Understanding Vaccine Hesitancy in Canada: Results of a Consultation Study by the Canadian Immunization Research Network

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Abstract

“Vaccine hesitancy” is a concept now frequently used in vaccination discourse. The increased popularity of this concept in both academic and public health circles is challenging previously held perspectives that individual vaccination attitudes and behaviours are a simple dichotomy of accept or reject. A consultation study was designed to assess the opinions of experts and health professionals concerning the definition, scope, and causes of vaccine hesitancy in Canada. We sent online surveys to two panels (1- vaccination experts and 2- front-line vaccine providers). Two questionnaires were completed by each panel, with data from the first questionnaire informing the development of questions for the second. Our participants defined vaccine hesitancy as an attitude (doubts, concerns) as well as a
behaviour (refusing some / many vaccines, delaying vaccination). Our findings also indicate that both vaccine experts and front-line vaccine providers have the perception that vaccine rates have been declining and consider vaccine hesitancy an important issue to address in Canada. Diffusion of negative information online and lack of knowledge about vaccines were identified as the key causes of vaccine hesitancy by the participants. A common understanding of vaccine hesitancy among researchers, public health experts, policymakers and health care providers will better guide interventions that can more effectively address vaccine hesitancy within Canada.

Introduction

Vaccination is widely considered to be one of the greatest achievements of public health [1]. Vaccination programs have contributed substantially to the decline in mortality and morbidity of infectious diseases of major public health significance [2]. To be successful in reducing the prevalence and incidence of vaccine-preventable diseases, vaccination programs rely on high and sustained vaccine uptake [3–5]. In addition to direct protection for vaccinated individuals, high vaccine coverage induces indirect protection for the overall community through the creation of herd immunity [6]. Childhood vaccination, moreover, is a specific public health priority because children are particularly vulnerable to infectious diseases. Despite the relatively high rate childhood vaccine coverage in Canada [7, 8], there are reasons to be concerned that vaccination programs might be losing public confidence [9, 10]. Recent outbreaks of vaccine-preventable diseases in North America and Europe have been linked to under-vaccinated or non-vaccinated communities, demonstrating the dramatic consequences of a decline in vaccine coverage [11]. For instance, in 2015, a large measles outbreak started by an unvaccinated traveler visiting Disneyland and spread to more than 20 US states, Mexico, and Canada [12].

“Vaccine hesitancy” is a concept now frequently used in vaccination discourse [13]. The increased popularity of this concept in both academic and public health circles is challenging previously held perspectives that individual vaccination attitudes and behaviours are a simple dichotomy of accept or reject. Rather, vaccine hesitancy, is defined, as a continuum of vaccine beliefs and associated behaviours ranging from complete refusal of all vaccines to complete vaccine acceptance [14, 15]. Vaccine-hesitant individuals are a heterogeneous group within this continuum [16, 17]. They may refuse some vaccines, but agree to others; they may delay or accept vaccines according to the recommended schedule but feel unsure about the “correctness” of their decision relative to their child’s health [17–19]. The World Health Organization (WHO) Strategic Advisory Group of Experts (SAGE) Working Group on Vaccine Hesitancy defined vaccine hesitancy as a “delay in acceptance or refusal of vaccines despite availability of vaccine services” [20]. According to SAGE, the scope of vaccine hesitancy includes instances where “vaccine acceptance in a specific setting is lower than would be expected, given the availability of vaccination services. Vaccine hesitancy is complex and multi-dimensional; it varies across time, place and vaccines” [20].

The WHO definition is focused on a binary behavioral outcome (e.g. vaccination or non-vaccination) in contrast to definitions usually used in the literature which also include attitudes or beliefs (e.g. vaccination despite important doubts and concerns). Our research group identified a need for a common definition of vaccine hesitancy among researchers, public health experts, policymakers and health care providers to advance our theoretical understanding of the phenomenon and to better guide interventions that can more effectively address vaccine hesitancy within Canada [21].
In this context, the current study was designed to assess the opinions of researchers, public health experts, policy decision-makers and healthcare providers concerning the definition, scope, and causes of vaccine hesitancy in Canada.

**Materials and Methods**

Our study used two rounds of stakeholder questionnaires in an approach based on the Delphi method, which is well suited for consensus-building [22, 23]. We sent online surveys (hosted by SimpleSurvey) (Saint-Jean-sur-Richelieu, Québec (QC)) to two stakeholder groups (hereafter named panels): 1) health professionals, researchers, experts and policy-makers who were members of the Canadian Association for Immunization Research and Evaluation (CAIRE) and of the Canadian Immunization Research Network (CIRN); and 2) front-line vaccine providers (nurses and physicians). Eligible participants (members of the research team were excluded) were invited to complete both questionnaires and two reminders were sent for the first and the second questionnaire. The research ethics committee at the Centre de recherche du CHU de Québec–Université Laval approved the study proposal.

**Study participants and recruitment**

The panels were constructed using a purposive sampling technique in a two-step procedure. After obtaining the approval of the Canadian Immunization Research Network (CIRN) management committee and the Canadian Association for Immunization Research and Evaluation (CAIRE) administrators, the principal investigator (ED) sent a study invitation to both CIRN and CAIRE to distribute to all members inviting them to participate. CIRN[24] and CAIRE [25] are non-mutually exclusive pan-Canadian networks including, respectively, approximately 100 and 300 members with diverse occupations (policymakers, experts/scientists/researchers, health professionals) all involved in vaccination research, evaluation or decision-making, and sometimes vaccine administration. Within the two rounds of data collection from CIRN and CAIRE members (hereafter named "research networks members"), we identified a dearth of responses from front-line vaccine providers. To remedy to this, team members identified 10 to 12 experienced vaccine providers within their 5 respective provinces to be invited to participate. The data collection process for this second panel was similar to the first. However, we adapted the questionnaire to include a section regarding one-on-one counseling with vaccine-hesitant patients (e.g. How do you counsel patients who have doubts and concerns regarding vaccines? Are you reluctant to disclose information on risks of vaccination because of patients’ concerns and doubts?) and trust in research findings from different funding sources (e.g. government, industry).

**Data collection**

Data were collected via questionnaires from each panel of participants (detail available in S1 Table). Questionnaires were available in French and in English. The questionnaire was first developed in English and then translated in French by the research team. A pre-test was made (for the first questionnaire) with both English and French-speaking participants. The final versions were revised to make sure they were identical. Two questionnaires were completed by each of the panels, ~ a month apart, with data from the first questionnaire informing the development of questions for the second. All potential participants were invited to respond to both questionnaires. The first questionnaire contained 15 open-ended questions to explore participants’ understanding of vaccine hesitancy and their views and perspectives about the causes and consequences of vaccine hesitancy. The questionnaire was developed on the basis of a previous study of the determinants of vaccine hesitancy conducted with vaccination programs.
managers from 13 countries [26]. The second questionnaire contained 16 closed-ended questions which asked participants to indicate their level of agreement, scored using a 10-point Likert scale, with statements about vaccine hesitancy that were derived from the first questionnaire. Participants were invited to provide additional comments in 3 open-text boxes in each section of the questionnaire. Both questionnaires also contained 5 questions to assess professional characteristics of the participants (region of practice, role in immunization, specialization, numbers of years of work in immunization, vaccine administration).

