The prevention of vaccine-preventable disease outbreaks, such as measles, rubella, or polio, is dependent on herd immunity. Yet ensuring widespread vaccination coverage is complicated by a wide range of factors, including vaccine hesitancy, which causes uncertainty in segments of the public about the safety and efficacy of vaccinations.

There is a broad continuum of public perspectives on vaccination, and although there are a few polarized individuals on the extremes, more people are somewhat uncertain or ambivalent about the vaccination decisions that they must make for themselves and their children. The debate also exists in the context of larger political issues surrounding vaccination, including individual freedoms and religious beliefs.

This series of articles investigates the social discourse surrounding vaccination, global perceptions and outcomes of vaccination, and the general issue of confidence or trust in healthcare or government establishments that can underpin medical decisions.

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Editorial

Hesitancy, Trust and Individualism in Vaccination Decision-Making
Jonathan E Suk, Pierluigi Lopalco, Lucia Pastore Celentano
Published 25 Feb 2015 | info:doi/10.1371/currents.outbreaks.49dba84ad4146de33706b1f131d7caa3

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Hesitancy, Trust and Individualism in Vaccination Decision-Making

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Related Articles
The article is part of the PLOS Currents Outbreaks “Vaccine Hesitancy Collection“.

Editorial
Based on recent trends, outbreaks of measles and other vaccine-preventable diseases could be more commonplace in the coming years, even in countries where such diseases have been considered eliminated or under control. In 2014, the United States reported over 600 cases of measles, far and away the highest number over the past decade. In the European Union, where measles is still endemic, this figure is an order of magnitude higher, with 3840 reported cases in the rolling twelve month period between December 2013 and November 2014. Measles continues to be challenge in many additional parts of the world, with countries such as Canada, Brazil, Vietnam and China all reporting recent increases in measles incidence and/or current outbreaks.

The willingness or reticence of individuals to vaccinate themselves and their children can have profound impacts not only for their own health and wellbeing, but for herd immunity and public health more widely. As noted in Europe for measles, each percentage point increase in national vaccination coverage contributes to a significant reduction in the overall burden of disease. Thus, when contemplating immunisations, individuals may be assessing personal risks and benefits – but they are impacting societal ones.

Very recently, a measles outbreak at a prominent Californian theme park sparked wide-scale public debate in the United States, ultimately reaching the highest political circles, with President Obama affirming on national television that “the science is pretty indisputable.” Other US politicians, meanwhile, situated the vaccination debate in the context of broader political discourses, such as the right to individual freedom versus state intervention. The latter is indeed an important factor contributing to lower than ideal vaccination coverage amongst some groups, but several other factors are known to create barriers to vaccination. These can include complacency and neglect;
the desire for “toxin-free” lifestyles; varying religious beliefs; public interpretations of risk and benefits of vaccines that are at odds with medical consensus; and, somewhat relatedly, a lack of trust in scientific and medical establishments.

If the recent Californian measles outbreak (and the reaction to it) is instructive of anything, it is perhaps simply that vaccine hesitancy and other barriers to vaccination (e.g. among hard-to-reach populations) is an issue that appears to be increasingly pressing and politicized in many parts of the world. It therefore warrants much greater attention from public health and epidemiology, medical sociology, anthropology, and the behavioural, economic and political sciences. Recognizing this need, PLOS Currents: Outbreaks and the European Centre for Disease Prevention and Control (ECDC) issued a call for papers aimed at building upon the insights collected from a 2013 workshop on the topic of vaccine hesitancy.8,9

The papers presented in this collection offer a unique and important contribution to the field. Peretti-Watel et al.10 and Larson et al.11 stress the importance of clarifying the language around vaccine hesitancy and confidence. The former notes the consistencies and inconsistencies of the ways in which the term has been used, offering much needed clarity in this emerging domain of research. They convincingly argue that is helpful to view vaccine hesitancy as a decision-making process. Recognising it as such requires attention to the many factors that may affect it. As addressed in this collection of papers, these can include the important but often overlooked role of social discourses (Abeyesinghe12); age and social position, as discussed in the context of measles vaccination coverage in Germany (Schuster et al.13); and perceptions of the severity of disease, noted in a study of the intentions of US women to receive antenatal influenza and Tdap vaccines (Chamberlain et al.14).

The theme of trust and of vaccine confidence, meanwhile, resonates across each of the papers in this issue. As Peretti-Watel et al.10 note, the parallels between vaccine hesitancy and the sociological theorisation on risk developed over twenty years ago are striking. For example, a particularly salient concept of risk society theory for vaccine hesitancy is reflexive modernisation, a process through which the risks produced by science and technology attract both attention and scepticism. This is accompanied by a growing lack of public trust in governments and scientific institutions, leading individuals to “privatize” their risk management decisions.15,16 Such a dynamic certainly appears to be at play when considering vaccination. As some recent studies have demonstrated, there is a connection between trust to broader social structures and individuals’ decisions to vaccinate in both Europe and the United States.17,18

One of the critiques of risk society theory has been the argument that it is not particularly relevant beyond the “West”. Irrespective of whether or not this is the case, vaccine hesitancy certainly is. Larson et al.11 present findings belonging to a global vaccine confidence survey. Data from Georgia, India, Pakistan, the UK and Nigeria indicate that for each of these countries, confidence in immunisation is linked to confidence in health systems more generally. Although vaccine hesitancy is relatively rare – and vaccine refusals even rarer – even small groups can undermine the success of immunisation programmes. This, they note, begs the question, “How much confidence is enough?” It is one of many pressing questions that the papers in this issue begin to address – and one that will
require much further research in the coming years.

