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Factors associated with the uptake of seasonal influenza vaccination in adults: a systematic review

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ABSTRACT

Background Studies on different populations have shown that a variety of factors influence attitudes and decision in the general population on vaccine uptake. This study explores factors associated with the uptake of influenza vaccination among adults.

Methods A systematic literature review was performed on literature searched in databases EMBASE, MEDLINE, Cochrane Library and Electronic Theses Online Service up until November 2013. A critical appraisal framework was designed to assess the methodological quality of the studies.

Results Twenty-three articles met the inclusion criteria and were selected for outcome analysis and 21 were quantitative observational studies. Advancement in age (OR 1.06–23.7) and having chronic diseases (OR 1.38–13.7) were strongly indicative of vaccine uptake. Perceptions on vaccine efficacy (OR 2.7–10.55) and vaccine safety and adverse events (OR 10.5) were more influential than the level of knowledge on influenza and its vaccination. Advice from doctors/health professionals/family and/or close friends and free vaccination were also key factors in association with uptake of vaccination.

Conclusions This review highlighted the finding that perception on vaccine efficacy, perception on vaccine safety and adverse events, advice from doctors/health professionals/family/close friends and free vaccination are changeable factors that are strongly associated with influenza vaccination in adults aged 18–64.

Keywords adults, immunization, public health

Background

Seasonal influenza vaccination (referred to as influenza vaccine or vaccine below) is effective in reducing influenza-like illnesses, working days lost and physician visits.[1–3] In many countries, only high-risk groups are subsidised or offered a free vaccination service. Non-high-risk groups usually include individuals of <65 years of age without a chronic disease, as well as those not working in the healthcare sector. In Australia, European countries and the USA, the influenza coverage rates for non-high-risk adults ranged from 5.8 to 45.1%.[4–6]

For most healthy adults, influenza is a mild and self-limiting disease. The health authorities of most countries do not consider healthy adults to be a priority group requiring annual vaccination against seasonal influenza.[7] Some exceptions include the USA, Austria and Estonia, which recommended that all people aged 6 months or older should receive influenza vaccination.[8–10]

The recent pandemic in 2009 may have shifted perspectives on vaccinating healthy adults. Reviews on international epidemiology reported that influenza A(H1N1)pdm09 virus disproportionately affected and increased hospitalization and death in adults aged below 65.[11–13] The influenza A(H1N1)pdm09 virus continued to be the predominant circulating strain in North America, Europe and China after the 2009 pandemic.[14]

Other benefits of vaccinating healthy adults included decreased work absenteeism and the need for medical visits and medication, including antibiotics.[15] Besides, many middle-aged adults have undiagnosed medical conditions such as diabetes mellitus.[16,17] Vaccination provides moderate

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protection to both high-risk and non-high-risk groups from influenza as well as its complications.[3,18]

A better understanding of the reasons behind people's choice of vaccination will guide the planning of health and promotion programmes for improving general population vaccine coverage. This article is a systematic review of factors associated with the uptake of the seasonal influenza vaccination in adults aged 18–64.

Methods

A systematic review was performed in November 2013 of published literature in medical databases EMBASE (1947–2013 November), MEDLINE (PubMed) (January 1966 to October 2013) and the Cochrane Library (1996 to present) including the Cochrane Central Register of Controlled Trials (CENTRAL), the Cochrane Database of Systematic Reviews (CDSR) and the Database of Abstracts of Reviews of Effects (DARE) via Cochrane Library. The search was further amplified by scanning the reference lists and bibliographies of relevant papers and the Electronic Theses Online Service (EThOS) using the defined keywords. The publications were in English.

Keywords used include a combination of free text terms and Medical Subject Heading (MeSH). Search terms included seasonal influenza vaccin*, influenza vaccin*, human, accept*, attitude, intent* and perception.

This study is on general population and not on influenza vaccine recommended group. Studies were excluded if >50% of study participants were not adults from the general population aged 18–64, or the study aim/objective was only related to the 2009 H1N1 pandemic vaccination. Studies focused on influenza recommended groups such as pregnant women, persons with chronic diseases and healthcare workers were also excluded. There was no limitation placed on the study design, but it had to have quantified the strength of association between the factors and the outcome.

