Factors affecting the uptake of vaccination by the elderly in Western society

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Factors affecting the uptake of vaccination older adults

Abstract

Objective: To present the results of a literature review on factors related to vaccine uptake by elderly persons.

Methods: A systematic literature search was performed using Medline, Embase, and SciSearch to collect all publications available on factors related to vaccine uptake from 1966 until October 2012 for West European and North American societies. In total, 1001 articles were identified and 60 were included in the review.

Results: We identified six main themes that influence the willingness to be vaccinated: 1) attitudes and beliefs regarding vaccination in general including positive and negative attitudes and beliefs; 2) perceived risk and severity including knowledge, perceived susceptibility and severity and personal experience; 3) vaccine characteristics including side-effects, effectiveness, content of the vaccine and knowledge; 4) advice and information including influence of the healthcare worker and relatives and the information source and format; 5) general health-related behavior including previous vaccinations, visiting GP or senior center and other preventive behavior; and 6) accessibility and affordability including logistics, combinations of vaccines and costs.

Conclusion: The most important factors related to vaccine uptake are people’s attitudes and beliefs regarding vaccination (especially their negative attitudes), recommendations of healthcare workers, side effects and effectiveness of the vaccine, and perceived susceptibility.
Introduction

The world is ageing. It is estimated that the proportion of the world’s population over 60 years of age will have doubled between 2000 and 2050. Rising from 11% to 22%, this reflects an increase from 605 million to 2 billion (World Health Organization (WHO), 2013). As a result of immunosenescence, co-morbidity, and general frailty, the elderly are increasingly susceptible to infectious diseases (Mathei et al., 2011). They are also more actively engaged in society, leading to a greater likelihood of disease transmission (de Boer, 2006). Consequently, infectious diseases will become ever more prevalent among the elderly.

Vaccination is one of the most successful interventions to prevent infectious diseases, as proven for children (WHO, 2014). People of 60 years or older are commonly offered vaccination against influenza but less so for other diseases (WHO, 2011; Eilers et al., 2013). As in any population, a high acceptance rate is crucial for the success of vaccination in the elderly. Their rates for influenza vaccination vary substantially across Europe, with most countries not meeting the WHO target of 75% (VENICE Consortium, 2011). To address this shortfall, it is important to know which psychosocial factors have most effect on vaccine uptake by the elderly. The psychosocial factors could be addressed and act upon with interventions. This topic has been the subject of several literature reviews, though only covering quantitative studies (Richardson and Michocki, 1994; Mieczkowski and Wilson, 2002; Ward and Draper, 2006; Kohlhammer et al., 2007; Baeyens et al., 2009). These reviews have identified lack of awareness and knowledge, fear of side-effects, low perceived effectiveness, low perceived susceptibility, and logistic reasons as being important factors in the vaccination uptake. However, since vaccines and vaccination practices have changed over time, reviews including qualitative research would have added value. During the last decade, a shift has been observed in medicine, from cure to prevention. This has led to increasing attention for preventive measures such as vaccination. For example, the Dutch health council released a report on vaccination programs for all ages (Health Council The Netherlands, 2007). This shows that vaccinations are becoming more prominent in life. It is therefore important to act upon these developments and to stay updated on the beliefs and attitudes on vaccinations of the different target groups. At the same time, the role of the general practitioner becomes less prominent for the younger target groups and people gather their own information from for example the internet. This was shown during the pandemic influenza outbreak in 2009 in the Netherlands. The internet was used as an information source by 56% of the acceptors of H1N1 influenza vaccine and by 75% of decliners (Bults, 2011). This is another reason why it is important to be updated on the beliefs and attitudes concerning vaccination.

In order to update the literature reviews and, this study presents a complete and updated systematic overview of the factors related to vaccine uptake by the elderly in Western countries based on qualitative and quantitative data.
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Methods

Search strategy

A systematic computerized search of the literature on vaccine acceptance by persons aged 50 years and older was performed by an information specialist (Appendix A). The databases used were Medline, from 1966 onwards, and Embase and SciSearch, both from 1981 onwards. The search yielded 1001 articles dating from 1966 through October 2012. Articles were removed if deemed irrelevant in light of title words (#6 in the search strategy) but then manually checked to ensure no relevant articles were missed. All checked articles were indeed irrelevant and therefore excluded.

Study selection

Of the 1001 retrieved articles, a selection was made by applying the following inclusion criteria (Appendix B). The article:
1) reports qualitative or quantitative research with original data;
2) examines factors influencing vaccine uptake of persons of 50 years or older;
3) describes research on the general population of community-dwelling elderly;
4) is written in English.

Five double references were identified and removed. One article was unobtainable. For ten others, only the abstract was available. A manual search of reference lists yielded five more acceptable articles. In total, 60 were included (Table 1). Forty-two considered influenza vaccination, while the other 18 examined vaccination for other infectious diseases (pneumococcal pneumonia, herpes zoster, and pertussis (whooping cough).

