

SOURCES OF INFORMATION AND THEIR IMPACT ON PARENTS' VACCINATION DECISIONS: A SYSTEMATIC REVIEW

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ABSTRACT

Background: The frequency and manner of which health information are used is influenced by the sources. These sources may be seen as having different credibility among various sub-groups of the population. Such credibility in turn can have a marked impact on the acceptance and trust of the population on a specific source of information.

Objective: The purpose of this review was to identify the various sources of information available on vaccination and how they influence the parents' decision towards their child's vaccination.

Methods: A systematic review of articles related to the role of information on parents' vaccination decisions for their children was compiled using a series of keywords in databases (PubMed, Science Direct, Google Scholar, ELCOSH and OSH-ROM). Studies included were those published between 2000-2014, written in English, elicited responses from parents or caregiver of children aged below 18 years old and used a quantitative design that addressed sources of information on vaccination.

Results: The search yielded 3678 titles, 51 articles were identified for full review and ten studies met the inclusion criteria. All were quantitative studies, except one which used a mixed method. Six studies were conducted in the United States, two in Europe and two in Asian countries. Studies which reported parents who cited health professionals as reliable sources of information showed a positive effect on vaccination decision, compared to those who reported non-health professionals as the sources of information.

Conclusion: Different groups of parents seek and trust information from a variety of sources, which positively or negatively influence parents' decision in immunizing their children.

Key Words: *sources, information, vaccination*

1.0 Introduction:

The success of the vaccination programs in many countries across the globe had result in decreased rates of vaccine preventable diseases (Centers for Disease Control and Prevention, 2008). Nonetheless, in recent years there have been a growing number of parents who have expressed doubts, refusal or delays to immunize their children (Olpinski, 2012). This could

be because parents who have no personal experience with vaccine preventable diseases might focus their attention on the perceived risks of vaccines instead of their well-documented benefits (Kennedy et al, 2011). This is a significant trend and an equally alarming one too. An unvaccinated child in a community threatens the whole community and places other children at risk of vaccine preventable diseases and disease outbreaks occur. An example of this was the largest decrease in vaccination coverage in Great Britain, where it caused an epidemic of pertussis and the deaths of many children (Olpinski, 2012). Thus parental acceptance of routine childhood vaccination is essential in protecting children's health.

The public have freedom to use different sources such as the internet, health care providers, friends, family, television, radio and newspapers to access information about their health (Anderson, 2004). Although health professionals remain the most highly trusted information sources, but the use and popularity of the non-health professionals such as the internet to get health information is rising (Kummervold et al, 2008). The source of health information may have an impact on the frequency and manner of its use. Sources may have different credibility with various sub-groups of the population. Such credibility can have a marked impact on the acceptance of information and the level of trust on a specific source of information.

The spectrum of source of vaccination information ranged from health-professionals such as doctor, nurses, physicians and general practitioners to non-health professionals such as the internet, friends, families, television and radios. Information can be provided through conventional mass-distribution methods such as public commercials and safety announcements or more personally through physician-patient communication. Information can also be channeled through electronic means of communication including social networks, websites, blogs and online forums (Freed et al, 2011). Misinformation about vaccines confuses parents and they tend to question the importance or safety of vaccines for children may ultimately choose to either refuse or delay vaccination, which will leave their children and others vulnerable to disease (Pineda and Myers, 2010).

This systematic review used a structured methodology for evaluating the literature and synthesizing evidence regarding the role of information in parents' vaccination decision n focused on childhood vaccination. This study also aims to identify the source of information used by the different groups of parents and if different sources of health-professionals and non-health professionals' influence the parents' decision towards their child's vaccination.

2.0 Methodology

2.1 Research strategy

Journal articles between the years 2000-2014 related to the role of information on parents' decisions for vaccination of their children were compiled using a series of keywords The keywords used were source of information*, vaccination*, parents*, child*, decision* and vaccination*. Five major databases (PubMed, Science Direct, Google Scholar, ELCOSH and OSH-ROM) were searched. The search was limited to abstracts and titles of papers published in English and with abstracts available.

