
ARTICLE REVIEW

Acceptance Factors of Pneumococcal Vaccination among Adult Population: A Systematic Review

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ABSTRACT

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Introduction	Pneumococcal disease causes considerable morbidity and mortality, including among adults. Adult pneumococcal vaccines help to prevent these burdens, yet, they are underutilized. Our objective is to systematically collect and summarize the available evidence on the potential factors that lead to pneumococcal vaccination acceptance among of adult community.
Methods	A systematic literature search was conducted involving studies published from January 1999 to December 2015. The studies were identified by searching electronic resources (PubMed/MEDLINE and Pro Quest database) and manual searches of references. The keywords “vaccine/ immunization”, “uptake/ coverage”, “determinant/ factor”, and “Streptococcus pneumoniae/ pneumococcus/ pneumococcal” were used. Final studies result and data were reviewed by two independent authors. Disagreement was resolved through discussion and consensus.
Results	A total of 171 studies were identified, only 17 studies were included in final discussion with 10 domains identified in the paper. 7 studies (41%) had reported that the provider domain, patients’ perception and socio-demographic factor have had the most effect on the pneumococcal vaccination acceptance rate. In addition, only 18% (3) of reviewed papers had highlighted that socio-economic was a factor influenced the pneumococcal vaccination acceptance while 24% (4 studies) were attributed to the comorbid domains.
Conclusions	Healthcare provider and patients’ perception about pneumococcal vaccination for adult population are significant domains which influence the acceptance towards vaccination. Strong recommendations from healthcare provider for pneumococcal vaccination would be an important step to increase vaccination acceptance among the population.
Keywords	Pneumococcal vaccination - Adult population - Acceptance.

INTRODUCTION

Pneumococcal disease, caused by the common bacteria *Streptococcus pneumoniae*, is associated with considerable morbidity and mortality as well as considerable health care costs disease. Pneumococcal disease is transmitted from person to person through close contact via respiratory droplets. The symptoms and severity of the disease vary depending on the clinical syndrome.¹ The most serious clinical manifestations of pneumococcal disease are pneumonia and invasive pneumococcal disease (IPD), which includes meningitis and bacteraemia.² Pneumococcal infection is responsible for 30–50% of pneumonia cases in children followed by *Haemophilus influenzae* type B for 10–30% of cases.³ Pneumococcal disease is found to be of the main cause of mortality and morbidity for children under five years of age, mainly in developing nations.⁴

Approximately, 1.6 million people globally die from the pneumococcal infection every year, in which almost 1 million from that figure are children under the age of five years. In 2009, Indonesia accounted for the sixth rank or 3% of the reported pneumococcal cases worldwide.⁵ It was reported that population older than 65 years are vulnerable to complications from influenza infection and invasive pneumococcal disease.⁶ All adults aged 65 years are at increased risk of developing pneumococcal disease, as are persons of any age with immunosuppressive conditions (i.e. cancer, HIV/AIDS, diabetes, alcoholism, chronic diseases of the heart, lung, liver, and kidney, and those who smoke cigarettes).⁷

The history of pneumococcal vaccination began more than 30 years ago in the USA, where the 23-valent pneumococcal polysaccharide vaccine (PPSV23) was licensed. PPSV23 is currently recommended in people aged >65 years and in high-risk adults aged 19-64 years.⁸ Pneumococcal vaccine that is used for childhood pneumococcal vaccination was first recommended in the United States in 2000 and was widely used in 26 countries. Since 2006, 18 out of these 26 countries have introduced the vaccine including Australia, New Zealand, South Korea, and countries in Europe, the Americas, and the Middle East.⁹