Identifying themes

Themes, factors, and elements were extracted from an inventory of the determinants named in the literature. While themes, factors and elements were derived primarily from quantitative studies, qualitative studies either confirmed or added a perspective to a theme or factor. Factors from the different quantitative articles were included in the review if they were reported to be significantly associated with the vaccination uptake. For studies that only presented frequencies, the factors presented in the papers in the top three of the frequency rankings were included in the review. We extracted the different elements from the data of the retrieved studies and via an inductive process we identified factors and eventually created themes. The constructing of the themes followed therefore a bottom-up or data-driven approach to make sure every relevant factor would be included.
A theme consists of a bundle of factors that captures a specific subject related to accepting vaccination. The factors, in turn, consist of elements that represent the data in
the identified articles. In order to serve as a label for a theme, a factor had to be mentioned in at least 10 articles. Also, consensus among the authors on the theme and its constituent factors was a requirement. The elements were classified by subject, not by the type of information (for example, belief or advice). Consequently, attitudes and beliefs will be presented throughout different themes.
Table 1: Overview of articles included in the review, with year of publication, study population and research method published in Western Societies.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year of publication</th>
<th>Study population</th>
<th>Research</th>
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<tbody>
<tr>
<td>Armstrong et al.</td>
<td>2001</td>
<td>Predominantly African-American low-income urban population ≥ 65 years</td>
<td>Quantitative: health-system-population telephone survey</td>
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<tr>
<td>Bardenheier et al.</td>
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<td>Quantitative: telephone survey</td>
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<td>Irish patients ≥65 years with a medical condition from two rural general practices</td>
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<td>Bloom et al.</td>
<td>1985 (abstract)</td>
<td>Patients [74-92 years] from general medical clinic of a major teaching hospital</td>
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<tr>
<td>Brunton et al.</td>
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<tr>
<td>Burns, Ring, Carrol</td>
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<tr>
<td>Carter et al.</td>
<td>1986</td>
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</tr>
<tr>
<td>CDC</td>
<td>2004</td>
<td>Nationally representative selection of Medicare population ≥65 years in a non-institutional setting</td>
<td>Quantitative: structured interview</td>
</tr>
<tr>
<td>CDC</td>
<td>1997</td>
<td>Hispanic and non-Hispanic white older adults ≥65 years</td>
<td>Quantitative: structured interview</td>
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<tr>
<td>CDC</td>
<td>1999</td>
<td>Nationally representative selection of Medicare population ≥65 years in a non-institutional setting</td>
<td>Quantitative: structured interview</td>
</tr>
<tr>
<td>CDC</td>
<td>1988</td>
<td>Persons ≥65 years living in DeKalb and Fulton counties</td>
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<td>Chen et al.</td>
<td>2007</td>
<td>Members of faith-based congregations in Los Angeles and Honolulu (50-75 years)</td>
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<td>Chi, Neuzil</td>
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<td>Cornford, Morgan</td>
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<td>Fowles, Beebe</td>
<td>1998</td>
<td>Seniors ≥65 years in the Minneapolis-St Paul area</td>
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<td>Harris et al.</td>
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<td>Herbert et al.</td>
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<td>Honkanen, Keistinen, Kivela,</td>
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<td>Kwong et al.</td>
<td>2010</td>
<td>Older people from China, Indonesia, Turkey, Korea, Greece, Canada, UK, Brazil, and Nigeria</td>
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<td>Lewis-Parham et al.</td>
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<td>Lindley et al.</td>
<td>2006</td>
<td>Medicare beneficiaries (white and African-American) ≥65 years</td>
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<td>Madhavan et al.</td>
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<td>Rural seniors ≥65 years</td>
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<td>Mangtani et al.</td>
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<td>Miller et al.</td>
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<td>Adults from medical clinics of an inner-city teaching hospital in Atlanta</td>
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<td>Mortensen</td>
<td>2011</td>
<td>Patients, relatives, and individuals with experience of herpes zoster 50-65 years</td>
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<td>Nexøe, Kragstrup, Søgaard</td>
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<td>Nicholson</td>
<td>1994 (abstract)</td>
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<td>Nicholson</td>
<td>1993</td>
<td>Elderly from Leicestershire listed by Family Health Practices and not in residential care ≥65 years</td>
<td>Quantitative: mail survey</td>
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<td>Nicoleau et al.</td>
<td>2001</td>
<td>Community-residing African-American patients from physician private practices ≥65 years</td>
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<td>Nowalk et al.</td>
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<td>Opstelten, Hak, Verweij, van Essen</td>
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<td>Patients of general practitioners ≥65 years in the Netherlands</td>
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<tr>
<td>Opstelten, van Essen, Hak</td>
<td>2009</td>
<td>Patients of general practitioners ≥65 years in the Netherlands</td>
<td>Quantitative: mail survey</td>
</tr>
<tr>
<td>Preglacco et al.</td>
<td>1999</td>
<td>Elderly from Milan, Molise and Naples ≥65 years</td>
<td>Quantitative: structured interview</td>
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<td>Authors</td>
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<td>Santibanez et al.</td>
<td>2002</td>
<td>Patients from different healthcare settings ≥66 years</td>
<td>Quantitative: telephone survey</td>
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<tr>
<td>Schler, Vargas, Ganguly, Haley</td>
<td>1987 (abstract)</td>
<td>Veterans ≥85 years living at home</td>
<td>Quantitative: mail survey</td>
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<tr>
<td>Sengupta et al.</td>
<td>2004</td>
<td>Non-institutionalized community-dwelling elderly African-Americans ≥65 years living in Durham county</td>
<td>Qualitative: semi-structured interview</td>
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<td>Skowronski et al.</td>
<td>2004</td>
<td>Adults ≥25 years</td>
<td>Quantitative: telephone survey</td>
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<tr>
<td>Small et al.</td>
<td>2005 (abstract)</td>
<td>Elderly patients at an urban geriatric clinic</td>
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<td>Sotnik, Sutin, Marcus</td>
<td>2001 (abstract)</td>
<td>Elderly urban population</td>
<td>Quantitative: self-administered questionnaire</td>
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<td>Telford, Rogers</td>
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<td>Patients from an inner-city general practice in England ≥75 years</td>
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<td>Van Essen, Kuyvenhoven, de Melker</td>
<td>1997</td>
<td>Healthy elderly people ≥65 years from family practices</td>
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<td>Zimmerman et al.</td>
<td>2003</td>
<td>Patients from various healthcare settings ≥66 years</td>
<td>Quantitative: telephone survey</td>
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<td>2003</td>
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<td>Quantitative: telephone survey</td>
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Results