Then, the bibliography of already published literature reviews on the role of information on parents' vaccination decisions for their children was examined and the relevant titles were retained. A total of 3678 publications related to the role of information on parents'

vaccination decisions were identified. The abstracts of these 257 publications were read. Fifty one publications were accepted since they did discuss the source of information

2.2 Quality assessment

The methodological quality of all the relevant full text articles retrieved was assessed by two reviewers. Disagreements were resolved by discussion.

2.3 Selection of publications

The final selection articles were done using the following criteria: the articles published between years 2000 until 2014, published in English, contained responses from parents or other child caregiver of children aged below 18 years old (not from child care providers, school personnel, or other medical professionals), focused on childhood vaccination (not on adolescent vaccination and specific population groups) and used a quantitative design that reported sources of vaccination information used by parents in relation to childhood vaccination decision. Articles published in books or book chapters as well as research reports were not considered. There were a total of 10 usable articles that met all of the selection criteria, as illustrated in Figure 1.

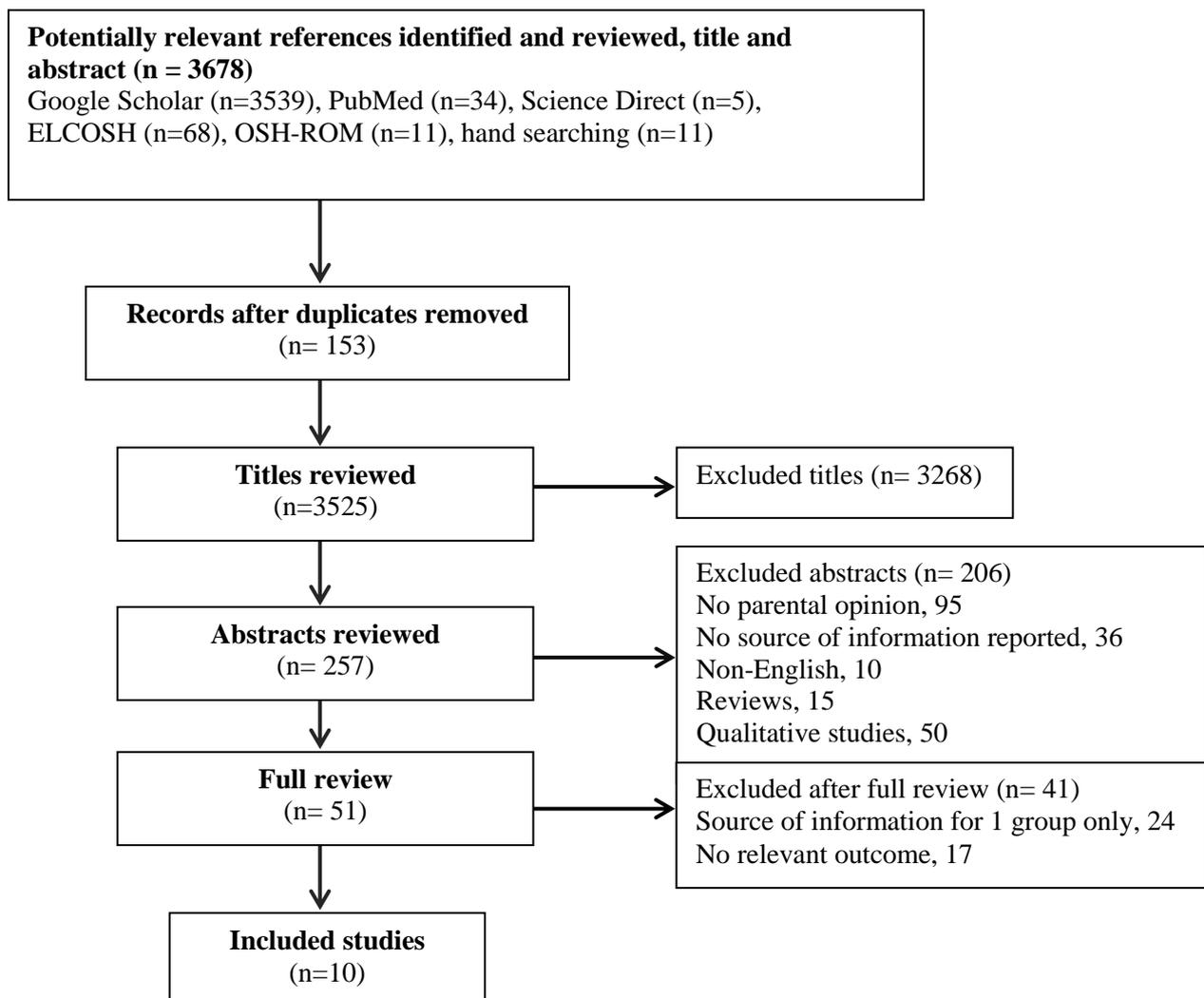


Figure 1: Flowchart of systematic review process. Abbreviation: (n) number.

2.3 Analysis strategies for selected publications

A detailed analysis grid was used to extract 3 major categories of information from the selected articles:

- a) Vaccine type: first step was to define the type of vaccine studied (e.g., measles/mumps/rubella [MMR], influenza or multiple types of vaccinations)
- b) Parent group: second step was to determine the groups of parent studied for comparison.
- c) Findings: Last step was to assess the findings from these studies.

In addition, the following characteristics were extracted from each study; first author, year of study, location, sample size, methodology, study design, response rate and caregiver status (e.g., mother, father, grandparent, other).

3.0 Results

3.1 Literature search