The e-mailed invitation included a description of the consultation’s purpose, the duration of the electronic survey (estimated to be less than 10 minutes), and a link to the online questionnaire.

Data analysis

Content analysis was conducted on the open-ended responses. Conceptual categories were created based upon the themes addressed in the questionnaire and were updated and revised until no new properties, dimensions or relationships emerged. A senior research professional trained in qualitative methods (DG) coded the data; a second researcher (ED) reviewed this work. Participants’ definitions of vaccine hesitancy are illustrated in a word cloud that was developed using NVivo 10 software (all words mentioned by participants were used except for short articles and pronouns).

Descriptive statistics were generated for all closed-ended responses. Wilcoxon test or Fisher’s exact test, as appropriate, were used to compare the characteristics of participants between the first and second questionnaire rounds and validation analysis was conducted to identify any statistically significant differences in participants’ responses according to the province of practice. Responses on the 10-item Likert scale were divided into 3 subcategories (items 1 to 4 as “disagree”; 5 to 7 as “uncertain”; and items 8 to 10 as “agree”). Chi-squared or Fisher’s exact tests, as appropriate, were used to compare these responses to the respondent characteristics. In the second questionnaire, participants ranked the three main causes of vaccine hesitancy from a list of 15 items taken from responses to the first questionnaire. A score was assigned to the three items identified by each respondent, ranging from 1 (third most important cause) to 3 (first most important cause). A score of 0 was assigned to all items not selected among the three most important causes of vaccine hesitancy by the respondent. Item scores were summed to obtain a total raw score and means were calculated to have a final ranking of all causes. All statistical analyses were performed using SAS version 9.2 (SAS Inc., Cary, N.C., USA). In all instances a P-value <0.05 was considered statistically significant.

Results

A total of 52 research networks members and 98 front-line vaccine providers completed the first questionnaire whereas 54 research networks members and 80 vaccine providers completed the second questionnaire. Professional and demographic characteristics of the participants in each round are presented in Table 1. Within each panel, there were no statistically significant differences in participants’ characteristics between the first and the second questionnaires.

Participants’ definition of vaccine hesitancy

In the first round of data collection, participants were asked how they would define “vaccine hesitancy”. The majority of participants defined vaccine hesitancy as a reluctance to receive (recommended) vaccinations, mainly due to concerns about safety and efficacy of vaccines. Others indicated that vaccine hesitancy was “having doubts” (some indicated unjustified doubts) with regards to vaccines.
In the second round, both stakeholder groups were invited to select their preferred definition among three choices provided: (a) the definition proposed by the WHO Strategic Advisory Group of Experts Working Group on Vaccine Hesitancy [20]; (b) a definition derived from highly cited studies on this topic [27, 28] and (c) a definition based on participants’ responses on the first questionnaire (Table 2). The third definition was preferred by the majority of participants in both panels.

Participants’ views regarding the impact of vaccine hesitancy on vaccination programs in Canada

In the first round, 91% (n = 41) of research networks members reported that vaccine hesitancy had an impact on vaccination programs in Canada. These participants reported that low vaccination coverage and vaccination delays and refusals leading to vaccine-preventable diseases outbreaks were the most common results, along with increased time needed to allay public fears about vaccines.

Vaccine coverage is suboptimal, and vaccine providers waste time dealing with this that they could be spending on more productive things. (Research networks member, Ontario)

Many research networks members also noted that the impact of hesitancy on vaccination programs is hard to quantify due to the lack of routinely collected vaccination data in many provinces.

| Table 1. Demographics of participants in each questionnaire.* |
|-------------------------------------------------------------|
| **Region of practice**                                       |
| Atlantic (New Brunswick, Nova Scotia, Newfoundland and Labrador, PEI) | n (n = 52) | n (n = 54) | p-value | n (n = 98) | n (n = 80) | p-value |
| 3 (7) | 9 (17) | 7 (7) | 6 (8) |
| 5 (12) | 12 (23) | 11 (11) | 12 (15) |
| 15 (37) | 16 (31) | 0.27 | 1 (1) | 1 (1) | 0.74 |
| 13 (32) | 12 (23) | 8 (8) | 3 (4) |
| 5 (12) | 3 (6) | 71 (72) | 57 (72) |
| **Vaccination practices**                                   |
| I administer vaccines myself | 13 (32) | 21 (42) | 0.39 | 94 (98) | 79 (100) | 0.50 |
| **Primary specialization**                                  |
| Epidemiologist | 8 (19) | 6 (11) |
| Nurse | 2 (5) | 3 (6) |
| Physician (family physician or paediatrician) | 21 (51) | 28 (54) | 0.28 | 87 (89) | 72 (91) | 0.42 |
| Program manager / administrator | 5 (12) | 2 (4) |
| Other | 5 (12) | 13 (25) | 3 (3) | 0 |
| **Number of years of work in immunization**                 |
| < 10 years | 14 (35) | 20 (38) | 31 (32) | 29 (37) |
| 10 to < 20 years | 13 (32) | 11 (21) | 0.67 | 37 (38) | 28 (35) | 0.83 |
| ≥ 20 years | 12 (30) | 19 (36) | 29 (30) | 22 (28) |
| Don’t work in immunization | 1 (2) | 2 (4) |

*Missing answers for 11 research networks members in the first round and 1 vaccine provider in the second round

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On-time immunization rates are almost certainly below what they were 10 years ago but with no vaccine registry, how are we to know? Vaccine hesitancy requires much more time from those who give vaccines to explain everything to parents. (Research networks member, Prairies)

In the first round of data collection, 87% (n = 85) of front-line vaccine providers reported that vaccine hesitancy resulted in increased time spent discussing vaccination issues with concerned patients. Extra appointments were needed to accommodate patients who wanted to spread out the vaccines over multiple visits.

More time needs to be taken with hesitant parents to provide information and education. No shows, cancellations and extra appointments for altered vaccine schedules affect workload and scheduling. Time spent following up with phone calls, letters, etc. to hesitant parents. Time spent trying to contact and offer immunization to those not immunized when doing a vaccine preventable disease follow-up. (Vaccine provider, Atlantic)

In the second round, 57% of research networks members and 75% of front-line vaccine providers agreed that vaccine hesitancy is a significant problem in Canada, and 76% of research networks members and 87% of vaccine providers agreed that it is contributing to sub-optimal vaccination coverage rates in Canada. The majority of research networks members (66%) and vaccine providers (78%) agreed that it is crucial to address this issue.