As shown in Figure 1, the factors found to influence an elderly person’s willingness to be vaccinated comprise six themes: 1) attitudes and beliefs on 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. In some instances, these themes or factors are expressed by wording in quotation marks, denoting literal renditions of the elements found in the studies, such as certain statements.

1) Attitudes and beliefs on vaccination in general

Both positive and negative attitudes and beliefs were identified with regard to a particular vaccine or to vaccination in general. These constitute the first theme.

A. Positive attitudes and beliefs
The elderly made their decision to accept or refuse vaccination by weighing the perceived advantages and disadvantages (Evans and Watson, 2003; Zimmerman, 2003; Nowalk et al., 2004; Cameron et al., 2009). In qualitative studies, vaccination was considered as a preventive strategy to improve their health (Daniels et al., 2004; Harris et al., 2006). An important predictor of accepting a vaccine in the future was agreement with the statement, “I would recommend everyone over 65 years of age to be immunized against flu” (Evans and Watson, 2003). Similar attitudes that positively influenced or predicted vaccine uptake were considering vaccination as wise, important or beneficial. Acceptance was also related to knowledge about the vaccine and a wish to try it (Hayes-Bautista et al., 1997; Ehresmann et al., 2001; Zimmerman, 2003; Daniels et al., 2004). Other predictors were akin to protecting others (Carter et al., 1986; Skowronski et al., 2004; Daniels et al., 2004; Harris et al., 2006; Kwong et al., 2010) and living together with people who might be exposed (Nexoe et al., 1999; Burns et al., 2005). Some elderly persons wanted to avoid having to ask other people for help if they would fall ill (Carter et al., 1986) or anticipated regret if they were to suffer from or transmit illness after refusing vaccination (Gallagher and Povey, 2006).

B. Negative attitudes and beliefs
Vaccine uptake was negatively associated with the opinion that vaccination weakens one’s natural defenses and that it is painful, causes disease or is irrelevant to health (Nexoe et al., 1999; Sotnik et al., 2001; Ehresmann et al., 2001; Zimmerman et al., 2003; Zimmerman, 2003; Harris et al., 2006; Chi and Neuzil, 2004; Madhavan et al., 2004; Nowalk et al., 2004; Nowalk et al., 2006; Mangtani et al., 2006; Gallagher and Povey, 2006). Furthermore, a fear of needles or a memory of discomfort caused by needles prevented some people from accepting vaccination (Carter et al., 1986; Schler et al., 1987; Drociuk, 1999; Nicoleau et al., 2001; Zimmerman et al., 2003; Sengupta et al., 2004; Mangtani et al., 2006). Others did not get a vaccination because it wasn’t a priority for them, they did not have the energy or health to obtain one, or they considered it
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inconvenient for other reasons (Schler et al. 1987; Nicholson, 1993; Drociuk, 1999; Pregliasco et al., 1999; Zimmerman et al., 2003; Mangtani et al., 2006; Chen et al., 2007; Funovits et al., 2012). Other negative attitudes that induced lower uptake were distrust of health services or modern medicine (Telford and Rogers, 2003; Daniels et al., 2004; Harris et al., 2006; Nowalk et al., 2006; Evans et al., 2007) or fear of contra-indications (Nicholson, 1993). Last, some behavioral factors were negatively associated with vaccine uptake, notably not being motivated, not thinking of it, forgetting it, not having the time, and having to make a special appointment (Drociuk, 1999; Pregliasco et al., 1999; Chen et al., 2007).

2) Perceived risk and severity

The second theme concerns whether the elderly perceive sufficient risk of contracting an infectious disease to make vaccination seem important. This depends on their knowledge of a vaccine’s importance, perceived susceptibility, perception of the severity of a disease, and their personal experience with it in the past.

A. Knowledge
Not believing or not knowing that a vaccine is needed or recommended was a reason (sometimes the most important one) for not accepting the vaccine (Bloom et al., 1985; Schler et al., 1987; Nicholson, 1993; Hayes-Bautista et al., 1997; Drociuk, 1999; Santibanez et al., 2002; Lewis-Parmar and McCann, 2002; Zimmerman, 2003; Adler and Winston, 2004; Hebert et al., 2005; Mangtani et al., 2006; Brown et al., 2011). On the other hand, having a prescription for a vaccination promotes acceptance (Burns et al., 2005).