The main objective for pneumococcal vaccination is to get vaccine coverage more than 90% among at-risk populations.¹⁰ After the vaccine introduction in many of those countries, the regular use of this vaccine has led to huge decline of invasive pneumococcal disease (IPD).¹¹ In the United States, routine use of the 7-valent pneumococcal conjugate vaccine (PCV7) in children since 2000 has led to waning disease incidence in this population, as well as reductions in IPD cases among adults due to “herd immunity”.² The widespread use of PCV7 in

children has altered the epidemiology of pneumococcal infections, bringing down the burden of adult pneumococcal disease. Adults presently bear the major burden of serious IPD; where about 85% of all IPD cases now occur in persons aged >18 years.¹² Previous studies have found associations between pneumococcal vaccination status and patient belief that the pneumococcal vaccine is effective and is a good idea and that pneumonia is a serious disease for the elderly.¹³

The Advisory Committee on Immunization Practices (ACIP) recommends that pneumococcal polysaccharide vaccine be administered to people aged ≥ 65 years; immunocompetent people aged ≥ 2 years who are at increased risk for illness and death from pneumococcal disease because of certain chronic medical conditions; people with functional or anatomic asplenia; and immunocompromised people who are at high risk for infection.¹⁴ As for those people aged ≥ 65 years should be administered a second dose of pneumococcal vaccine if they received the first dose of vaccine ≥ 5 years previously and were aged <65 years at that time.¹⁴

The Advisory Committee on Immunization Practices developed guidelines in 1997, recommending all adults ages 65 and older receive the vaccine; however, the immunization rates among older adults are low.¹⁵ In 2014, pneumococcal vaccination coverage (23-valent pneumococcal polysaccharide vaccine [PPSV23] and 13-valent pneumococcal conjugate vaccine [PCV13]) among adults aged 19 – 64 years at high risk was 20.3% in the United States.¹⁶ Meanwhile, the coverage was 61.3% among adults aged ≥ 65 years, which did not progress from 2013.¹⁶

Pneumococcal vaccination has been shown to reduce morbidity, mortality and health care costs.¹⁷ A safe and effective pneumococcal vaccine is available, but underused.¹⁸ However, there are still few issues hindered more broad-scale use of pneumococcal vaccination, including doubts about its effectiveness in reducing the incidence of community-acquired pneumonia. The incremental cost-effectiveness of the vaccine in persons immunized against pneumonia and patient compliance.¹⁹ However, pneumococcal vaccine has limited effectiveness against invasive pneumococcal disease, especially among immunocompromised adults, and PPSV23 protection is short-lived, with a rapid waning of antibody concentrations and with a lack of memory B-cell production following immunization.²⁰

Both physician and patient factors contribute to this suboptimal vaccination rate. While physicians often miss opportunities to vaccinate patients, patients also refuse vaccination.

A Review of Pneumococcal Vaccination

Vaccine refusers have not been targeted for study in the past.²¹ The objectives of this study are to understand and identify the potential factors that lead to pneumococcal vaccination acceptance among of adult community.

METHODOLOGY

Systematic Literature Review (SLR) was carried out on factors and determinants which were

associated with pneumococcal vaccination intake or acceptance, considering key words used in combination and referred to vaccine/immunization, uptake/coverage, determinant/factor, and *Streptococcus pneumoniae*/ pneumococcus/ pneumococcal, with medical subject headings (MeSH) and MeSH major topics included in the syntax.