The second questionnaire asked the extent to which participants considered that vaccine hesitancy focused on specific vaccines. Measles-containing vaccines, newly introduced vaccines, influenza vaccines, and human papilloma virus (HPV) vaccines were deemed to contribute most to vaccine hesitancy by both groups of participants.

Table 2. Participants’ preferred definition of vaccine hesitancy.

| Definitions of vaccine hesitancy | Preferred definition | Research networks members n (%) | Vaccine Providers n (%) |
|----------------------------------|----------------------|---------------------------------|------------------------|
| A) SAGE Working Group on Vaccine Hesitancy: Vaccine hesitancy refers to delay in acceptance or refusal of vaccine despite availability of vaccination services. Vaccine hesitancy is complex and context specific, varying across time, place and vaccines. It is influenced by factors such as complacency, convenience and confidence. | 14 (28) | 20 (27) |
| B) Definition derived from highly cited studies: Vaccine attitudes can be seen on a continuum, ranging from total acceptance to complete refusal. Vaccine-hesitant individuals are a heterogeneous group in the middle of this continuum. Vaccine-hesitant individuals may refuse some vaccines, but agree to others; delay vaccines or accept vaccines but are unsure in doing so. | 14 (28) | 12 (16) |
| C) Definition based on answers to the first round: Vaccine hesitancy refers to reluctance to receive recommended vaccination because of concerns and doubts about vaccines that may or may not lead to delayed vaccination or refusal of one, many or all vaccines. | 22 (44) | 41 (56) |

Two missing answers from research networks members and 9 for vaccine providers.

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Causes of vaccine hesitancy in Canada

In the first questionnaire, both panels of participants were asked about the main causes of vaccine hesitancy in Canada. The most frequently mentioned causes were misinformation or lack of knowledge and mistrust and fears around vaccination.

Misinformation about links between diseases, safety and immunizations. Educated, intelligent people who no longer take physician recommendations at face value and wish to research the recommendations on their own. (Research networks member, Ontario)

People not knowing the risks of disease, not seeing these diseases or burden of disease in their lifetime. (Vaccine-provider, Atlantic)

Some participants also mentioned that vaccine hesitancy is complex and that there are multiple causes.

There are many causes and these may differ by individual. Some may have fear, some may be political "conspiracy theories", some may be true or perceived prior adverse events, some lack of knowledge, some beliefs "religious or other". There is no one issue so there is no one answer or response.” (Research networks member, Atlantic)

In the second round of data collection, participants were asked to identify what they consider to be the main causes of vaccine hesitancy from a list of causes generated from responses to the first questionnaire (mean scores on the 10-point Likert scale are shown in Table 3). Participants were also asked to rank the three main causes of vaccine hesitancy. For both groups of participants, the diffusion of negative information on vaccination in Internet and social media

### Table 3. Causes of vaccine hesitancy in Canada.

|                                | Research networks members | Vaccine providers |
|--------------------------------|---------------------------|-------------------|
|                                | n  | Mean Score* | n  | Mean Score* |
| Lack of confidence in vaccines’ safety | 53† | 7.6† | 79  | 8.5 |
| Lack of confidence in vaccines’ effectiveness | 79  | 6.8 |
| Mistrust of the pharmaceutical industry | 54  | 7.9 | 80  | 8.3 |
| Mistrust of conventional medicine | 54  | 5.9 | 80  | 6.4 |
| Mistrust of the medical establishment | 50  | 5.8 | 79  | 6 |
| Diffusion of negative information on vaccination in Internet and social media | 54  | 8.5 | 79  | 9.2 |
| Preference for other mode of prevention | 53  | 6.3 | 80  | 7.1 |
| Lack of knowledge about vaccination, misinformation | 54  | 8.4 | 79  | 8.7 |
| Anti-vaccine movement and anti-vaccine lobby | 54  | 7.7 | 77  | 8.3 |
| Complacency | 52  | 8   | 79  | 7.7 |
| Lack of convenience | 54  | 5.1 | 80  | 3.7 |
| Issues related to vaccination policies and programs | 54  | 5.8 | 80  | 5.6 |
| Poor communication on vaccination by public health authorities | 54  | 6  | 80  | 5.5 |
| Religious beliefs against vaccination | 54  | 5.1 | 80  | 4.5 |
| Fear of needles and fear of pain |  -  | -   | 80  | 5 |

*Mean score on the 10-point Likert scale ranging from 1 = unimportant cause to 10 = very important cause
†Research networks members were asked one item: “Lack of confidence in vaccines”. 

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followed by lack of knowledge about vaccination received the highest mean ranks. For research networks members and vaccine provider participants, respectively, mistrust in the pharmaceutical industry and a lack of confidence in vaccine safety, were the third most important cause of vaccine hesitancy.

Counseling vaccine-hesitant patients

Front-line vaccine providers were asked to answer specific questions regarding how they deal with vaccine hesitancy in their practice. In the first round of data collection, the majority of vaccine providers emphasized that they listen, try to understand the concerns of, and educate vaccine-hesitant patients about vaccines.

Reassure and listen. I answer parents’ questions and I’m honest and open to keep a trusting relation with parents. (Vaccine provider, Quebec)

Listen to the parent/client first to find out what their hesitancy is. Build a rapport. The reasons can vary greatly. . . Determine from this contact what the barriers are . . . it maybe misinformation and then can provide counsel along with written documentation. (Vaccine provider, Prairies)

The majority of vaccine providers (88%, n = 94) did not hesitate to disclose information on vaccination risks because of patients concerns and doubts. Most vaccine providers considered that it was their responsibility to ensure that patients understand the risks of both vaccines and of non-vaccination and that patients need to have all the facts to make an informed decision.

I feel confident in disclosing what the risks are and do so to everyone that I immunize. (Vaccine provider, Prairies)

I think it is better to fully inform people of all benefits and potential risks. I believe leaving out selective information would not only be unethical but could lead to a climate of distrust of health care providers and feed the irrational fears and beliefs that some people already have. (Vaccine provider, Atlantic)

In the second round, vaccine providers were asked about their level of agreement with the best practices in counselling vaccine-hesitant patients. The preferred approaches were to listen to concerns, to be non-judgemental and to correct misinformation (Table 4).