Since most of the selected studies were observational studies and surveys, a critical appraisal framework was designed to assess the methodological quality of non-randomised trials. Reference has been made to the US CDC Transparent Reporting Evaluations with Nonrandomized Designs[19] and the National Health Service's (NHS) Critical Appraisal Skills Programme (CASP)[20] in reviewing the quality of the articles. The reporting of this review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement to ensure scientific rigour and comprehensiveness in reporting.[21]

Results

A total of 2235 articles published in English were identified. Twenty-three articles fulfilling the inclusion criteria were retained for critical appraisal and analysis. Most of these articles were quantitative observational studies. There were 18 cross-sectional surveys, 1 case–control study, 1 randomized control trial, 2 longitudinal studies and 1 meta-analysis. The studies were carried out in the following countries: Australia, China, Japan, 11 European countries, France, Netherland, Spain and the USA. The data collection period of the 23 selected articles was from 1997 to 2012. After review of the 23 selected articles, 21 were found to be of high or moderate methodological quality. The summary of the characteristics of these articles is shown in Table 1.

In the selected studies, the results comprised mostly subjective opinions given by study participants, rather than objective accounts obtained using validated tools. The associated factors were categorized into eight groups (demography, knowledge, need, health behaviour, belief and perceptions, healthcare system, advice and social support and external environment). The strengths of associated factors with influenza vaccination uptake are presented by adjusted odds ratios (ORs) in Table 2.

Theories and models of behaviours

Most selected articles did not state what behavioural theory or model had been used. The Health Behavioural model was the commonest model and was cited in three articles. The Protection Motivation Theory, Theory of Reasoned Action, PRECEDE model and Utilities Theory were each used separately in one article.

Demography

Increasing age was an important factor associated with uptake of vaccination in studies in European and Asian populations (OR 1.06–23.7).[4,23,31,33] Education level and being health professionals were inconsistently associated with getting vaccinated in different studies.[4,29,31,32,40] Sex, ethnic origin, income, employment and household size were not consistent predictors of influenza vaccination in different European countries.[4,28]

Knowledge on influenza and influenza vaccine

There was a weak association between increased knowledge and vaccination, and the strength of this association was relatively weak compared with that of most of the other groups. People with better knowledge of influenza and its vaccination (OR 1.6–3.3)[31,37] and on the effective measures to prevent influenza (OR 1.59–3.06)[37] were more likely to get vaccinated. Those who had better knowledge about vaccination being required annually (OR 1.59),[31] of vaccine being recommended to some high-risk groups (OR 1.30),[37] and of other