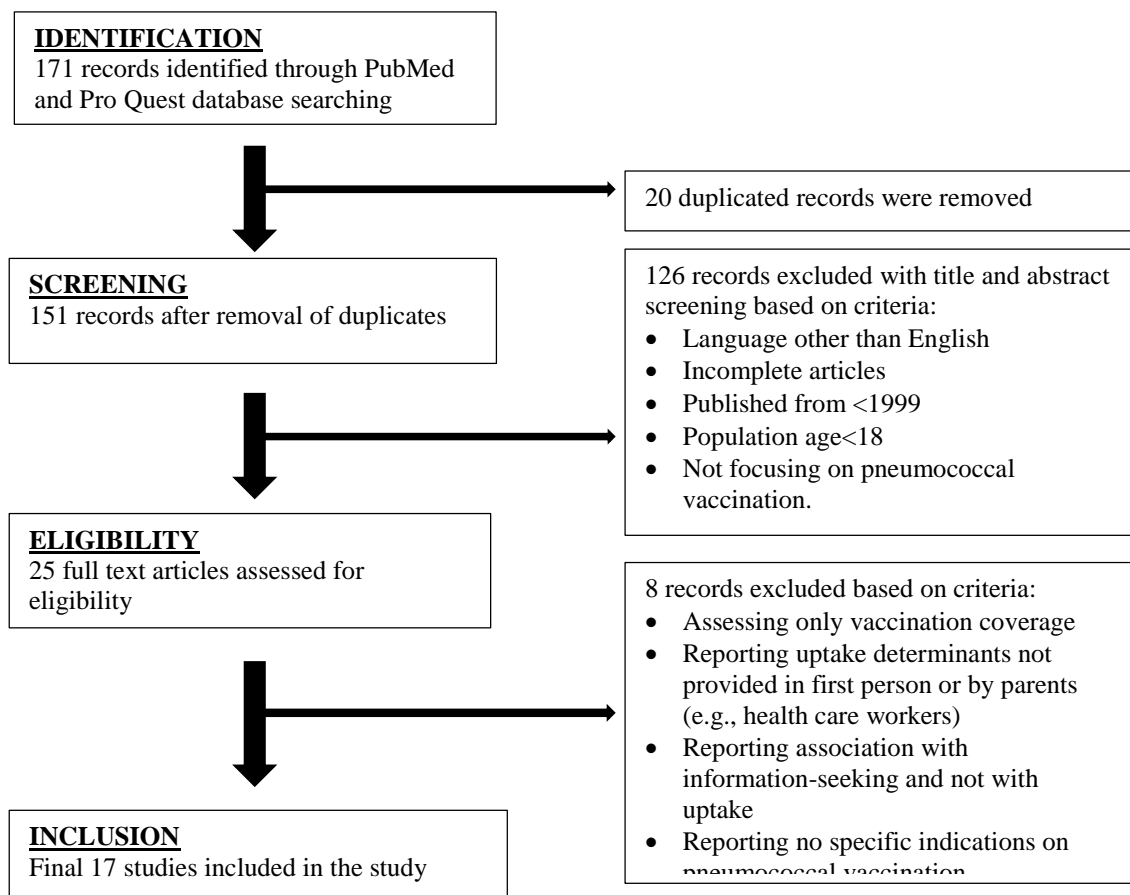


Figure 1 Flow Systematic Literature Review (SLR) diagram of the factors of pneumococcal vaccination acceptance

The PubMed/MEDLINE online database was utilized, as well as the grey literature, and a manual search was performed based on the references of the articles retrieved. Original qualitative and quantitative articles published from January 1999 to December 2015 were collected. Through standardized database searching, 171 records were identified. After duplicates were

removed, 151 records were screened and 126 records were excluded on the basis of title and abstract screening (based on language, study setting, methodology, or target population). Finally, among 25 articles assessed for eligibility, 8 were excluded on basis of exclusion criteria and 17 were analysed in this study (Figure 1).

RESULT

There was a total of 17 eligible papers reviewed and summarised based on the year of published, author and findings (Table 1). Twelve papers were qualitative study. The findings were further

classified into main domains based on the Health Belief Model and domains used in other related literatures. The domains are: awareness, socio-demographic, knowledge, perception, provider, socio-economic, social factor and others.