In the second round, vaccine providers were asked about their level of confidence in dealing with vaccine-hesitant patients. Sixty-nine percent (69%) said they were comfortable dealing with vaccine-hesitant patients and 64% felt capable of counselling them. The majority of

| Table 4. Vaccine providers’ level of agreement with statements about the best ways to counsel vaccine-hesitant patients. |
|---------------------------------------------------------------|
| **Disagree** | **Somewhat Agree** | **Agree** |
| **(1 to 4)** | **(5 to 7)** | **(8 to 10)** |
| % | % | % |
| Listen to the patients’ concerns, show reassurance, act and talk in a non judgmental way (n = 79) | 0 | 4 | 96 |
| Correct misinformation / provide most accurate information about vaccines (n = 79) | 1 | 11 | 88 |
| Remind of the benefits of vaccination and point out the risk of not immunizing (n = 79) | 1 | 27 | 72 |
| Give fact sheets and other resources about vaccination (e.g. websites, books) (n = 79) | 4 | 32 | 64 |
| Accommodate patients’ requests (e.g. alternative schedule, vaccine refusal) (n = 79) | 4 | 33 | 63 |
| Provide personal examples (own vaccination / examples of vaccine-preventable diseases in practice) (n = 78) | 17 | 36 | 47 |
| Refer patient to other providers or schedule another appointment to discuss vaccination concerns (n = 78) | 26 | 33 | 41 |

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vaccine providers considered themselves to be well-prepared to provide information about risks and benefits, but fewer considered themselves well-prepared to discuss their patients’ values, priorities and goals, or the link between values and vaccination decisions (Table 5).

Finally, vaccine-providers were asked about their level of trust in vaccine research funded by different research funding sources. Vaccine research funded by the government and by academic institutions was more highly trusted than industry funded research (Table 6).

**Discussion**

The aim of this study was to identify the views of Canadian vaccination experts and health professionals concerning the definition, scope, causes, and consequences of vaccine hesitancy in Canada. Our participants defined vaccine hesitancy as an attitude (doubts, concerns) as well as a behaviour (refusing some / many vaccines, delaying vaccination). Although both definitions are similar, this definition could be seen as broader than the definition adopted by the SAGE Working Group on Vaccine Hesitancy, which recognized vaccine hesitancy to be vaccination behaviour per se (delay in acceptance or refusal of vaccines). While the WHO definition refers to behavior, it also acknowledges that factors such as complacency, confidence and convenience can lead to vaccine hesitancy and these factors include beliefs, perceptions, attitudes and knowledge. The explicit recognition that attitudes and beliefs play an important role in influencing behaviour suggests aspects that could be addressed by public health interventions. For example, people who are “on the fence” in their attitudes and beliefs are an important

| Table 5. Vaccine providers’ perceived preparedness in dealing with vaccine-hesitant patients (n = 79). |
|--------------------------------------------------|------------------|------------------|
| How prepared are you to effectively provide information about risks and benefits of vaccination | Not at all prepared | Somewhat Prepared | Very prepared |
| % | % | % |
| 2 | 11 | 87 |
| How prepared are you to effectively discuss patient/family values, priorities and goals. | 8 | 24 | 68 |
| How prepared are you to effectively help patient/family understand the link between their values, priorities and goals and vaccinating/not vaccination (e.g., “I understand that it’s important to you to give your children the best possible chances of being healthy. Here is how that fits with vaccinating. . .”) | 9 | 21 | 70 |

This question was based on a 5-point Likert-scale ranging from “Not at all prepared” to “Very prepared”.

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| Table 6. Vaccine providers’ level of trust in vaccine research based upon research funding sources (%) |
|--------------------------------------------------|------------------|------------------|
| I trust findings when the research is funded by the government (Public Health Agency of Canada, provincial and territorial governments, etc.) (n = 98) | Disagree | Somewhat Agree | Agree |
| % | % | % |
| 0 | 10 | 90 |
| I trust findings when the research is funded by the private sector (pharmaceutical industries) (n = 96) | 28 | 46 | 26 |
| I trust findings when the research is funded by academic institutions (Canadian Institute of Health Research, Universities) (n = 96) | 1 | 10 | 89 |
| I trust findings when the research is funded by academic institutions in partnership with the private sector (pharmaceutical industries) (n = 96) | 15 | 35 | 50 |

|            | Disagree | Somewhat Agree | Agree |
|------------|----------|----------------|-------|
|            | (1 to 4) | (5 to 7)       | (8 to 10) |
|            | %        | %              | %     |
|            |          |                |       |

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group for which public health interventions are needed, because they are “at risk” of stopping vaccinating and may be more open to public health advice than the outright refusers [29, 30].

Our findings indicate that the majority of participants—both vaccine experts and front-line vaccine providers—have the perception that vaccine rates have been declining and consider vaccine hesitancy an important issue to address in Canada. In the absence of a pan-Canadian immunization registry linked with validated and standardized measures of vaccine hesitancy, we lack hard evidence to support an increase in the prevalence of vaccine hesitancy and its impact on vaccine uptake rates. However, a recent Ontarian study looked at trends in medical and nonmedical immunization exemptions to measles-containing vaccines over a decade. The authors found that the overall percentage of students with any exemption classification remained low between 2002/03 to 2012/13 (<2.5%). However, religious or conscientious exemptions significantly increased during the study period whereas medical exemptions significantly decreased for both 7- and 17 years old students [31]. Others studies conducted in the United States have also found hard evidence of an increase in nonmedical exemptions [32–34]. Furthermore, suboptimal vaccine uptake rates in Canada can be explained by barriers to vaccination in terms of ease of access to vaccination services. Indeed, at the population level, identifying, measuring and monitoring the proportion of individuals who are vaccine-hesitant but who still follow the recommended schedule is not a simple task. If vaccine hesitancy encompasses a heterogeneous group of individuals with diverse attitudes and behaviours, as we suggest, then operationalizing this concept will be challenging [35]. The concept of vaccine hesitancy has been criticized as being an “ambiguous notion with an uncertain theoretical background” [36]. As pointed out by Peretti-Watel and collaborators, the heterogeneity in the conceptualization is problematic. Two groups of people—those who are “uncertain but very interested and committed in vaccination issues are prone to information seeking and long and balanced decision-making”, and those who have “no definite opinion, little knowledge and little interest about vaccination issues and who randomly forget or delay some vaccines”—could both be considered vaccine-hesitant, while showing very different attitudinal and behavioural patterns [36]. Indeed, more effort is needed to improve the ability to measure and assess vaccine hesitancy at the population level. Because research has mainly focused on the metrics of vaccine uptake (coverage rates, delays, refusals), the degree to which vaccine hesitancy influences vaccination behaviours remains an important, though complex, domain for investigation [13]. There is an urgent need to develop good techniques to identify and monitor patterns of both “attitudinal” and “behavioural” vaccine hesitancy in individuals and populations, and over time [37]. The consensus for most questions found in the current study suggests a common conceptualization and could serve as a basis for the development of such techniques.