Table 1 Characteristics and key results of the included studies

First author place of study	*Study design*	*Participants*	*Data collection method and date*
Blank *et al.*[4] (Austria, Czech Republic, France, Finland, Germany, Ireland, Italy, Poland, Portugal, Spain and UK)	Cross-sectional survey	~1200–2000 representative adults per country	Annually repeated population-based surveys (telephone, postal or face-to-face) on influenza vaccination; 2006/07–2007/08
Caille-Brillet *et al.*[22] France	Longitudinal study	1451 individuals from 575 households	Data from Cohort for Pandemic Influenza (CoPanFlu); December 2009
Carrasco-Garrido *et al.*[23] Madrid, Spain	Cross-sectional survey	7341 adults aged 16 and above	Personal, home-based interviews using structured questionnaire; November 2004 to June 2005
Cassidy *et al.*[24] USA	Cross-sectional study	1311 patients attending AED	Interview AED patients and retrieve records; December 2005 to March 2006
Chapman and Coups[25] USA	Cross-sectional survey	79 university employees and 435 corporate employees	Interview and self-administered questionnaire; fall 1997
Chapman and Coups[26] USA	Cross-sectional survey	412 corporate employees offered a free flu vaccine	Interview and self-administered questionnaire; 1–10 December 1997
Cohen *et al.*[27] New York, USA	Cross-sectional, part of a randomized controlled trials (RCT)	2788 participants from 509 households (contained ≥3 people in the household)	20 min structured interview, 2006/07 and 2007/08 flu seasons
Endrich *et al.*[28] Austria, Czech Republic, France, Finland, Germany, Ireland, Italy, Poland, Portugal, Spain and UK	Longitudinal survey	92 101 participants from 11 different European countries	Annually repeated population-based surveys (telephone, postal or face-to-face) on influenza vaccination; 2001/02–2006/07
Horby PW *et al.*[29] Australia	Cross-sectional survey	1496 people aged 40–64	Computer-assisted telephone interview; 19 October to 15 November 2001
Hong Kong Medical Association[30] Hong Kong, China	Cross-sectional survey	1013 Cantonese-speaking Hong Kong Citizens of age 18 or above	Web-based computer-assisted telephone interview; 6–16 November 2012
Lau *et al.*[31] Hong Kong, China	Cross-sectional survey	1102 Hong Kong Chinese adults aged 18–64	Random telephone survey; April to May 2006
Liao *et al.*[32] Hong Kong, China	Cross-sectional survey	505 Chinese students and employees from a university	Online survey. Wave 1: January and March 2009; Wave 2: January and March 2010
Lin *et al.*[33] USA	Randomized cluster trial	2389 workers aged 18–49	Questionnaire; 2007–2008 vaccination season
Looijmans-van den Akker *et al.*[34] Netherland	Cross-sectional survey	1725 Dutch patients age over 50 years random selected in a university medical centre database	Self-administered questionnaire; 2005
Mok *et al.*[35] Hong Kong, China	Cross-sectional survey	452 outpatient clinic patients aged ≥18, able to read and speak Chinese	Self-administered questionnaire; September to October 2004
Santibanez *et al.*[36] USA	Cross-sectional survey	4835 participants at 50–64 years old	Telephone survey; February to May 2004
Takahashi *et al.*[37] Japan	Case–control study	98 out-patients aged 18 or above	Telephone interview; November 1998 to February 1999
Thomas *et al.*[38] Multiple (review)	Meta-analysis on randomized controlled trials (RCT)	44 RCTs were included	Meta-analysis with pooled OR and systematic analysis
Uscher-Pines *et al.*[39] USA	Cross-sectional survey	4040 adults aged 18 and above	Draw data from a nationally representative survey conducted on 5–24 March 2010

Continued

Table 1 Continued

First author place of study	*Study design*	*Participants*	*Data collection method and date*
Vaux *et al.*[40] France	Cross-sectional survey	10 091 people from 8905 households	Telephone survey, May 2009 to April 2010
Vlahov *et al.*[41] New York City, USA	Cross-sectional survey	991 participants from medically underserved area	Street-intercept method; 10 min survey; end of the 2009/10 flu season
Wada and Smith[42] Japan	Cross-sectional survey	3192 Japanese aged 20–69	Web-based survey for those registered in a web-based survey company
Wu *et al.*[43] Beijing, China	Cross-sectional survey	13 002 Chinese adults ≥18 years	Interviewers visited the households and conducted face-to-face interview; January 2011

general information about influenza transmission and treatment (OR 1.25),[27] were slightly more likely to choose to be vaccinated than those without adequate knowledge.

Needs

Presence of chronic disease(s) was the most frequently stated reason for people getting vaccinated (OR 1.38–13.7).[4,23,24,27–29,32,35,40] Recent visits to a medical doctor may or may not have been associated with vaccination.[23,36,37] People consulted doctors for acute and chronic illnesses and therefore visiting a medical doctor did not imply their having long-term illnesses. The association of living with children or elders at home was inconclusive.[40,42] It is uncertain if self-reported health status had an association.[30,36]

Health behaviour

Previous influenza vaccination was a good predictor for subsequent vaccination (OR 4.06–5.18).[25,32,35,42] Health behaviour such as smoking was not associated.[34,42] No data were found on other health behaviours such as drinking or frequent exercise.

Belief and perception

Belief and perception were difficult to distinguish from each other so they were grouped under the same heading. Perception of vaccine efficacy (OR 2.7–10.55) had the strongest association in this group.[29,36,37] The perceived vaccine safety and adverse events after vaccination were a concern (OR 10.5) and fear of adverse reaction deterred people from getting vaccinated (OR 0.21).[37] The perceived chances of contracting influenza (OR 1.62–5.40) and the perceived health impact of having influenza (OR 2.21) were also positively associated with intention to get vaccinated.[31] It is inconclusive whether fear of injections had an association.[30,37]