B. Perceived susceptibility
Perceived susceptibility refers to the extent to which an elderly person feels at risk for an infectious disease. Perceived need showed high effect sizes in several studies. A high perceived susceptibility to influenza was associated with vaccination (Madhavan et al., 2004; Chen et al., 2007). The perception that declining the offer will lead to developing the flu was associated with a higher likelihood of being vaccinated against and influenza and also against pneumococcal disease (Zimmerman, 2003; Nowalk et al., 2004; Nowalk et al., 2006). The fear of developing disease or the perception of being at high risk of getting an infectious disease were also reasons to take the vaccine (Hayes-Bautista et al., 1997; Brunton et al., 2005; Mangtani et al., 2006). Conversely, one reason why some healthy elderly people were unwilling to be vaccinated is that they did not perceive a threat. They felt they would not get influenza, or they felt it was unlikely they would get an infectious disease (Frank et al., 1985; Nicholson, 1993; Gianino et al., 1996; Drociuk, 1999; van Essen et al., 1997; Santibanez et al., 2002; Zimmerman et al., 2003; Canova et al., 2003; Brunton et al., 2005; Mangtani et al., 2006). A low risk of contracting shingles was found to be associated with refusal of the herpes zoster vaccination by persons of 65 years or older (Opstelten et al., 2009). Qualitative studies also suggest that perceived
susceptibility is related to vaccination (Telford and Rogers, 2003; Evans et al., 2007, Cameron et al., 2009; Kwong et al., 2010; Mortensen, 2011).

Perceptions that elderly persons hold about their health status are important to their perceived susceptibility to infectious disease. Those who felt susceptible rated their health status as lower, and vice versa. The perception that one’s own health was good was strongly associated with vaccine non-compliance (van Essen et al., 1997; Nowalk et al., 2006). The elderly were more likely to be vaccinated when they perceived their health status as poor (Canova et al., 2003, Evans and Watson, 2003). The latter association was also observed in qualitative studies (Cornford and Morgan, 1999; Kwong et al., 2010).

C. Perceived severity
The perceived severity of an infectious disease can be described as the perceived impact of its consequences. A larger perceived impact and “being concerned about getting influenza and its complications” (Brunton et al., 2005) were identified as predictors of acceptance or reasons to take the vaccine (Nexoe et al., 1999). Those elderly who did accept influenza vaccination reported a higher perceived severity and a higher rating of discomfort from previous influenza than those who didn’t (Carter et al., 1986).

The perception that influenza is not dangerous was associated with vaccine non-uptake (Opstelten et al., 2001; Opstelten et al., 2009). Likewise, doubting the danger of possible complications was correlated with non-uptake (van Essen et al., 1997). A person’s perception of or knowledge about specific symptoms of an infectious disease also plays a role in one’s willingness to receive vaccination. For instance, more people aged 65 years and older (54%) accepted pertussis vaccine after they had read about its symptoms in the elderly (Skowronski et al., 2004). On the other hand, the perception that herpes zoster causes only short-lasting pain was associated with less chance of being vaccinated (Opstelten et al., 2009).

According to qualitative data, one of the main elements of vaccination behavior is the perceived seriousness of the target disease. However, there was no consensus among the elderly on whether influenza and its complications are dangerous (Cornford and Morgan, 1999; Cameron et al., 2009; Kwong et al., 2010). Being unaware of the severity of an infectious disease was seen as a major barrier to uptake of its vaccine (Sengupta et al., 2004). The perception that an infectious disease is more serious for the elderly than for others was positively associated with receiving an influenza vaccination (Pianko et al., 1981). That belief was one of the variables that distinguished the vaccinated elderly from the unvaccinated (Cameron et al., 2009).

D. Personal experience
A major factor in the non-uptake of influenza vaccine is the absence of this disease in the past (Lewis-Parmar and McCann, 2002; Daniels et al., 2004; Mangtani et al., 2006). Conversely, a major reason to be vaccinated was the experience of getting very sick from influenza. Furthermore, a positive association was found between a history of influenza or pneumonia and vaccination (Pianko et al., 1981; Bloom et al., 1985). For
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pneumococcal vaccine, it was also found that a history of pneumonia was a predictor of obtaining the pneumococcal vaccine (Nowalk et al., 2004). The personal experience of herpes zoster motivated even the most skeptical to consider accepting vaccination (Mortensen, 2011).

3) Vaccine characteristics

This third theme refers to the real and perceived characteristics of a vaccine. These include side effects, effectiveness of the vaccine, and content of the vaccine.

A. Side effects

Many studies have found that uptake is negatively influenced by side effects or adverse reaction to a vaccine. Particularly influential are the fear or the perceived risk of side effects and the perception that the vaccine has side effects (Frank et al., 1985; Bloom et al., 1985; Carter et al., 1986; Schler et al., 1987; Nicholson, 1993; Honkanen et al., 1996; van Essen et al., 1997; Drociuk, 1999; Pregliasco et al., 1999; Opstelten et al., 2001; Evans and Watson, 2003; Zimmerman, 2003; Adler and Winston, 2004; Hebert et al. 2005; Small et al., 2005; Burns et al., 2005; Brunton et al., 2005). In addition, one's personal history or a report on side effects was negatively associated with vaccine uptake or was mentioned as a reason to refuse vaccination (Armstrong et al., 2001; Santibanez et al., 2002; Chi and Neuzil, 2004).