Our findings also illustrate common opinions among vaccine experts and stakeholders regarding the main causes of vaccine hesitancy in Canada. Negative and false information about vaccination online and in social media was perceived to be the most important cause of vaccine hesitancy by participants. Indeed, many studies have suggested that the ubiquity of anti-vaccination content on the Internet contributes to the increase in vaccine hesitancy [9, 38–43]. Most studies that have examined vaccination-related content on websites or social media platforms have shown that the quality of information is highly variable with a substantial volume of negative and inaccurate information [42, 44–50]. Despite the potential impact of the Internet on vaccine hesitancy, limited information is available about parental use of online vaccination information and its influence on their level of vaccine hesitancy and their decision-making regarding childhood vaccination [39, 51, 52]. Most studies are descriptive, and though many attribute the increase in vaccine hesitancy to negative vaccination-related content on the Internet, they offer limited empirical evidence to support these claims [39, 42, 44, 53]. The emergence of social media as a source of online health information concomitant with
decreasing trust in vaccination signals a critical need to understand better the role of social media in vaccine hesitancy. Further, social media role in vaccine hesitancy creates a need to develop appropriate strategies for online communication; such strategies should aim to provide vaccine-supportive information, to address misinformation published online, and to correspond to parents’ needs and interests [45]. The perceived link between the sources of vaccine research (e.g., government versus industry) funding and trust or mistrust in vaccine information requires further research, especially in light of our participants’ own concerns regarding research funded by the industry.

According to participants, misinformation or lack of knowledge about vaccines are other important causes of vaccine hesitancy. Indeed, lack or inadequate knowledge is frequently raised by public health professionals who are dealing with vaccine-hesitant populations [54, 55]. Recent educational interventions to correct ‘misinformation’ about vaccines, however, were largely ineffective to reduce vaccine hesitancy and, even worst, contribute to augment negative attitudes in the most vaccine-hesitant participants [56, 57]. The “knowledge-deficit” assumption can lead to labelling parents with vaccination doubts as innumerate, irrational, emotional, or easily manipulated by anti-vaccination groups. This rationalist approach implies that decision-making about vaccination can be improved by “correcting” emotional, cognitive and social distortions or biases affecting judgement and that external influences, such as those triggered by media, can be offset [54, 58, 59]. Many studies, however, have shown that vaccine decision-making is complex and that knowledge is only one of the many determinants of vaccination decisions [35, 54, 60]. While vaccine hesitancy exists in all strataums of the population, it is often associated to highly-educated parents. Studies conducted in different settings have shown that non-compliant parents appear to be well-informed individuals who have considerable interest in health-related issues and actively seek information [61–63].

As our study has shown, most Canadian vaccine providers support listening to the concerns of vaccine-hesitant patients, reassuring them in a nonjudgmental way, and providing accurate information on vaccination [64, 65]. This is in contrast with the recent call for a “gloves off” approach by public health authorities in the midst of the 2015 measles outbreak [66]. Research shows the majority of patients see health care professionals as the most trusted source of information on vaccination [67, 68], and many tools and tips exist to help providers in their discussions with vaccine-hesitant or vaccine-refusing patients [69–72]. While approaches vary, they share common characteristics, such as the importance of maintaining a trustworthy patient-provider relationship, as well as tailoring communication to patients’ specific concerns and doubts. Three studies assessed the effects of partial or full patient decision aids, which are tools intended to complement discussions with health care professionals and to facilitate informed and values-congruent decisions. Few have shown measurable results [25, 73–75]. Clearly, our results showed providers recognized the common characteristics found in these approaches; however the lack of results from studied approaches indicates more research may be needed to identify and implement effective ways to support health care providers’ communication with vaccine-hesitant patients [64, 76].

The data from our study should be interpreted with some caveats. First, by design the results reported here represent the opinions of only some non-randomly selected key opinion leaders. The results of this study were not intended to be representative of all vaccination experts, health professionals and front-line vaccine providers in Canada. Moreover, the voluntary participant sample targeting individuals with vaccine expertise or front-line vaccine delivery experience resulted in selection bias towards individuals with high interest in the topic of vaccine hesitancy. In addition, studies have shown that front-line vaccine providers may themselves be vaccine-hesitant, thus unlikely to strongly recommend vaccines [77, 78]. We did not include specific questions vaccine providers’ own level of vaccine hesitancy and it is probable that
participants in our study held pro-vaccine attitudes. However, one third of vaccine-providers who participate in our study felt uncomfortable dealing with vaccine-hesitant patients and inadequately prepared to counsel them. Further studies will be needed to better understand vaccine hesitancy among front-line vaccine providers. Moreover, despite having been invited, no key opinion leaders from the Northern territories participated in the study. Because we have adapted our questionnaire for the recruitment of vaccine providers, we were not able to regroup for analysis the responses of vaccine providers of both panels. Despite these caveats, our study has generated rich findings on the opinions of key stakeholders regarding the scope and impact of vaccine hesitancy in Canada. Because vaccine hesitancy is a relatively new research topic, the use of many open-ended questions allowed us to obtain the opinions of participants without biasing the responses based on the research team’s assumptions. The fact that all data were collected anonymously should also have minimized social desirability bias.

To conclude, this study has shown that vaccine hesitancy is a concern for Canadian vaccination experts and health professionals. In the context of declining trust in science and state institutions [79, 80] and increasing consumerist orientation to healthcare [81, 82], more and more people wish to be—and, indeed, are encouraged to be—engaged in health decisions and to feel empowered to do so [83–87], regardless of whether their sources of information are perceived by experts as lacking credibility. It is important for health professionals to recognize the impact of the broader social landscape that "gives shape to ideas and ideals" about health, prevention and what a good citizen does about vaccination [88].

Supporting Information

S1 Author List. Author List.  
(PDF)

S1 Table. Questions asked during the First questionnaire and Second questionnaire.  
(PDF)

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Author Contributions

Conceived and designed the experiments: ED DG JAB MG SH KW J. Graham HOW S. MacDonald WF LM DT AG J. Guichon VS JMH S. Meyer SMD JG HM. Performed the experiments: ED DG. Analyzed the data: ED DG MO JAB MG SH KW J. Graham HOW S. MacDonald WF LM DT AG J. Guichon VS JMH S. Meyer SMD JG HM. Contributed reagents/materials/analysis tools: ED DG MO JAB MG SH KW J. Graham HOW S. MacDonald WF LM DT AG J. Guichon VS JMH S. Meyer SMD JG HM. Wrote the paper: ED DG MO JAB MG SH KW J. Graham HOW S. MacDonald WF LM DT AG J. Guichon VS JMH S. Meyer SMD JG HM.