Table 1 Summary of study characteristic and findings for comparison

Year	Author	Geographical setting/ Target population	Significant Determinant	Domain Classification
1999	Kyaw et al.	Birmingham, United Kingdom / Patients admitted at a large teaching hospital	<ul style="list-style-type: none"> • Unaware vaccine existed • General Practitioner(GP) had not recommend the vaccine • GP recommended but patient refused • Fear of adverse reaction • Vaccine contraindicated due to current therapy • Could not be bothered • Did not think it would work 	<ul style="list-style-type: none"> • Awareness • Provider • Perception • Side effect • Side effect • Attitude • Perception
2001	Wahid et al.	Middlesbrough, Gateshead and Newcastle, United Kingdom / Out-patient diabetic patients	<ul style="list-style-type: none"> • Not aware of need • Previous side effects • Believed not effective • No time • Never offered 	<ul style="list-style-type: none"> • Awareness • Side-effect • Perception • Attitude • Provider
2001	Opstelten et al.	Amersfoort, Netherlands / Patients from 2 solo and 2 group General Practitioners	<ul style="list-style-type: none"> • General Practitioner(GP) did not recommend the vaccine • Expected local side effects from pneumococcal vaccination 	<ul style="list-style-type: none"> • Provider • Side effect
2003	Egede & Zheng	US National Health Interview Survey / Individuals aged >18 years old with at least one chronic medical condition	<ul style="list-style-type: none"> • Age > 65 • Race; Non-Hispanic White • Income, \$<20 000 • Employed • Health care coverage • Access to care • One Comorbid conditions 	<ul style="list-style-type: none"> • Socio-demo • Socio-demo • Socio-econ • Socio-econ • Socio-econ • Provider • Co-morbid
2003	William et al.	USA	<ul style="list-style-type: none"> • Unnecessary • Doctor did not recommend • Did not think of missed • Do not prevent pneumococcal disease • Not at risk of developing pneumococcal • Fear of shot/needles 	<ul style="list-style-type: none"> • Perception • Provider • Perception • Knowledge • Perception • Perception
2004	Nowalk et al.	Pittsburgh, USA / Patients from inner-city health centers	<ul style="list-style-type: none"> • Attitude • Social influence • Perceived consequences 	<ul style="list-style-type: none"> • Perception • Attitude • Social • Side effect
2005	Singleton et al.	Atlanta, Georgia / Adults aged >65 years community	<ul style="list-style-type: none"> • Concerned about side effects • Do not think the vaccine works • Do not think the need for vaccination 	<ul style="list-style-type: none"> • Side effect • Perception • Perception • Attitude
2006	Nowalk et al.	Pittsburgh, USA / Adults aged at least 50 years old	<ul style="list-style-type: none"> • Allergic to the vaccine • Female; OR 3.79 (1.47,9.74) • Smoking status-Never smoked OR; 10.67 (1.67,68.28) • Frequency of visits to physician – 3-4 times per year OR; 8.77 (2.36 – 32.62) 	<ul style="list-style-type: none"> • Side effect • Socio-demo • Social • Awareness
2006	Daniels et al.	California, USA / Patient attending general	<ul style="list-style-type: none"> • Vaccine is unnecessary • Fearing shots in general • Fearing vaccine-induced 	<ul style="list-style-type: none"> • Perception • Perception • Perception