Elderly persons with the perception that vaccinations have no side effects were more likely to have undergone influenza vaccination. In addition, a predictor for accepting the offer of a vaccine was the perception that its side effects are less risky than the target disease (Lewis-Parmar and McCann, 2002; Evans and Watson, 2003).

Qualitative studies showed that real or perceived side effects are taken into account by the elderly when deciding to be vaccinated or not (Evans et al., 2007; Cameron et al., 2009). Side effects were seen as a barrier to influenza vaccination. Those who held negative views about vaccination often stressed the side effects of a vaccine or were more likely to think that there were side effects (Cornford and Morgan, 1999). Prior experiences with side effects, whether serious or not, were also important in decision-making (Telford and Rogers, 2003).

B. Effectiveness

The assumption that both influenza and pneumococcal vaccines are effective in preventing these diseases was positively associated with their uptake (Frank et al., 1985; Bloom et al., 1985; Honkanen et al., 1996; Lewis-Parmar and McCann, 2002; Zimmerman et al., 2003, Chi and Neuzil; 2004). This assumption was also a reason for accepting the influenza vaccine (Brunton et al., 2005; Ehresmann et al., 2001). It was the most important factor among the clusters of unvaccinated elderly persons who were studied to develop targeted messages (Bardenheier et al., 2006). The converse was also found. Not believing in a vaccine’s effectiveness or harboring a negative attitude about vaccine effectiveness in general was a reason not to accept it (Sievert et al., 1988;
Nicholson, 1993; Nichol et al., 1994; Hayes-Bautista et al., 1997; Drociuk, 1999; Pregliasco et al., 1999; Evans and Watson, 2003; Burns et al., 2005). Doubt about the effectiveness of the vaccine was also associated with non-compliance (van Essen et al., 1997).

In qualitative studies too, the effectiveness of a vaccine was shown to influence decision-making. The assumption that the influenza vaccine is ineffective was a factor in deciding to refuse it (Evans et al., 2007). In one study, the predominant perceived benefit of influenza vaccination was that it prevents individuals or communities from getting sick (Sengupta et al., 2004). The assumption of the vaccine’s capacity to effectively prevent influenza was also noted in focus groups (Cameron et al., 2009). People who refused the vaccine mentioned its poor efficacy as the most important factor (Telford and Rogers, 2003).

C. Assumptions regarding the content of the vaccine
Concerns about a possible drug interaction or an interaction with other vaccines led people to refuse a vaccine (Nicholson, 1993; Santibanez et al., 2002; Funovits et al., 2012). Concerns about the safety of the vaccine were also associated with refusal (Nichol et al., 1994; Ehresmann et al., 2001; Lewis-Parmar and McCann, 2002). Believing there is something in the vaccine that you are not aware of contributed to the differentiation among the unvaccinated persons (Bardenheier et al., 2006). In addition, "mistrust of shot contents" was associated with a possible reduced acceptance of the influenza vaccination (Armstrong et al., 2001). In a qualitative study, half of the participants feared the herpes zoster vaccine. These people believed that this vaccine could produce viral resistance or be unsafe when used in large numbers of people (e.g., if other vaccines are introduced, besides influenza vaccine, for adults) (Mortensen, 2011). On the other hand, older people were more likely to be immunized if they expressed confidence in the safety of vaccination (Evans and Watson, 2003).

D. Knowledge
Knowledge about the characteristics of a vaccine also influences the decision on whether to be vaccinated. Persons of 50 years or older who refused to accept the herpes zoster vaccine said they would first like to inform themselves about it (Funovits et al., 2012). Lack of information on the effectiveness and safety of the influenza vaccine was the most frequent reason given for its low uptake (Pregliasco et al., 1999).

5) Advice and information

The fourth theme concerns the influence that physicians and other healthcare personnel, as well as relatives or others, have on vaccination uptake. Influence can take the form of personal or professional recommendation, personal examples of compliance, or information obtained from healthcare workers, the media, or other channels.
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A. Influence of healthcare workers
A recommendation or advice from a healthcare worker was positively associated with vaccination status (Pianko et al., 1981; Sievert et al., 1988; Honkanen et al., 1996; Armstrong et al., 2001; Lewis-Parmar and McCann, 2002; Evans and Watson, 2003; Burns et al., 2005; Mangtani et al., 2006; Francisco et al., 2011), reporting odds ratios up to 41. Furthermore, healthcare providers had a facilitating effect on the vaccination status of older adults and also influenced their vaccination intentions and uptake (Zimmerman, 2003; Nowalk et al., 2004; Gallagher and Povey, 2006; Nowalk et al., 2006). Vaccination rates were significantly higher among people aged 65 years and over who received a professional recommendation than among those who did not (Brunton et al., 2005; Lindley et al., 2006). Studies of pneumococcal vaccination found that predictors ranged from "anyone in the patient's doctor's office recommending they should receive the shot" (Zimmerman et al., 2003) to "thinking that the doctor wanted them to be vaccinated" (Nexoe et al., 1999 and “a physician ever offering a pneumococcal vaccination” (Ehresmann et al., 2001). Regarding pertussis, 81% of those aged 65 and older would accept vaccination if a doctor or nurse recommended it to them (Skowronsksi et al., 2004).