References

1. Centers for Diseases Control and Prevention. Ten great public health achievements—worldwide, 2001–2010. MMWR Morb Mortal Wkly Rep. 2011; 60(24): 814–8. PMID: 21697806
2. National Advisory Committee on Immunization. Canadian Immunization Guide. 7th ed. Ottawa: Public Health Agency of Canada; 2006, p. 410.

3. Ministère de la Santé et des Services sociaux. Programme national de santé publique 2003–2012. In: Gouvernement du Québec, (ed.). Québec: Direction de la communication, ministère de la Santé et des Services sociaux; 2003, p. 133.

4. Basrur S, Stuart AJ. Rubella Outbreak in Southern Ontario. 2005. Available:http://www.health.gov.on.ca/en/pro/programs/emb/health_notices/ihn_050305.pdf

5. Watanabe M, Nagai M. Acellular pertussis vaccines in Japan: past, present and future. Expert Rev Vaccines. 2005; 4(2): 173–84. PMID: 15889991

6. Fine P, Eames K, Heymann DL. "Herd immunity": a rough guide. Clin Infect Dis. 2011; 52(7): 911–6. doi: 10.1093/cid/cir007 PMID: 21427399

7. Laroche J, Frescura A-M, Belzac L. Results from the 2006 and 2009 Childhood National Immunization Coverage Surveys. 9th Canadian Immunization Conference. Québec, CanadaDecember 5–8, 2010.

8. Smith M, Church E. Canada's high vaccination rates still need improvement, study finds The Globe and Mail. 2015;Tuesday Jul. 21.

9. Cooper L, Larson H, Katz S. Protecting public trust in immunization. Pediatrics. 2008; 122(1): 149–53. doi: 10.1542/peds.2008-0987 PMID: 18595998

10. Dubé E, Vivion M, MacDonald NE. Vaccine hesitancy, vaccine refusal and the anti-vaccine movement: influence, impact and implications. Expert Rev Vaccines. 2014; 14(1): 99–117. doi: 10.1586/14760584.2015.964212 PMID: 25373435

11. Siddiqui M, Salmon DA, Omer SB. Epidemiology of vaccine hesitancy in the United States. Hum Vaccin Immunother. 2013; 9(12): 2643–8. doi: 10.4161/hv.27243 PMID: 24247148

12. Zipprich J, Winter K, Hacker J, Xia D, Watt J, Harriman K. Measles outbreak—California, December 2014—February 2015. MMWR Morb Mortal Wkly Rep. 2015; 64(16): 153–4. PMID: 25695321

13. Eskola J, Duclos P, Schuster M, MacDonald NE. How to deal with vaccine hesitancy? Vaccine. 2015; 33(34): 4215–7. doi: 10.1016/j.vaccine.2015.04.043 PMID: 25896378

14. Remes O, Smith LM, Alvarado-Llano BE, Colley L, Levesque LE. Individual- and regional-level determinants of human papillomavirus (HPV) vaccine refusal: the Ontario Grade 8 HPV vaccine cohort study. BMC Public Health. 2014; 14(1047).

15. National Vaccine Advisory Committee. Assessing the state of vaccine confidence in the United States: recommendations from the National Vaccine Advisory Committee. Draft Report Version 2. 2015. Available: http://www.hhs.gov/nvpo/nvac/meetings/pastmeetings/2015/vaccineconfidencereport2015.pdf.

16. Lantos J, Jackson M, Opel DJ, Marcuse E, Myers AL, Connelly B. Controversies in Vaccine Mandates. Curr Probl Pediatr Adolesc Health Care. 2010; 40(3): 38–58. doi: 10.1016/j.cppeds.2010.01.003 PMID: 20230978

17. Benin A, Wisler-Scher D, Colson E, Shapiro E, Holmboe E. Qualitative Analysis of Mothers’ Decision-Making about Vaccines for Infants: The Importance of Trust. Pediatrics. 2006; 117(5): 1532–41. PMID: 16651306

18. Gust D, Darling N, Kennedy A, Schwartz B. Parents with Doubts About Vaccines: Which Vaccines and Reasons Why. Pediatrics. 2008; 122(4): 718–25. doi: 10.1542/peds.2007-0538 PMID: 18829793

19. Dube E, Laberge C, Guay M, Bramadat P, Roy R, Bettinger J. Vaccine Hesitancy—An Overview. Hum Vaccin Immunother. 2013; 9(8): 1–11.

20. MacDonald NE. Vaccine hesitancy: definition, scope and determinants. Vaccine. 2015; 33(34): 4161–4. doi: 10.1016/j.vaccine.2015.04.036 PMID: 25896383

21. Francis J. Designing theoretically-informed implementation interventions. The Improved Clinical Effectiveness through Behavioural Research Group (ICEBeRG). Implement Sci. 2006; 1(4): 1–8.

22. Hsu CC, Sandford BA. The Delphi Technique: Making Sense of Consensus. Practical Assessment, Research & Evaluation. 2007; 12(10): 1–8.

23. Adler M, Ziglio E. The Delphi Method and its Application to Social Policy and Public Health. London: Jessica Kingsley Publishers; 1996; p. 252.

24. Quadri-Sheriff M, Hendrix K, Downs S, Sturm L, Zimet GD, Finnell M. The role of herd immunity in parents’ decision to vaccinate children: a systematic review. Pediatrics. 2012; 130: 522–31. doi: 10.1542/peds.2012-0146 PMID: 22926181

25. Shouieb S, Jackson C, Cheater FM, Bekker HL, Edlin R, Tubeuf S, et al. A cluster randomised controlled trial of a web based decision aid to support parents’ decisions about their child’s Measles Mumps and Rubella (MMR) vaccination. Vaccine. 2013; 31(50): 6003–10. doi: 10.1016/j.vaccine.2013.10.025 PMID: 24148574
26. Dubé E, Gagnon D, Nickels E, Jeram S, Schuster M. Mapping vaccine hesitancy: Country specific characteristics of a global phenomenon. Vaccine. 2014; 32(40): 6649–54.

27. Benin AL, Wislier-Scher DJ, Colson E, Shapiro ED, Holmboe ES. Qualitative analysis of mothers’ decision-making about vaccines for infants: the importance of trust. Pediatrics. 2006; 117(5): 1532–41. PMID: 16651306

28. Opel DJ, Taylor JA, Mangione-Smith R, Solomon C, Zhao C, Catz S, et al. Validity and reliability of a survey to identify vaccine-hesitant parents. Vaccine. 2011; 29(38): 6598–605. doi:10.1016/j.vaccine.2011.06.115 PMID: 21763384

29. Leask J. Target the fence-sitters. Nature. 2011; 473(7348): 443–5. doi:10.1038/473443a PMID: 21614055

30. Betsch C, Bohm R, Chapman GB. Using Behavioral Insights to Increase Vaccination Policy Effectiveness. Policy Insights Behav Brain Sci 2015; 2(1): 61–73.