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		medicine clinic	illness	
2006	Vila-Corcoles et al.	Catalonia, Spain / Individuals aged more than 65 years old	<ul style="list-style-type: none"> • Wanting more information regarding the vaccine • Age > 75 • Chronic lung disease • Diabetes mellitus • Active neoplasia • Immunocompromised • Chronic heart disease • Chronic nephropathy • Obesity 	<ul style="list-style-type: none"> • Knowledge • Socio-demographic • Co-morbid
2008	Merrick et al.	The primary data source from nationally representative 2003 Medicare Current Beneficiary Survey (MCBS) in US	<ul style="list-style-type: none"> • Age ≥81; OR 2.16 (1.88,2.47) • Race-Black; OR 0.62 (0.51,0.74) • College degree; OR 1.23(1.04,1.46) • Income >\$40,000; OR 1.28 (1.11,1.48) • Relative health risk; OR 1.10 (1.05,1.14) • Private supplemental insurance; OR 1.25 (1.09,1.44) • Non-drinker; OR 0.94 (0.83,1.07) 	<ul style="list-style-type: none"> • Socio-demographic • Socio-demographic • Socio-economic • Socio-economic • Co-morbidity • Socio-economic • Social
2008	Hausmann et al.	Using 'Behavioral Risk Factor Surveillance System (BRFSS) among adults in USA	<ul style="list-style-type: none"> • Perceived positive racial discrimination; OR 1.47 (1.20,1.80) 	<ul style="list-style-type: none"> • Social
2008	Ridda et al.	Sydney, Australia / Patients aged 60 years and older who are admitted to selected wards in a tertiary referral hospital	<ul style="list-style-type: none"> • More positive attitude to vaccination • More positive perception to vaccination. • Older patients tend to be more likely to receive either both or any one of the vaccine. • More correct knowledge on vaccination 	<ul style="list-style-type: none"> • Attitude • Perception • Socio-demo • Knowledge
2010	Jones et al.	USA / Adults age ≥65 years of age between 1989 and 1993	<ul style="list-style-type: none"> • Racial variation in the receipt of influenza vaccine. • Lack of awareness of the benefits • Higher income • Lack of contact with health-care providers or missed opportunities to vaccinate during contact. 	<ul style="list-style-type: none"> • Socio-demo • Awareness • Socio-econ • Provider
2010	Daniels et al.	California, USA	<ul style="list-style-type: none"> • Increasing age • Female • Being a former smoker • Having a check-up in the past year • Having diagnosed with heart disease 	<ul style="list-style-type: none"> • Socio-demo • Socio-demo • Social • Awareness • Co-morbid
2015	Eilers et al.	Netherlands / Age >50 years old from	<ul style="list-style-type: none"> • Healthy aging • Usefulness of vaccination in older age 	<ul style="list-style-type: none"> • Social • Awareness

		sheltered housing institutions, care homes, and residential groups across the Netherlands	<ul style="list-style-type: none"> • Risk of getting an infectious disease • Vaccine characteristics • Severity of the disease • The experiences of previous vaccinations • The influence of healthcare workers and other people • The need for information. • Favourable attitude towards vaccination in general aOR 4.20 (3.20-5.51) • High global knowledge aOR 2.21 (1.55-3.15) 	<ul style="list-style-type: none"> • Perception • Side-effect • Perception • Perception • Provider • Knowledge • Attitude • Knowledge
2015	Loubet et al.	France / Adults > 18 years old who are immunocompromised patients		

Out of 17 studies, 7 studies (41%) had reported that the provider domain, patients' perception and socio-demographic factor had the most effect on the pneumococcal vaccination acceptance rate. In addition, only 18% of the

reviewed papers had highlighted that socio-economic factor had influenced the pneumococcal vaccination acceptance while 24% were attributed to the comorbid domains (Table 2).

Table 2 Distribution of study factors in pneumococcal vaccination acceptance and refusal

	Kyaw et al	Wahid et al	Opstelten et al	Egede & Zheng	William et al	Nowalk et al (04)	Singleton et al	Nowalk et al (06)	Daniels et al	Vila-Corcoles et al.	Elizabeth	Hausmann et al	Ridda et al	Jones et al	Daniels et al	Eilers et al	Loubet et al	TOTAL
Awareness	x	x						x						x	x	x		6
Side effect	x	x	x			x	x									x		6
Knowledge					x				x			x				x	x	5
Perception	X	X			X		x		x				X			X		7
Provider	X	X	x	X	x									X		X		7
Social						X		X		X	x				X	X		6
Socio-demographic factor				X				x		X	X		X	X	X			7
Socio-economic status				X							x			x				3
Co-morbid				x						x	X				x			4
Attitude	x	x				x	X						x				x	6