A total of 3678 records were identified from the literature search and screened as shown in Figure 1. The records were reduced to 3535 after removing duplicates. Based on title alone, 3268 articles were excluded because it was evident that they addressed adolescent vaccination, human papillomavirus (HPV), adult vaccination, reviews, qualitative studies and studies reporting global scales with a combination of various factors.

The remaining 257 abstracts were identified as potentially relevant, 206 of which were excluded after review. Abstracts were excluded when it was clear that the article, based on the abstract, fell into one of these exclusion categories: (1) parent or child caregiver opinion regarding source of vaccination information was not addressed; (2) specific source of information for childhood vaccination were not reported; (3) abstract indicated a non-English article (4) abstract did not describe an original study (example, was a review article or theory piece); and/or (5) abstract indicated a qualitative study design. After exclusion of these 206 abstracts, 51 potentially relevant full-text reports were obtained and reviewed

Of the articles left for full reviews, 41 were excluded primarily because they did not examine the sources of information for at least 2 parent groups for comparison and did not provide relevant data and outcome, which was not clear based on abstract review alone. Of these, all articles retrieved by the search were assessed according to a number of inclusion criteria, yielding 10 studies which met the selection criteria for the review.

3.2 Analysis of Included Studies

Ten studies between 2000 and 2014 related to the role of information on parents' vaccination decisions for their children were identified. All of the included studies were quantitative in nature; however one used mixed quantitative or qualitative methods. In these studies, data were obtained primarily using questionnaire that was conducted in either over the telephone, mailed or electronically with an individual parent or child caregiver. One study by Brunson et al (2013) used social network analysis to formally examine and quantifies how parents are influenced by the people and sources around them, which data were collected via an online survey. Five of these articles were identified as cross-sectional studies, while four of them employed case-control study design and one on cohort study (Table 1).

Table 1: Review of ten included studies related to the role of information on parents' vaccination decisions for their children