Healthcare system

Free vaccination (OR 4.5–7.8) was strongly associated with vaccination.[38,40] People who had easy access (OR 1.8) and who were satisfied with their healthcare service were more likely to receive the influenza vaccine (OR 1.23).[23,34] The usefulness of interventions to remind clients, such as telephone calls and post card reminders, was uncertain.[38]

Advice and social support

Doctors' advice (OR 4.03–7.82) and health professionals' advice (OR 1.23–13.0) were significantly correlated with influenza vaccination.[4,23,37,39] Recommendation from healthcare workers was an intervention encouraged by many of the selected articles based on its strong association. Relatives' or close friends' advice (OR 17.74), or their having received influenza vaccination in the previous year (OR 6.44), was associated with acceptance of influenza vaccine in a Japanese study.[37,39]

External environment

Past experiences of infectious diseases and widespread severe epidemic could influence people's perception of vaccination.[44] The post-pandemic effect on seasonal influenza vaccination varied in different places. In Beijing China, a study did not find any impact of the 2009 pandemic on vaccination in the 2010/11 season.[43] In France, there was a moderate negative effect of the 2009 pandemic on vaccination in the following two seasons.[22]

Discussion

Main finding of this study

Advancement in age (OR 1.06–23.7) and having chronic disease(s) (OR 1.38–13.7) were the two most consistent and

Table 2 Summary of factors (variables) associated with uptake of influenza vaccination.

	Group	*Factors*	*Odds ratio (range of mean OR)*
1	Demography	– age[4,**23**,31,**33**]	– 1.06–23.7
		– education level[4,29,31,32,**40**]	– insignificant/1.54–2.25
		– being health professional[4,28,**29**,31]	– insignificant/2.4–4.9
		– married[32]	– 2.71
		– gender, ethnic origin, income, employment, household size[4,28,40]	– insignificant or varies
2	Knowledge	– knowledge of influenza and influenza vaccination[31,37]	– 1.6–3.3
		– knowledge of effective measures to prevent influenza[**29**,37]	– 1.59–3.06
		– knowledge that vaccination was required annually[31]	– 1.59
		– knowledge of influenza vaccine being recommended[37]	– 1.30
		– general knowledge on transmission and treatment of influenza and upper-respiratory infections[**27**]	– 1.25
3	Needs	– the presence of chronic disease(s)[4,**23**,24,27,**28**,29,**32**,35,**40**]	– 1.38–13.7
		– visit to physician recently[**23**,36,37]	– insignificant/1.55–2.0
		– living with children and/or elders[40,**42**]	– insignificant/1.37
		– self-reported health status[36]	– insignificant
4	Health behaviour	– previous influenza vaccination status[25,32,**35,42**]	– 4.06–5.18
		– smoking[**34**,42]	– insignificant/0.79
5	Belief and perceptions	– perceived vaccine efficacy[**29**,36,37]	– 2.7–10.55
		– perceived vaccine safety and adverse events[37]	– 10.5
		– perceived chances of contracting influenza[36,41]	– 1.62–5.40
		– perceived health impact of having influenza[**31**]	– 2.21
		– fear of adverse reactions[37]	– 0.21
		– scare about injection[37]	– insignificant
6	HealthCare Systems	– free vaccination[38,40]	– 4.5–7.8
		– access to healthcare settings[34]	– 1.8
		– satisfied with the health services[23]	– 1.23
		– client reminder system (e.g. telephone, post cards)[38]	– inconsistent result
7	Advice and social support	– advice from doctors[4,**23**,37]	– 4.03–7.82
		– advice from health professionals[**23**,37]	– 1.23–13.0
		– advice from family and/or close friends[37]	– 17.74
		– cues to action (relative and friends receive vaccine)[37]	– 6.44
8	External environment	– pandemics[**22**,43]	– insignificant/moderate negative (i.e. reduce vaccination)

Findings of three selected studies[26,30,39] were not presented in this table but included in the text or other table. All references in bold are of moderate methodology quality and the rest are of high methodology quality.

strongly associated factors for influenza vaccine uptake. Increase in age usually increases the chance of contracting chronic diseases, so these two factors were related.