DISCUSSION

Pneumococcal infections, including pneumonia and invasive disease such as bacteremia and meningitis, are important sources of morbidity and mortality in infants and young children, older adults (≥65 years of age), and persons with conditions that affect their ability to produce antibody. Patients with chronic lung disease are at increased risk for pneumococcal pneumonia, and patients with conditions such as heart failure are more likely to have adverse

outcomes if pneumonia occurs. Asplenic patient greatly increases the risk for overwhelming pneumococcal sepsis, and cerebrospinal fluid leak or a cochlear implant greatly increases the risk for meningitis. Pneumococcal vaccination is recommended for all children and for adults who have a condition that places them at increased risk for developing pneumonia or invasive pneumococcal disease or for having a serious outcome should pneumonia develop.⁷

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The highest incidence of invasive pneumococcal disease occurs in children <5 years of age, persons who have conditions that compromise antibody responses (eg, solid organ transplantation, multiple myeloma, HIV infection), and those ≥ 65 years of age. The highest mortality rates occur in individuals aged more than 65 years of age, especially in those who have significant comorbidities.²² Preventing pneumococcal disease in older adults and those with certain underlying conditions is an important goal given the burden of disease and associated morbidity and mortality in these populations. The development of pneumococcal conjugate vaccines represented a major advance; the universal use of such vaccines in infants has led to dramatic reductions in the incidence of pneumococcal disease. This decline is seen both among children who are vaccinated and, because the vaccine effectively eradicates nasal colonization, also among older, unvaccinated children and adults.²²

However, several factors are believed to influence the acceptance of pneumococcal vaccination. With the vaccine efficacy, up to 60% for all serotype (Cochrane systematic review), this

vaccine is not widely promoted to the populations.²³ Acceptance and refusal factors of pneumococcal vaccination can be divided into multifactorial of person, provider and policy factors.²⁴ Studies have found that the reason most people do not take this vaccine is either due to poor recommendation or the vaccination was not provided.^{25,26} In some cases, vaccination was even not recommended by the general practitioner.^{25,27}

One of the main factors that influence the acceptance of vaccination was the perception of the individual. Among the good perception towards acceptance of pneumococcal vaccination was that the patient believed the vaccination may prevent them against invasive pneumococcal disease²⁴ while most of refusal perception towards pneumococcal vaccination stated that the vaccine may produce adverse side-effect and not effective^{24, 25} and vaccine is believed to be contradicted with current therapy.²⁶ Negative attitudes and misconceptions about vaccination and because of fear of shots or vaccine-related illness may be related to refusal towards vaccination in low education population.²⁵