31. Wilson SE, Seo CY, Lim GH, Fediurek J, Crowcroft NS, Deeks SL. Trends in medical and nonmedical immunization exemptions to measles-containing vaccine in Ontario: an annual cross-sectional assessment of students from school years 2002/03 to 2012/13. CMAJ Open. 2015; 3(3): E317–23. doi: 10.9778/cmajo.20140088 PMID: 23664998

32. Richards JL, Wagenaar BH, Van Otterloo J, Gondalia R, Atwell JE, Kleinbaum DG, et al. Nonmedical exemptions to immunization requirements in California: a 16-year longitudinal analysis of trends and associated community factors. Vaccine. 2013; 31(29): 3009–13. doi:10.1016/j.vaccine.2013.04.053 PMID: 23664998

33. Omer SB, Pan WK, Halsey NA, Stokley S, Moulton LH, Navar AM, et al. Nonmedical exemptions to school immunization requirements: secular trends and association of state policies with pertussis incidence. JAMA. 2006; 296(14): 1757–63. PMID: 17032989

34. Safi H, Wheeler JG, Reeve GR, Ochoa E, Romero JR, Hopkins R, et al. Vaccine policy and Arkansas childhood immunization exemptions: a multi-year review. Am J Prev Med. 2012; 42(6): 602–5. doi: 10.1016/j.amepre.2012.02.022 PMID: 22608376

35. Dubé E, Laberge C, Guay M, Bramadat P, Roy R, Bettinger JA. Vaccine hesitancy: An overview. Hum Vaccin Immunother. 2013; 9(8): 1–11.

36. Peretti-Watel P, Larson HJ, Ward JK, Schulz WS, Verger P. Vaccine hesitancy: clarifying a theoretical framework for an ambiguous notion. PLoS Curr. 2015; 7.

37. Leask J, Willaby HW, Kaufman J. The big picture in addressing vaccine hesitancy. Hum Vaccin Immunother. 2014; 10(9): 1–3.

38. Kata A. Anti-vaccine activists, Web 2.0, and the postmodern paradigm—an overview of tactics and tropes used online by the anti-vaccination movement. Vaccine. 2012; 30(25): 3778–89. doi: 10.1016/j.vaccine.2011.11.112 PMID: 21725054

39. Betsch C, Brewer NT, Brocard P, Davies P, Gaissmaier W, Haase N, et al. Opportunities and challenges of Web 2.0 for vaccination decisions. Vaccine. 2012; 30(25): 3727–33. doi: 10.1016/j.vaccine.2012.02.025 PMID: 22365840

40. Kennedy A, Lavail K, Nowak G, Basket M, Landry S. Confidence about vaccines in the United States: understanding parents' perceptions. Health Aff (Millwood). 2011; 30(6): 1151–9.

41. Fabry P, Gagneur A, Pasquier J. Determinants of A (H1N1) vaccination: cross-sectional study in a population of pregnant women in Quebec. Vaccine. 2011; 29(9): 1824–9. doi:10.1016/j.vaccine.2010.12.109 PMID: 21219988

42. Zimmerman R, Wolfe R, Fox D, Fox J, Nowalk M, Troy J, et al. Vaccine Criticism on the World Wide Web. JMIR. 2005; 7(2): e17. PMID: 15998608

43. Salathe M, Khandelwal S. Assessing vaccination sentiments with online social media: implications for infectious disease dynamics and control. PLoS Comput Biol. 2011; 7(10): e1002199. doi: 10.1371/journal.pcbi.1002199 PMID: 22178516

44. Wolfe R, Sharp L, Lipsky M. Content and Design Attributes of Antivaccination Web Sites. JAMA. 2002; 287(24): 3245–8. PMID: 12076221

45. Witterman HO, Zikmund-Fisher BJ. The defining characteristics of web 2.0 and their potential influence in the online vaccination debate. Vaccine. 2012; 30(25): 3734–40. doi:10.1016/j.vaccine.2011.12.039 PMID: 22178516

46. Davies P, Chapman S, Leask J. Antivaccination Activists on the World Wide Web. Arch Dis Child. 2002; 87(1): 22–5. PMID: 12089115

47. Scullard P, Peacock C, Davies P. Googling Children's Health: Reliability of Medical Advice on the Internet. Arch Dis Child. 2010; 95(8): 580–2. doi: 10.1136/adc.2009.168856 PMID: 20371593
48. Larson HJ, Smith DM, Paterson P, Cumming M, Eckersberger E, Freifeld CC, et al. Measuring vaccine confidence: analysis of data obtained by a media surveillance system used to analyse public concerns about vaccines. Lancet Infect Dis. 2013; 13(7): 606–13. doi: 10.1016/S1473-3099(13)70108-7 PMID: 23676442

49. Keelan J, Pavri V, Balakrishnan R, Wilson K. An analysis of the Human Papilloma Virus vaccine debate on MySpace blogs. Vaccine. 2010; 28(6): 1535–40. doi: 10.1016/j.vaccine.2009.11.060 PMID: 20003922

50. Robichaud P, Hawken S, Beard L, Morra D, Tomlinson G, Wilson K, et al. Vaccine-critical videos on YouTube and their impact on medical students’ attitudes about seasonal influenza immunization: A pre and post study. Vaccine. 2012; 30(25): 3763–70. doi: 10.1016/j.vaccine.2012.03.074 PMID: 22484293

51. Betsch C. Innovations in Communication: The Internet and the Psychology of Vaccination Decisions. Euro Surveill. 2011; 16(17): 1–6.

52. Smith J, Appleton M, Macdonald N. Building Confidence in Vaccines. In: Curtis N, Finn A and Pollard A, editors. Hot Topics in Infection and Immunity Children IX. New-York: Springer; 2013. pp. 81–98.

53. Kata A. A postmodern Pandora’s box: anti-vaccination misinformation on the Internet. Vaccine. 2010; 28(7): 1709–16. doi: 10.1016/j.vaccine.2009.12.022 PMID: 20045099

54. Hobson-West P. Understanding vaccination resistance: moving beyond risk. Health Risk Soc. 2003; 5(3): 273–83.

55. Kahan DM. A risky science communication environment for vaccines. Science. 2013; 342(6154): 53–4. doi: 10.1126/science.1245724 PMID: 24092722

56. Nyhan B, Reifler J. Does correcting myths about the flu vaccine work? An experimental evaluation of the effects of corrective information. Vaccine. 2015; 33(3): 459–64. doi: 10.1016/j.vaccine.2014.11.017 PMID: 25499651

57. Nyhan B, Reifler J, Richey S, Freed GL. Effective messages in vaccine promotion: a randomized trial. Pediatrics. 2014; 133(4): 1–8.