First Author/ Year	Location	Sample Size	Methodology	Study Design	Response Rate	Caregiver Status	Vaccine Type	Parent group	Findings
McCauley 2012	Georgia, United States of America	1500	Telephone survey	Cross-sectional	46%	Parents 69.4% females, 30.6% males	Multiple	74.5% parents following vaccine recommendations, 25.5% parents not following the vaccine recommendations	Parent not following the vaccine recommendations cited Internet as a trusted source of information (7.7%;95% CI, 5.5%–10.9%) versus those following it (3.2%;95% CI, 2.3%–4.4%) and less likely cited medical professionals as source (67.7%, 95% CI, 62.5%–72.4%) versus those following recommendations (79.0%; 95% CI, 76.5%–81.4%) $p < .001$.
Smith, 2010	Georgia, United States of America	2,921	Telephone survey	Cross-sectional	70%	96% parents, 3% Grandparents, 1% other family members	Multiple	78.2% Parents who did not intentionally delay vaccines, 21.8% parents who intentionally delayed vaccines	Parents who intentionally delayed vaccines significantly more likely to seek information from the Internet (11.4% versus, 1.1%, respectively, $p < 0.05$), significantly more likely to seek information from media sources (10.8% versus, 1.0%, respectively, $p < 0.05$), and significantly less likely to seek information from a doctor (73.9% versus, 93.9%, respectively, $p < 0.05$).
Bults, 2011	The Netherlands	3127	Postal survey, in-depth interviews	Case-control	71%, 19%	Parents	Influenza	Parents who accept influenza (Accepters), Parents who decline influenza (Decliners)	Decliners more frequently solicited advice from their social networks (72% versus 61%, $p < 0.001$), family (59% versus 43%), and friends (55% versus 44%) than accepters. Decliners less solicited advice from general practitioners (34%) than accepters (43%)
Matsui, 2011	Kyoto, Japan	1182	Postal survey	Cross-sectional	44.9%	Parents	Influenza	40.8% parents of vaccinated children, 59.2% parents of unvaccinated children	Parents of unvaccinated children obtain information mostly from TV/radio (44% versus 37%), newspaper/magazine (30.9% versus 22.4%), friends (14.2% versus 8.6%) and internet (3.6% versus 1.7%) than parents of vaccinated children. Parents of unvaccinated children less likely obtain information from medical professionals (17.9%) than parents of vaccinated children (38%)
Dannetun, 2005	Sweden	172	Telephone survey	Cohort	Not reported	Parents	MMR	40% parents abstain vaccination (abstainers) 60% parents postpone vaccination (postponers)	Abstainers more likely used friends/relatives (31% versus 22%) and internet (25% versus 17%) as source than postponers. Abstainer less likely use child health centers (20%) as source than postponers (35%)
Choi, 2007	Korea	337	Online survey	Case-control	Not reported	Parents 95.2% males, 4.8% females	Multiple	vaccination communities, anti-vaccination communities	Anti-vaccination communities more likely used internet as a source (77.6%) than vaccination communities (36.9%) $p < 0.01$, and less likely used medical professionals as source (19.0%) than vaccination communities (49.8%) $p < 0.01$

Keane, 2005	United states of America	2018	Postal survey	Cross-sectional	49%	Parents	Multiple	33% Vaccine believer, 23% Cautious parents, 34% Relaxed parents, 10% Unconvinced parents	Unconvinced parents placed a significantly lower level of trust in healthcare providers as compared to the other parent groups.
Salmon, 2005	United states of America	2345	Postal survey	Case-control	56.1%	66.5% mothers, 9.3% fathers, 2.2% other caregivers	Multiple	Parents of exempt children (cases), Parents of fully vaccinated children (control)	The majority of both exempt and vaccinated parents trusted their child's health care provider, used them for information, and thought that they are a good source for information. Parents of exempt children were more likely to report internet (36.8% versus 14.8%), media (62.1% versus 45.5%) and friends (70.8% versus 49.7%) as source than parents of vaccinated children
Salmon, 2009	Wisconsin, United stated of America	963	Postal survey	Case-control	42.4%	Parents	Multiple	Parents of exempt children (cases), Parents of fully vaccinated children (control)	The majority of parents of vaccinated and exempt children reported their child's primary health care professional as a source. Parents of exempt children were more likely to obtain information from internet (14% versus 7%), media (44.9% versus 40%), and parents/friends (40.3% versus 29.7%)
Brunson, 2013	Washington, United states of America	196	Online survey	Cross-sectional	Not reported	Parents	Multiple	64.3% parents who conform to the recommended vaccination schedule (conformers) 35.7% parents who did not conform to the recommended vaccination schedule (nonconformers)	Nonconformers were more likely to rank internet as source (34%) than conformers (27%). Nonconformers were less likely to rank health care providers as source (88%) than conformers (90%)

In five of the ten included studies, the researchers asked participants to rate or order the sources of vaccination information's credibility either in terms of quality ("extremely poor source" to "excellent source"), the most influential (source ranked 1), and level of trust ("not at all trustworthy" to "extremely trustworthy"). In three of these five ratings-based studies, the investigators used Likert-type scales. While the other two remaining, investigators asked participants to rank-order the source of vaccination information's credibility in comparison with other sources.

