burden of pneumococcal disease in Germany. Continued surveillance and modelling efforts are essential to inform public health policies aimed at reducing the overall burden of pneumococcal disease. The findings of this study highlight the importance of continued vaccination efforts and the need to account for demographic changes in public health planning. Strategies to increase vaccination coverage among older adults and high-risk populations may further reduce the burden of pneumococcal disease in Germany.

The integrated probabilistic differential equation approach used in this study provides valuable insights into the combined effect of PCV13 vaccination and demographic changes on the future pneumococcal disease burden in Germany. Continued monitoring and adaptation of vaccination strategies are essential to mitigate the impact of pneumococcal disease in the future.

Acknowledgement

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Conflict of Interest

None.

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