58. Brownlie J, Howson A. 'Between the demands of truth and government': health practitioners, trust and immunisation work. Soc Sci Med. 2006; 62(2): 433–43. PMID: 16046042

59. Leach M, Fairhead J. Vaccine anxieties—global science, child health and society. London: Earthscan; 2007; p.

60. Streetland P, Chowdhury AMR, Ramos-Jimenez P. Patterns of vaccination acceptance. Soc Sci Med. 1999; 49(12): 1705–16. PMID: 10574240

61. Burton-Jeangros C, Golay M, Sudre P. Compliance and resistance to child vaccination: a study among Swiss mothers. Rev Epidemiol Sante Publique. 2005; 53(4): 341–50. PMID: 16353509

62. Cassell JA, Leach M, Poltorak MS, Mercer CH, Iversen A, Fairhead JR. Is the cultural context of MMR rejection a key to an effective public health discourse? Public Health. 2006; 120(9): 783–94. PMID: 16828492

63. Guay M, Gallagher F, Petit G, Ménard S, Clément P, Boyer G. Pourquoi les couvertures vaccinales chez les nourrissons de l’Estrie sont-elles sous-optimales? Sherbrooke: Centre de santé et de services sociaux—Institut universitaire de gériatrie de Sherbrooke; 2009, p. 62.

64. Wittteman HO. Addressing Vaccine Hesitancy With Values. Pediatrics. 2015; 136(2).

65. Wittteman HO, Chipenda Dansokho S, Exe N, Dupuis A, Provencher T, Zikmund-Fisher BJ. Risk Communication, Values Clarification, and Vaccination Decisions. Risk Anal. 2015; 35(10): 1801–19. doi: 10.1111/risa.12418 PMID: 25996456

66. Rainford J, Greenberg J. The hardline strategy on vaccine hesitancy. Policy Options. 2015. Available: http://policyoptions.irpp.org/2015/06/04/the-hardline-strategy-on-vaccine-hesitancy/.

67. Dempsey AF, Schaffer S, Singer D, Butchart A, Davis M, Freed GL. Alternative vaccination schedule preferences among parents of young children. Pediatrics. 2011; 128(5): 848–56. doi: 10.1542/peds.2011-0400 PMID: 21969290

68. Ekos Research Associates Inc. Survey of Parents on Key Issues Related to Immunization. Ottawa: Public Health Agency of Canada; 2011, p. 53.

69. Halperin SA. How to manage parents unsure about immunization. Can J CME. 2000; 12(1): 62–75.

70. Healy CM, Pickering LK. How to communicate with vaccine-hesitant parents. Pediatrics. 2011; 127(Supp 1): S127–S33.

71. Opel DJ, Robinson JD, Heritage J, Korfiatis C, Taylor JA, Mangione-Smith R. Characterizing providers’ immunization communication practices during health supervision visits with vaccine-hesitant parents: a pilot study. Vaccine. 2012; 30(7): 1269–75. doi: 10.1016/j.vaccine.2011.12.129 PMID: 22230593
72. Leask J, Kinnersley P, Jackson C, Cheater F, Bedford H, Rows G. Communicating with parents about vaccination: a framework for health professionals. BMC Pediatr. 2012; 12: 154. doi: 10.1186/1471-2431-12-154 PMID: 22998654
73. Wroe AL, Turner N, Owens RG. Evaluation of a decision-making aid for parents regarding childhood immunizations. Health Psychol. 2005; 24(6): 539–47. PMID: 16287399
74. Witteman H, Chipenda Dansokho S, Exe N, Dupuis A, Provencher T, Zikmund-Fisher B. Risk Communication, Values Clarification, and Vaccination Decisions. Risk Anal. 2015; 35(10): 1801–19. doi: 10.1111/risa.12418 PMID: 25996456
75. Henrikson NB, Opel DJ, Grothaus L, Nelson J, Scrol A, Dunn J, et al. Physician communication training and parental vaccine hesitancy: a randomized trial. Pediatrics. 2015; 136(1): 70–9. doi: 10.1542/peds.2014-3199 PMID: 26034240
76. Leask J, Kinnersly P. Physician communication with vaccine-hesitant parents: the start, not the end, of the story. Pediatrics. 2015; 136(1): 180–2. doi: 10.1542/peds.2015-1382 PMID: 26034247
77. Enropean Cenrer for Disease Prevention and Control. Vaccine hesitancy among healthcare workers and their patients in Europe—A qualitative study. Stockholm: ECDC; 2015.
78. Verger P, Fressard L, Collange F, Gautier A, Jestin C, Launay O, et al. Vaccine Hesitancy Among General Practitioners and Its Determinants During Controversies: A National Cross-sectional Survey in France. EBioMedicine. 2015; 2(8): 889–95. doi: 10.1016/j.ebiom.2015.06.018 PMID: 26425696
79. Gauchat G. Politicization of Science in the Public Sphere: A Study of Public Trust in the United States, 1974 to 2010. Am Sociol Rev. 2012; 77(2): 167–87.
80. Dube E, Laberge C, Guay M, Bramadat P, Roy R, Bettinger J. Vaccine hesitancy: an overview. Hum Vaccin Immunother. 2013; 9(8): 1763–73. doi: 10.4161/hv.24657 PMID: 23584253
81. Leask J, Willaby HW, Kaufman J. The big picture in addressing vaccine hesitancy. Human Vaccines & Immunotherapeutics. 2014; 10(9): 1–3.
82. Blume S. Anti-vaccination movements and their interpretations. Soc Sci Med. 2006; 62(3): 628–42. PMID: 16039769
83. Pelletier LR, Stichler JF. Action Brief: Patient engagement and activation: A health reform imperative and improvement opportunity for nursing. Nurs Outlook. 2013; 61(1): 51–4. PMID: 23527404
84. Dentzer S. Rx For The 'Blockbuster Drug' Of Patient Engagement. Health Aff (Millwood). 2013; 32(2): 202.
85. Gruman J, Holmes Rovner M, French ME, Jeffress D, Sovaer S, Shaller D, et al. From patient education to patient engagement: Implications for the field of patient education. Patient Educ Couns 2010; 78: 350–56. doi: 10.1016/j.pec.2010.02.002 PMID: 20202780
86. Osborn R, Squires D. International Perspectives on Patient Engagement. J Ambul Care Manage. 2012; 35(2): 118–28. doi: 10.1097/JAC.0b013e31824a579b PMID: 22415285
87. Hibbard JH, Greene J. What the Evidence Shows About Patient Activation: Better Health Outcomes And Care Experiences: Fewer Data On Costs. Health Aff (Millwood). 2013; 32(2): 207–14.
88. Kaufman SR. Regarding the rise in autism: vaccine safety doubt, conditions of inquiry, and the shape of freedom. Ethos. 2010; 38(1): 8–32.