Older adults also accepted vaccination upon the personal recommendation or advice of a doctor or receipt of a letter from a doctor (van Essen et al., 1997; Canova et al., 2003; Burns et al., 2005). Qualitative studies likewise show the positive influence of professionals on the decision (Daniels et al., 2004; Sengupta et al., 2004; Evans et al., 2007; Kwong et al., 2010). Some older people refused any vaccination other than for influenza because they had not received or did not recall getting a recommendation from a healthcare worker, or because they had been advised against vaccination (Pianko et al., 1981).

Two studies demonstrated the power of provider recommendations among respondents who were negative about vaccination. The first found that uptake was twice as high for those with a provider recommendation than for those without one (Lindley et al., 2006). The second found that a recommendation by the primary care physician could be persuasive, even given an initially negative attitude (Nicoleau et al., 2001). The provider-patient relationship is certainly influential. In one study, a disturbed relationship was found to be a risk factor for refusal of the pneumococcal vaccine (Miller et al., 2005).

Although most studies confirmed the important role of the healthcare worker, a few showed that some people refused vaccination despite the advice of their doctors (Nichol et al., 1994; Gianino et al., 1996; Opstelten et al., 2001; Chi and Neuzil, 2004; Opstelten et al., 2009). Most older persons refused the herpes zoster vaccination even though their physician had strongly recommended it (Funovits et al., 2012).

B. Influence of relatives and others
Relatives and others also influence uptake, though less than healthcare providers, by offering advice, making recommendations, or sharing their personal experience with vaccination. Several studies showed a positive association between their encouragement
and the decision to comply (Sievert et al., 1988; Drociuk, 1999; Adler and Winston, 2004; Mangtani et al., 2006; Nowalk et al., 2006; Opstelten et al., 2009; Kwong et al., 2010). Some elderly took such suggestions as a reason or a cue to get vaccinated (Drociuk, 1999; Zimmerman, 2003). However, the advice of friends or family was more highly valued among the vaccinated elderly than among those not vaccinated (Zimmerman, 2003).

In one study, knowing someone who had experienced pneumonia or influenza was a predictor for accepting vaccination for these infections (Madhavan et al., 2004). A qualitative study showed that the decision to be vaccinated was reinforced by a higher perceived risk of contracting the illness. The perception of increased personal risk could change one’s attitude; the same study showed that social networks reinforce the decision to be vaccinated (Kwong et al., 2010). One explanation could be that older people perceive influenza as dangerous, having observed its effects on others (Telford and Rogers, 2003).

While advice from a doctor or nurse had a positive influence on vaccine uptake, advice from relatives and friends could also have a negative effect (Evans and Watson, 2003). Some people might refuse the influenza vaccination after being told about a friend’s bad experience or that the vaccine does not work or has unpleasant side effects (Sotnik et al., 2001; Lewis-Parmar and McCann, 2002; Sengupta et al., 2004; Burns et al., 2005).

C. Information source and format

Another factor is the source of information and its format. In a study on influenza, both vaccinated and unvaccinated respondents reported that only information provided by a healthcare professional affected their decision (Lewis-Parmar and McCann, 2002). In addition, not being informed or advised by a physician or other healthcare provider was associated with refusing influenza and pneumococcal vaccination (Nicholson, 1993; Hayes-Bautista et al., 1997; Drociuk, 1999). In one study, information from the GP on influenza vaccination was shown to be positively associated with vaccine uptake (Honkanen et al., 1996). Besides healthcare professionals, information from the media can facilitate vaccination uptake (Zimmerman, 2003; Nowalk et al., 2004; Sengupta et al., 2004; Kwong et al., 2010).

6) General health-related behavior

The fifth theme concerns health behavior in general. It covers vaccinations received previously and other preventive behaviors related to general health, such as regular visits to the GP or senior center.

A. Previous vaccinations refused or accepted

Studies showed high effect sizes for prior immunization relating to vaccination uptake. "Vaccinated in previous influenza seasons" was found to be a predictor for vaccination (Nexoe et al., 1999). Another was accepting vaccinations in the past (Nichol
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et al., 1994; Bedford et al., 2000; Lewis-Parmar and McCann, 2002; Santibanez et al., 2002; Canova et al., 2003; Telford and Rogers, 2003; Miller et al., 2005; Nowalk et al., 2006; Gallagher and Povey, 2006). A positive experience induced people to accept subsequent vaccinations, whereas a negative experience led to refusal. This association was also shown in two qualitative studies (Kwong et al., 2010; Sengupta et al., 2004).

B. Visiting the general practitioner or senior center
Older adults who did not have a regular physician were immunized significantly less often than those who did have one. Preventive healthcare that is irregular or absent formed a barrier to getting the influenza vaccine (Sengupta et al., 2004). People between 50 and 64 who were regularly seen by a physician were likely to have received a pneumococcal vaccination (Fowles and Beebe, 1998; Nowalk et al., 2006). In addition, going to an old-age social center or general practice also had a positive influence on vaccine uptake (Ehresmann et al., 2001). The structure of primary care influenced the likelihood of vaccination. Patients going to a small group practice were less likely to be vaccinated than those visiting staff-model clinics and multi-specialty groups (Fowles and Beebe, 1998).