Among the ten included studies, a total of 14761 parents or caregivers of children aged below 18 years old from diverse groups contributed their views, based upon the ten studies that reported a sample number. The studies had between 172 and 3,127 participants with response rates between 19% and 71%. In one study by Matsui et al (2011), the researchers also enrolled adult vaccination; however, outcome data were reported separately for child vaccination and thus satisfied our inclusion criteria for the review.

3.3 Location of Studies

Among of these studies, six of them were conducted in the United States and the other two were conducted in Europe, which were in The Netherlands and Sweden. Nevertheless, the other two remaining studies were conducted in Asian countries, which were in Japan and Korea (Table 1).

3.4 Caregiver Status

The population of these studies included parents or caregivers of children. In six of the ten studies, the authors indicated the participants were parents or caregivers but did not explicitly elicit or report parental status such as mother, father, stepparent, and grandparent. While two of the studies, investigators specifically recruited parents or caregivers (e.g., legal guardians) of children which majority of them were females, ranged from 69.4% to 95.2%. In the remaining two studies that revealed the caregiver type, the majority of participants were parents, ranged from 75.8% to 96% as shown in Table 1.

3.5 Vaccination Type Investigated

An attempt was made to categorize the studies as related to types of vaccine used. Seven of the studies focused childhood vaccinations in general. Two studies addressed the influenza vaccination. The remaining one study focused specifically on the measles/mumps/rubella (MMR) vaccination (Table 1)

3.6 Parent Group Investigated

A variety of parent group were addressed. Majority of the studies investigated at least two groups of parents for comparison. There was only one study conducted by Keane et al, 2005 had classified parents into four groups that exhibited differences in vaccination compliance levels and vaccination attitudes. A summary of the self-reported source of vaccination information in relation to the parent group is presented in Table 1. Overall, majority of the studies reported health professionals were the most frequently mentioned and trusted source of vaccination information. Parents who more likely cited health professionals such as doctors, nurses, child care centers and general practitioners as a reliable source of information exhibited a positive attitude of parent group (e.g. parents of vaccinated children).

Parents who more likely viewed non-health professionals as sources of vaccination information such as the internet, media, friends or family exhibited a negative attitude of parent group (e.g. parents of unvaccinated children). Eight of the ten included studies, parents who exhibited a negative attitude of parent group were less likely cited health professionals as source of vaccination information. This review shows that parents who did not cited health-professionals as a source of information were more likely to obtain information through the help of non-health professionals.

A study by Bults et al (2011), showed that the use of Internet to search for vaccine related information was apparent during the influenza outbreak in the Netherlands, when 61% of the acceptors of influenza vaccine and 72% of decliners of the H1N1 vaccine searched for information from their social networks. The investigator also showed that 22% of the vaccine

acceptors and 25% of the vaccine decliners visited Internet sites that were critical of vaccination.

Two studies among the included articles found that the both of the negative attitude parent group (parents of exempt children) and positive attitude parent group (parents of vaccinated children) trusted their child's health care provider, used them for information, and thought that they are a good source for information. However, the same two studies found that parents who exempt children from vaccination are more likely to have obtained information from the Internet than parents who have their children vaccinated.

A study by Brunson et al (2013) evaluated the impact of social networks on parents' vaccinations decisions which were implemented towards 196 parents. The results found that social networks, and particularly people networks, play an important key role in shaping parents' vaccination decisions. Although people networks were reported by 95% of parents in both groups, nonconformists (parents who delay vaccination, partially vaccinate, and not vaccinate their children) were significantly more likely to report source networks.

