In search of Healthy Ageing
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The willingness of older adults to receive vaccination
Vaccines have been very successful in preventing infectious diseases. Since the implementation of routine vaccination of children, incidences of childhood diseases and mortality have reduced significantly. Next, a new and vulnerable target population received increased attention in the Netherlands. As a result, the National Influenza Prevention Program was implemented in 1997, offering influenza vaccination to persons aged 65 years and older (from 2007 persons aged 60 years and older) and certain risk groups to prevent associated complications and mortality of influenza. Life expectancy has over the course of 150 years risen spectacularly in most European countries and will keep rising which results in a increasing size and proportion of the population 50 years and older. This population is more susceptible to infectious diseases because of immunosenescence, co-morbidity and general frailty. Thus, to promote healthy aging, vaccination against other vaccine-preventable-diseases could be a strategy. In addition to its possible individual benefits, vaccination may also yield social benefits, for example lower overall cost of healthcare.

Assessment vaccine candidates

In chapter 2, we assessed herpes zoster, pneumococcal disease, pertussis and hepatitis A vaccines according to a previously formulated set of criteria for additions to a national immunization programme. Herpes zoster, pneumococcal disease and pertussis are common among persons aged 50 and older in the Netherlands. In the future, older adults will become more susceptible to hepatitis A, because fewer persons will have acquired natural immunity through exposure. For each of these infectious diseases, a vaccine is available, although its effectiveness varies and it may not be specifically registered for the elderly population. Whereas vaccination might have consequences for the virulence by serotype replacement or antigenic changes and prevalence of pneumococcal disease and pertussis, it could lower the disease burden and reduce healthcare costs. Currently, only vaccination against herpes zoster and pneumococcal disease appear to be cost-effective. Considering the incidence and the crude estimated burden of these diseases, prevention of pneumococcal disease and herpes zoster might warrant higher priority than prevention of pertussis and hepatitis A. We conclude that vaccination may improve the health of the elderly population and identified pneumococcal disease, herpes zoster and pertussis vaccination as candidate vaccines. However, our review shows that there are still gaps in our knowledge, and therefore an accurate judgement about its potential impact remains difficult. More research is needed to determine how vaccination can most effectively improve the health of the growing population 50 years and older.

We therefore estimated the burden of disease of pneumococcal disease, herpes zoster, pertussis and influenza, specifically for persons aged 50 years and older in chapter 3. The average annual disease burden for these four diseases in the Netherlands was estimated for the period 2010-2013 using the disability-adjusted life year (DALY) measure. Disease models and parameters were obtained from previous research. Where possible these models were adapted specifically for older adults and applied age-specific parameters derived from literature. The disease burden based on these adapted models
and parameters was compared with the disease burden based on the general population models. Among older adults, the disease burden in the period 2010-2013 was highest for pneumococcal disease, mostly because of high mortality, followed by influenza. Disease burden of herpes zoster and pertussis was relatively low and consisted mostly of years lived with disability. Better information on the course of infectious diseases and long-term consequences would enable more accurate estimation of disease burden in older adults.

**The willingness of older adults to receive vaccination**

For any vaccination program to be successful in a given population, acceptance of vaccines is crucial. The aim of this thesis was to identify prominent factors that play a role in the vaccination decision-making process and to determine the relative importance of these identified factors.

In order to gain insight in the willingness of older adults to receive vaccination pneumococcal disease, herpes zoster and pertussis, chapter 4 describes a literature review to identify all relevant factors related to vaccine uptake for persons aged 60 years and older in relevant literature databases.

We identified six main themes that influence the willingness to be vaccinated: 1) attitudes and beliefs regarding vaccination in general; 2) perceived risk and severity; 3) vaccine characteristics; 4) advice and information; 5) general health-related behavior; and 6) accessibility and affordability. The most prevalent determinants in the literature are related to attitudes and beliefs, vaccine characteristics, recommendations of healthcare workers, and perceived susceptibility.

In addition, qualitative research was conducted to elucidate the motives of Dutch persons aged ≥50 years for accepting vaccination. Chapter 5 describes the results of 13 focus groups with Dutch older adults receding in different living arrangements. The transcripts were analyzed according the principles of thematic survey. By an inductive process, main themes and related subthemes were extracted from the responses. Eight themes were found to play an important role in accepting vaccination: 1) healthy aging; 2) usefulness of vaccination in older age; 3) risk of getting an infectious disease; 4) vaccine characteristics; 5) severity of the disease and its implications; 6) the experiences of previous vaccinations; 7) the influence of healthcare workers and other people; and the need for information. The most important one appears to be the risk of getting an infectious disease.