Perceptions such as vaccine efficacy (OR 2.7–10.55), and safety and adverse events (OR 10.5), were more influential than the level of knowledge on influenza and its vaccination. Meta-analysis supported the notion that risk perceptions are central to many health behaviours.[45] Although there is a general consensus that knowledge is positively correlated with positive health behaviours, the selected studies demonstrated a mild association of the two here. If greater knowledge increased the tendency to be vaccinated, one would expect doctors, nurses and other health professionals to have a high vaccination rate, irrespective of whether it was compulsory or not. However, being a health professional was not associated with vaccination in some European countries (Germany, Italy and Poland).[4] The coverage rates were generally low among health professionals in the same study on 11 European countries, with coverage ranging from the lowest at 6.4% (Poland) to 26.3% (Czech Republic).[4]

Advice from doctors/health professionals/family/close friends and free vaccinations were other crucial factors that determined the choice of many to be vaccinated. Hence, health professionals could help to implement influenza

vaccination programmes and contribute to increasing the vaccination coverage rates in their patients.

Past experiences of influenza pandemic vaccination and the widespread severe epidemic could influence perception on vaccination. However, evidence demonstrated that a past pandemic was only insignificantly or moderately negatively associated with (i.e. reduced) later seasonal vaccination.

What is already known on this topic?

The fact that people have positive perceptions regarding vaccination or have even expressed their interest in receiving the vaccine does not necessarily lead them to receive the actual vaccination.[46] A meta-analysis with 47 experimental tests on behavioural intentions and behaviour concluded that a medium to large change in intention leads to a small to medium change in behaviour.[47] Even of those who had intended to get vaccinated, only half had actually been vaccinated.[48] One solution would be to follow up participants and verify their actual behaviour after their verbal response.

A person's decision to uptake influenza vaccination is influenced by a number of contributing factors. Most of the published articles were surveys and they reflected the conscious subjective opinions of individuals. Choice of uptake could also be influenced by change of health service, media, culture, values and social norms.

What this study adds?

This is a systematic and evidence-based approach to the survey design. A range of ORs for factors associated with influenza uptake are presented and grouped artificially into eight domains (Table 2). These ORs were indicative of the strengths of associations between the factors that influence attitudes and decision in the general population on vaccine uptake. The selected studies used broad and imprecise terms such as 'knowledge of influenza and influenza vaccination' and 'access to healthcare settings', and these would be subjected to respondents' interpretation. Therefore, the ORs are not meant to be compared using their absolute values, neither within nor across domain. However, the consistency and coherence of high ORs of a factor were strongly indicative of a high strength of association across populations.

Limitations of this study

Since most included articles are cross-sectional surveys, recall bias and/or report bias exists. For self-administered questionnaires, misclassification could have occurred due to cultural or religious differences, e.g. the report of having chronic disease(s). Nonetheless, the approach of analyzing self-reported data on chronic conditions was reasonably accurate.[49] The sample was also restricted by the sampling method, e.g. individuals without a home telephone were excluded for telephone interviews.

A meta-analysis of the adjusted ORs in the selected articles was not performed. While the selected studies all examine the factors associated with the uptake of the seasonal influenza vaccination, there are substantial heterogeneities among them. There is diversity in the demography of the study respondents, because data were collected from >15 countries. Methodological variation exists, because studies had different aims, sampling subject recruitment criteria, scope of question asked and outcomes measurement. Besides, because many of the associated factors (variables) were examined in one to three studies, pooling of data would not represent the overall result.

Articles on pH1N1 pandemic vaccination were excluded, because the determinants for seasonal influenza vaccination were different from that of pH1N1 pandemic vaccination.[40] Systematic reviews found that younger age, believing in vaccine safety and/or effectiveness, and higher socioeconomic status were important determinants of the pH1N1 vaccine.[50,51] The perceived mild nature of the disease and the impact of extensive media publicity on adverse events after vaccination were major reasons the public refused the pH1N1 vaccine.[50,52]

Conclusions

This review highlighted the finding that perception on vaccine efficacy, perception on vaccine safety and adverse events, advice from doctors/health professionals/family/close friends and free vaccination are changeable factors that are strongly associated with influenza vaccination in adults aged 18–64.

Authors' contributions

M.P.S.Y. generated the research framework and methods; collected, analysed and interpreted the data and drafted the manuscript. F.L.Y.L. contributed to the study selection criteria and performed critical appraisal of the articles. R.C. contributed to the conception, design, analysis and interpretation of the study and critically revised the manuscript. All authors read and approved the final manuscript.

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