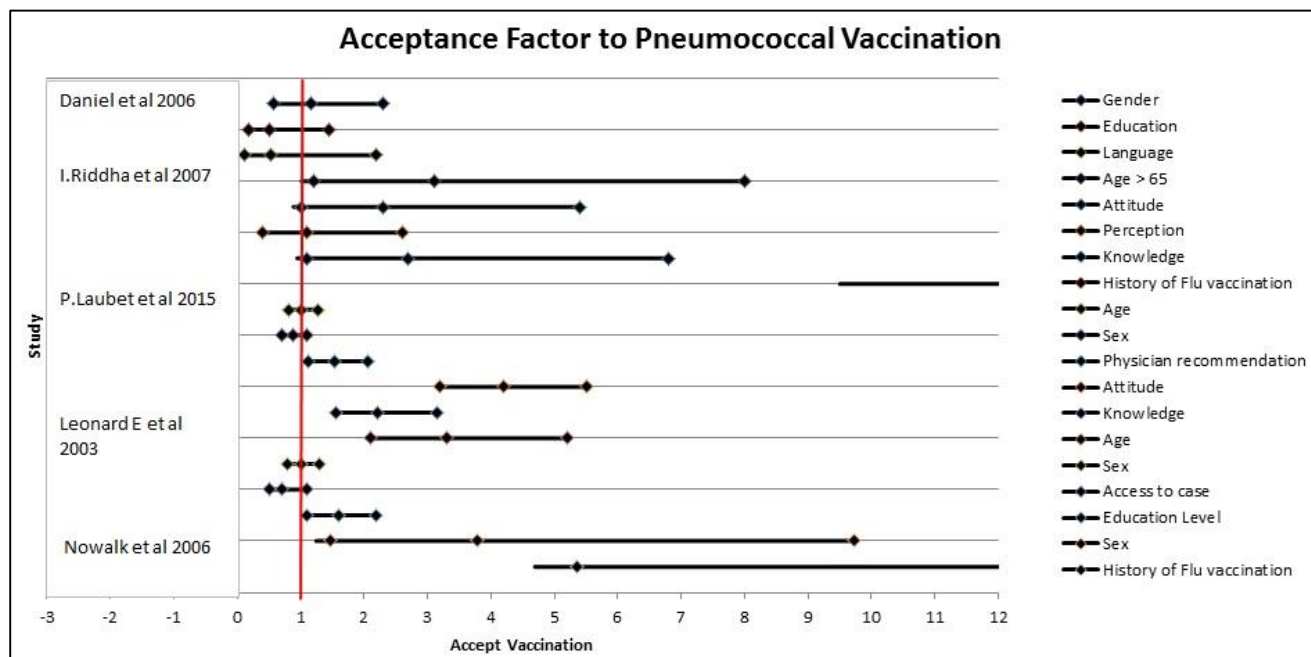


Figure 2 Descriptive analysis of acceptance of pneumococcal vaccination

History of taking influenza vaccination is the most significant factor contributed to acceptance of pneumococcal vaccination (Figure 2). Studies showed that the history of taking flu vaccination may give high odds of taking pneumococcal vaccination with OR 54.8 and 12.8 respectively. This was because that most of the patient believed that they will be protected after

taking the vaccination.^{28,29} Other sociodemographic factor such as gender had showed female were more likely to accept the pneumococcal vaccination comparing to male³⁰ while other studies had not given the significant difference between the gender towards vaccine acceptance.^{28,31} Other studies showed that those

who are more than 65 years contributed to significant acceptance factor.^{29,30}

RECOMMENDATION

Among some recommendations that could be implemented in order to achieve high coverage of pneumococcal vaccination should include increasing awareness among high risk groups and providing education on the benefits of pneumococcal through social media, such as Facebook, Twitter or blogs. The healthcare provider can create their own social media accounts to offset that content with information favoring immunization.

Physician recommendation is the most important factor influencing a patient's decision to be immunized, and, in fact, most patients won't get vaccinated without a physician recommendation. Trust develops when patients identify both competence and caring in their physician. A trusting relationship is also necessary to effectively communicate the benefits of these interventions and address barriers to vaccinations. One way to make sure patients receive the recommendation is to create a system with the team, making vaccination a front-end priority, rather than an afterthought, and appropriately delegating authority. Hence, physicians' attitudes and practices are important for this matter.

Meanwhile, elderly patients may also remember what life was like in their community when measles, mumps, and polio were endemic, before vaccines became available. Sharing experience by combining their experience with our medical advice can be a useful way to emphasize the importance of vaccinations.

STRENGTH AND LIMITATIONS

Strengths of this systematic review include the large number of articles screened to get different racial, ethnic, age, and multicentre studies with different geographical area that may represent whole population as general. The review had also covered a long period to consider all studies from the year 1999 till 2015. However, there were several limitations of the review such as this review had only considered free open access published articles and accessible search engines or online databases.

CONCLUSION

In conclusion, healthcare provider and patients' perception on pneumococcal vaccination for adult population are significant domains which influence the acceptance towards vaccination. Strong recommendations from healthcare provider for pneumococcal vaccination would be an important step to increase vaccination acceptance among the population.

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