From the previous two discussed studies, it can be concluded that different factors play a role in the vaccination decision making of older adults. Chapter 6 determines the relative importance of vaccine and disease specific characteristics and acceptance for Dutch older adults, including pneumococcal disease, herpes zoster, pertussis vaccination, and influenza vaccination. Based on the literature review and the focus group study, we identified 6 factors to be included in a discrete choice experiment study to determine the relative importance of these 6 factors. These factors were: the clinical syndrome, the mortality rate, the vaccine effectiveness, the side effects, the risk of
getting the disease (or vulnerability) and the number of vaccinations that need to be given. The study generated choice data that was analyzed using a mixed multinomial logit statistical model. Using this model, the vaccine uptake of the included vaccines (pneumococcal, herpes zoster, pertussis and influenza vaccination) could also be estimated. Older adults were invited by sending a questionnaire and information letter. The response rate amounted to 41% (735 older adults). Of the included factors, high mortality risk of the infectious disease (20%), high susceptibility of getting the infectious disease (100%), and high vaccine effectiveness (100%) were found to be most important for vaccine acceptance. Age, having received influenza vaccination in 2013 and self-perceived health score were identified as individual factors that affect these vaccine preferences. Persons who received the flu vaccination in 2013 reported a higher preference for vaccination against the clinical syndromes of influenza compared to pertussis and herpes zoster compared to persons that did not receive the influenza vaccination in 2013. Persons with a higher self-rated health score attributed more importance to a vaccine that protects against an infectious disease with a 20% mortality rate, a vaccine with 100% effectiveness and a vaccine that has to be given twice in comparison to persons with a lower self-reported health score. Potential vaccination rates of older adults were estimated at 68% for pneumococcal vaccination, 58% for herpes zoster vaccination and 54% for pertussis and influenza vaccination. For persons aged 50-65, potential vaccination rates were estimated at 58% for pneumococcal vaccination, 50% for herpes zoster vaccination, 44% for pertussis vaccination and 42% for influenza vaccination. For persons aged 65 and older, these were 76%, 68%, 58% and 66%, respectively. These results suggest that older adults are most likely to accept pneumococcal vaccination of the three candidate vaccines. In addition, the information that accompanies the implementation of a new vaccine has to be tailored for the individual and the vaccine it concerns. Special attention is needed to ensure high uptake among persons aged 50-65 years.

The attitude of the general practitioner on adult vaccination

From the previous studies, it also became apparent that the general practitioner plays an important role in vaccination decision making of older adults. In The Netherlands and other countries, the general practitioner's office is the central location for organizing these immunization campaigns. The general practitioner (GP) (together with the practice nurse) selects, invites, and vaccinates the target population, accounting for 95% of all vaccinations administered to risk groups. Consequently, the feasibility of extending current programmes depends on the willingness of the GPs to organize and endorse these campaigns. Therefore, we explored the Dutch GPs’ attitudes regarding older adult vaccination in general and their attitudes regarding the incorporation of additional vaccines in the current Dutch influenza vaccination programme. Chapter 7 and 8 focus on adults aged 60 years and older, as the influenza vaccination program is offered to this target population. In these studies, the included vaccines were pneumococcal disease, herpes zoster, pertussis and influenza vaccination. Chapter 7 describes a qualitative
study were ten Dutch GPs (five men and five women) were interviewed that worked either in an academic hospital, in a practice based in a health centre, or in individual practice. Transcripts were again analysed according to thematic analysis. GPs perceived prevention as part as their job and believed vaccination to be effective for preventing infectious diseases. However, influenza vaccination was not always perceived as effective. Doubts regarding the usefulness of additional vaccinations were identified. If additional vaccines would be offered, this should be based on scientific evidence and the severity of the infectious disease. Selection of patients for vaccination should not be based solely on age, but more on risk factors. The GP indicated that they should be the central point of contact for new vaccination campaigns. However, high workload was seen as a concern and several GPs questioned whether they could actually refuse to conduct the vaccination program when it is implemented. We concluded that a positive attitude towards implementing additional vaccinations is not apparent. Achieving the most health benefits seems to be the most important consideration of Dutch GPs regarding vaccinating older adults.

In order to confirm these results among a wider range of GP's, a questionnaire was designed based on the findings of the qualitative study and send online to all general practitioners’ offices in the Netherlands (chapter 8) Using RandomForrest analysis, the most important factors were identified that predict the intention of general practitioners to give additional vaccination and their attitude towards expanding older adult vaccination. In total, 723 GP’s filled in the questionnaire (response rate of 6%). The intention of GPs to offer additional vaccination to people aged 60 years and older other than influenza vaccination was mainly predicted by their attitude towards offering additional vaccination, their attitude towards vaccination as a preventive tool in general, and their attitude towards offering vaccination during the outbreak of an infectious disease. The factors with the largest predictive value for attitude include the selection of vaccination for older individuals on the basis of co-morbidities instead of age, general attitude towards vaccination as a preventive tool, the attitude towards offering people aged 80 years and older vaccination, the attitude towards offering older people vaccination during an outbreak of the infectious disease, and the perceived severity of herpes zoster and pneumonia, as well as the prevalence of herpes zoster.

On average, GPs seem to be positive about vaccination as a preventive tool in general, but a bit less positive about offering additional vaccination to people aged 60 years and older. Our findings further suggest that GPs are more willing to recommend vaccination against pneumococcal disease, herpes zoster and pertussis to patients in their 60s when those patients have co-morbidities, with the most positive intention for pneumococcal disease.
Summary

Conclusion

The studies presented in this thesis give insights in the willingness of older adults to receive vaccination and the importance of adult vaccination. It is apparent that the decision of older adults to accept vaccination is not based on a single argument but on multiple arguments. Most certain, a part of the older adult population will typically base their decision on the opinion of the GP. However, the remaining part of people will weigh the pros and cons, taking their perceived vulnerability, the vaccine effectiveness and severity of the infectious disease into account. Overall, older adults are willing to accept vaccination. Considering the studies in this thesis, pneumococcal vaccination will be the vaccination with the highest acceptance. Herpes vaccination follows in second place and pertussis in last place. However, this thesis also shows that individual differences exist in accepting vaccination. This relates to the age of the person that would receive the vaccination, their influenza vaccination status and their self-perceived health. Therefore, it is of utmost importance to focus on tailored information when implementing new vaccines to achieve the highest vaccination uptake possible in an effort to contribute to healthy ageing.