C. Practicing other preventive behaviors to maintain or improve health
A positive association was found between vaccine uptake and preventive behavior such as wearing a seatbelt, getting enough exercise, and having regular physical examinations (Fowles and Beebe, 1998; Nowalk et al., 2006; Francisco et al., 2011). However, a qualitative study found that some elderly persons attributed such high value to these behaviors that they did not see any need to get vaccinated (Kwong et al., 2010).

7) Accessibility and affordability

Last, acceptance is also influenced by the accessibility and affordability of a vaccine. This theme concerns whether the elderly are able to visit the clinic (logistics), whether multiple vaccines can be combined in a single vaccination (cocktail vaccine), and how much the vaccine costs (affordability).

A. Logistical reasons
Inadequate mobility or transportation was associated with non-uptake of the influenza, pneumococcal, and herpes zoster vaccines (Schler et al., 1987; Nicholson, 1993; Drociuk, 1999; Pregliasco et al., 1999; Lewis-Parmar and McCann, 2002; Zimmerman, 2003; Opstelten et al., 2009). Waiting time at the clinic was also a barrier in both quantitative (Fowles and Beebe, 1998) and qualitative studies (Daniels et al., 2004; Sengupta et al., 2004; Cameron et al., 2009; Kwong et al., 2010).
B. Combination of vaccinations
The convenience of getting influenza and pneumonia vaccinations on the same visit had a positive association with uptake (Ehresmann et al., 2001; Santibanez et al., 2002; Zimmerman et al., 2003; Zimmerman, 2003; Nowalk et al., 2004). Most (71%) respondents were likely or very likely to accept a pertussis vaccination when combined with tetanus and diphtheria vaccines (Skowronski et al., 2004).

C. Costs
Costs were a barrier in both qualitative and quantitative studies (Pianko et al., 1981; Fowles and Beebe, 1998; Mortensen, 2011). Coverage by one's insurance was positively associated with receiving the vaccination (Ehresmann et al., 2001; Zimmerman et al., 2003; Chen et al., 2007). Fewer elderly people (59%) would accept pertussis vaccine if they had to pay 40 Cdn dollars (Skowronski et al., 2004). Affordability was also mentioned in some qualitative studies; the likelihood of being vaccinated was greater if available at little or no cost (Cameron et al., 2009). Moreover, offering a free or low-cost influenza vaccine was seen as a way to facilitate its acceptance (Sengupta et al., 2004; Mortensen, 2011).
Figure 1: Overview of themes and factors identified in this literature review (covering 1966 until October 2012 and West European and North American societies). The light gray boxes represent the six main themes: attitudes and beliefs, perceived risk, vaccine characteristics, advice and information, general health-related behavior, and accessibility and affordability. Each theme consists of several factors that are named in the white boxes.
Discussion

This article presents an updated overview of determinants reported in the literature to influence vaccination uptake by persons aged 50 years and older in Western societies. We used these determinants to construct six themes: 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.

Our constructed themes resemble concepts from models explaining and predicting health behavior. Examples of these models are: the Health Belief model (HBM) (Janz and Becker, 1984), the theory of planned behavior (Ajzen, 1991), the Andersen healthcare utility model (Andersen, 1995), and the model of Wilson and Cleary (Wilson, 1995). Many of these models have been used in vaccination studies and other preventive measures such as screening for the HBM (Coe et al., 2012; Wardle et al., 2000). The HBM consists of six aspects: ‘perceived benefits’, ‘perceived barriers’, ‘perceived severity’, ‘perceived susceptibility’, ‘self-efficacy’, and ‘cues to action’. The Andersen model consists of three constructs; environment, population characteristics and health behavior. The theory of planned behavior originates from behavioral attitude, subjective norms, perceived behavioral control and intention. And last, the model of Wilson and Cleary shows the influence of characteristics of the individual and the environment on different aspects on the quality of life.

Looking at the different constructs of the different models, it becomes clear that HBM resembles the most of our constructed themes. The ‘perceived benefits’ are covered by our positive attitudes and beliefs on vaccination in general. Certain beliefs about vaccine effectiveness and side effects resemble HBM’s ‘perceived benefits’, as do positive previous experiences and performing other preventive measures. ‘Perceived severity’ and ‘perceived susceptibility’ are reflected by the theme ‘risk perception and severity’. Neither ‘self-efficacy’ nor ‘cues to action’ are directly reflected by our themes. Nonetheless, our theme accessibility and affordability partly covers people’s capacity to get a vaccination, while recommendations by health practitioners or others constitute cues to action, alongside information from the GP (under theme of advice and information).

A factor that we identified but do not find in the HBM is knowledge: not knowing the vaccine is needed. Although the HBM does not explicitly refer to this factor, we include it because, in our view, knowledge is the first step toward acceptance. Awareness could be raised through advertisements and reminder letters. The effectiveness of reminders in increasing the acceptance of influenza vaccination has been demonstrated in healthcare workers (Hollmeyer et al., 2013). These letters provide knowledge about the vaccination and invite patients to talk to their physicians about it.
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Other barriers identified here and covered in the HBM are the following: negative attitudes regarding vaccination; no recommendation from a healthcare worker; personal and friend/family’s bad experience with vaccination; not believing or knowing that the vaccine is needed; low level of perceived risk and low perceived severity of infectious disease; no experienced sickness episode; assumptions on non-effectiveness and side effects of the vaccine; perceived non-safety of vaccine’s contents; and logistics. While addressing these barriers would improve uptake, it should be realized that many of them originate in beliefs and perceptions and reflect the experiences of others. Therefore, communication should include objective information regarding vaccination in general, its side effects, and its efficacy. Concretely, the elderly should be clearly informed about the risk of getting an infectious disease, preferably by the GP. In particular, uptake could be increased by ensuring that the information is addressed to the individual (Thomas et al., 2010).