A study by Keane et al (2005) found that "Vaccine Believer" parents who are convinced of the benefit of vaccination placed a significantly higher level of trust in medical professionals as compared to the other parent groups. Conversely, "Unconvinced" parents who have the most negative attitudes towards vaccination placed lesser level of trust than other parents of all information sources and were significantly less trusting of medical professionals.

4.0 Discussion:

This systematic review identified several types of source of information used by parents to obtain vaccination information in making decision to immunize their children. This study found that health professionals as the most common source of vaccination information used by parents to obtain favorable information leading to positive decisions to immunize their children compared to non-health professionals as source of information. These findings highlight the importance of the trust parents place in their health professional in making decision for their child's vaccination.

It would seem that ensuring a strong physician-parent relationship and using physicians in public roles such as public service announcements and commercial would be appropriate to consider. Available evidence suggests that those whose parents' decision to vaccinate was influenced by a health care provider had an estimated vaccination coverage rate that was significantly higher than among children whose parents' decision was not influenced by a health care provider (Smith et al, 2006). This shows that parents may be influenced positively by their health care providers

Conversely, this study found that parents who reported non-health professionals such as the internet, friends, family, media, TV and radio as sources of information had lead to negative decisions to either delay, abstain or not to immunize their children. Anti-vaccination messages are more common on the Internet than in other forms of media, increasing the likelihood that vaccination decisions may be based on misleading information (Davies et al, 2002). There was some evidence stated that parents who reported using the Internet to obtain information about vaccines were less likely to agree with accepted tenets of vaccine science, less likely to agree that children need or benefit from vaccines, and more likely to have obtained

nonmedical exemptions from vaccination for their children (Jones et al, 2012). The Internet is therefore assumed to be increasingly influential in the decision not to immunize (Zimmerman et al., 2005). This shows that parents' decision process is affected by the information on the internet.

This review included the possible effect of the non-health professionals as source of information on the decision against vaccination. A large-scale Internet experiment demonstrated that anti-vaccination information on the Internet has a particular impact on the perceived risk of vaccinating. Participants were randomly assigned to real Internet sites, either a Swiss vaccine-critical or a neutral control site. The effect of vaccine-criticism was examined by assessing the perceived risks of vaccinating and not vaccinating as well as vaccination intentions before and after the information search. The results of this study revealed that even a short viewing on vaccine critical websites for only five to 10 minutes increases the perception of risk regarding vaccinations. After viewing the vaccine-critical site, risks of vaccinating were perceived to be greater than before, while significantly decreased the intentions to vaccinate (Betsch et al, 2010)

Some potentially significant findings of the present study relate to the comparison of sources of information which are most commonly used, and that are considered to be most influential by parents. To successfully deliver public health messages to the general public, it is necessary to understand how people get their information on vaccines and vaccination. In majority of the studies, the most important source of information was health professionals. Moreover, parents who were more likely to report health professional as source of vaccination showed a positive influential in the decision to immunize their children. In order to assure appropriate information to the general public, it is crucial to ensure that the nurses, doctors as well the future health professionals delivering the vaccination program are provided with reliable and comprehensive information on all elements of the program.

5.0 Conclusion and recommendation

A variety of sources provide vaccination information, and parents have many options regarding where to seek it. Overall, among several sources of vaccination information, the most common source of information reported by parents is health professionals. Moreover, health professional as source of information showed a positive influential in the decision to immunize their children. Nevertheless, non-health professionals as source of information used by parents showed a negative influential in the decision not to immunize their children. This study indicate that different groups of parents seek and trust information from a variety of available sources, which may positively or negatively influence parents decision in immunizing their children. Those who design public health efforts to provide evidence-based information must recognize that different strategies may be required to reach some groups of parents who are currently using other information sources.

It is clear that to make an informed decision about vaccination, parents should have access to balanced information. However, with the media reporting of dramatic scare stories this balance can be distorted, resulting in an increase in misleading information and myths. It is the responsibility of the health care professionals to redress this imbalance. They need to use their knowledge and skills to interpret the evidence for parents, dispel the myths and eliminate their concern on child vaccination.

Declaration of conflict of interest

We, the authors of the article declare that there is no conflict of interest regarding publication of this article.

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