Removal of logistic barriers could give the elderly an incentive to accept vaccination and obtain it at locations other than the GP’s office. There is strong evidence that vaccinating elderly people during home visits and using facilitators in the practice, for instance, would increase uptake of the influenza vaccine (Thomas et al., 2010). The effect of such interventions remains to be demonstrated among community-dwelling adults, however (Lau et al., 2012). Those elderly who do not engage in preventive health behavior warrant special attention, since they do not regularly visit a general practice where they could be vaccinated or at least get objective information.

The present literature reviews gives insight into the role of external influence, particularly that of healthcare workers or friends and family. The GP remains the most important person concerning vaccination uptake while The Internet is not that predominantly present in the literature. It also sheds light on how behavior concerning general health and personal susceptibility affects vaccine uptake. These perspectives distinguish the findings presented here from those in other published reviews, perhaps signaling a shift in the literature that in turn might reflect a change in attitudes towards prevention of diseases. Nowadays, prevention is given more priority. A focus on healthy living could make people think differently about their health status (namely susceptibility) and behavior, leading them to consult their GP. Heightened awareness would also lead them to discuss health matters with friends and family.

Study strengths and limitations

This review offers a complete and elaborate overview of the factors related to the vaccine uptake of persons aged 50 years and older. Because it includes both quantitative and qualitative research articles and covers a long time span, it offers new information on intervention strategies aimed at increasing the uptake of vaccines by the elderly. Three earlier reviews about the uptake of both influenza and pneumococcal vaccination covered material published almost a decade ago or longer (Richardson and Michocki, 1994; Mieczkowski and Wilson, 2002; Ward and Draper, 2006). More recent ones only
included quantitative studies (Kohlhammer et al., 2007) or did not describe a systematic literature search (Baeyens et al., 2009).

Unfortunately, a limited number of articles studied a combination of different vaccines, which would have given us the opportunity to compare data between vaccinations. Looking at individual studies for both the influenza as well as the pneumococcal vaccination, determinants were identified for each of the all different themes except for ‘knowledge of vaccine characteristics’. This theme was not considered to be important for the uptake of pneumococcal vaccine. In addition, our review would be more complete by adding patient characteristics. However, patient characteristics are less changeable over time and because there are several reviews/ elaborate studies on vaccination uptake and patient characteristics for example (Ward and Draper 2006) and (Crawford, O’Hanlon et al. 2011), we feel that it is less necessary to update the literature on this specific subject. Therefore, we focused on the psychosocial factors which can be influenced by interventions.

The relative importance of the different factors could not be determined due to the diversity of study designs, the quality of the studies, and the period of time covered by the articles. Concerning the time span, it should be kept in mind that some articles appeared more than 20 years ago. Although these contain important information, changes have since occurred in views on vaccination as well as public awareness of vaccines. Questions, therefore, could be raised about the comparability of the studies reviewed. Nevertheless, no distinct differences in the identified factors could be found between the older articles and the more recent articles. In that light, doubts about their applicability are (at least partly) unwarranted. On the other hand, the methodological approach of the present review adopting this long time span and including both qualitative and quantitative data ensures a thorough overview of the factors of vaccine uptake for persons aged 50 years and older.

Conclusion

Of the six main themes identified, the two most influential ones are attitudes and beliefs regarding vaccination, but especially the negative attitudes and beliefs about vaccine characteristics. The individual factors recommendations of healthcare workers and the individual’s perception of susceptibility to the targeted disease also seem to be highly influential. We conclude that many factors play a role in the acceptance of vaccination by the elderly, and future research is needed to ascertain their relative importance.
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Conflict of Interest Statement
The authors declare that there are no conflicts of interest.
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Gallagher, S. & Povey, R. 2006. Determinants of older adults’ intentions to vaccinate against influenza: a theoretical application. J public health (oxf), 28, 139-44.


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Appendix A Search strategy

#9 Search #8 AND (english[la] OR dutch[la] OR german[la] OR french[la])

#8 Search #7 NOT (africa[mh] OR asia[mh] OR latin america[mh] OR south america[mh] OR central america[mh])

#7 Search #5 NOT #6


#5 Search #1 AND #2 AND #3


[mh] = keywords
[mh:noexp] = keywords without underlying terms
[majr] = most important keyword field
[ti] = in title
[tiab] = in title or abstract
Appendix B Selection of articles

1001 articles in total (Medline and other databases)

- 677 articles removed based on title

324 articles left

- 231 articles (incl 5 double references) removed based on abstract

93 articles left

- 9 non-Dutch and non-English articles removed

84 articles left

- 29 articles removed after reading full text
  1 article was unavailable

55 articles left

- 5 articles added by a manual search

Total: 60 articles