**Competing Interests**
The authors have declared that no competing interests exist.

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Vaccine Hesitancy: Clarifying a Theoretical Framework for an Ambiguous Notion

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Abstract
Today, according to many public health experts, public confidence in vaccines is waning. The term “vaccine hesitancy” (VH) is increasingly used to describe the spread of such vaccine reluctance. But VH is an ambiguous notion and its theoretical background appears uncertain. To clarify this
concept, we first review the current definitions of VH in the public health literature and examine its most prominent characteristics. VH has been defined as a set of beliefs, attitudes, or behaviours, or some combination of them, shared by a large and heterogeneous portion of the population and including people who exhibit reluctant conformism (they may either decline a vaccine, delay it or accept it despite their doubts) and vaccine-specific behaviours. Secondly, we underline some of the ambiguities of this notion and argue that it is more a catchall category than a real concept. We also call into question the usefulness of understanding VH as an intermediate position along a continuum ranging from anti-vaccine to pro-vaccine attitudes, and we discuss its qualification as a belief, attitude or behaviour. Thirdly, we propose a theoretical framework, based on previous literature and taking into account some major structural features of contemporary societies, that considers VH as a kind of decision-making process that depends on people’s level of commitment to healthism/risk culture and on their level of confidence in the health authorities and mainstream medicine.

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**Related Articles**

The article is part of the *PLOS Currents Outbreaks* “Vaccine Hesitancy Collection“.

**Introduction**

Today, according to many public health experts, public confidence in vaccines is waning. Researchers investigating this phenomenon are now abandoning expressions such as “vaccine resistance” or “vaccine opposition”, increasingly replacing them by the new term “vaccine hesitancy” (VH) to describe the spread of vaccine reluctance. According to the Working Group on Vaccine Hesitancy appointed by the World Health Organisation’s Strategic Advisory Group of Experts (SAGE) on Immunisation, VH “refers to delay in acceptance or refusal of vaccines despite availability of vaccination services”, and this phenomenon “is complex and context specific varying across time, place and vaccines”. Several literature reviews have already been devoted to this issue. Articles using the VH terminology have mainly been published in journals specialised in vaccination or paediatric issues, but also in more generalist journals (Lancet, British Medical Journal).

Despite — or perhaps because of — this success, VH is an ambiguous notion and its theoretical background appears uncertain. It may have originated as a catchy expression coined by experts to capture policy-makers’ attention, as current vaccine coverage rates do not yet reflect the growing reluctance toward vaccination witnessed by empirical researchers. But hasty use of this notion may lead to misunderstandings and ineffective policies if, for example, one considers hesitancy as a necessarily transient state between full support and strong opposition.

In this paper, we first review the current definitions of VH in the public health literature and examine its most prominent characteristics; we also underline some of its ambiguities. We then call into question the usefulness of the common understanding of VH as an intermediate position along
a continuum ranging from anti-vaccine to pro-vaccine attitudes, and we discuss its qualification as a belief, attitude, or behaviour. Finally, we propose a theoretical framework related to two different concepts: healthism/risk culture and (dis)trust toward health authorities and mainstream medicine.

**The ambiguities of current definitions of VH.**

**VH definitions in the public health literature.**

VH has been defined as a set of beliefs, attitudes, behaviours, or some combination of them, exhibited by lay people in regard to their own or their children’s immunisations, but also sometimes by healthcare professionals. VH is an attribute ascribed to a large and heterogeneous category that regroups people who share varying degrees and motives of indecision and who hold an intermediate position along a continuum ranging from full support for vaccination to strong opposition to any vaccine.

These people are characterised by what we may call reluctant conformism and vaccine-specific behaviours. They may decline a vaccine, but they may also delay it or even accept it in due time despite their doubts/reluctance. In other words, they may endorse a wide range of non-specific behaviours, all of which can result from something else than VH. This behavioural outcome can vary from one vaccine to another: they may accept one vaccine, but decline/delay another, as they base their decision on vaccine-specific features.

**A catchall category, not a concept.**

Definitions that try to describe VH as it is used by researchers tend to be very broad and to embrace heterogeneous people/situations and many different explanatory factors (including historic, political and socio-cultural contexts, as well as individual/social group influences). Moreover, some previous empirical studies have found quite contrasting profiles of attitudes among those who could be categorised as vaccine-hesitant.

Previous studies also show several contradictions in their use of VH. First, some authors argue that it is something new, distinct from old-fashioned anti-vaccination, while others state that it is as old as vaccination itself. Second, some authors consider that VH corresponds to an intermediate position, in the middle of the continuum between the pro-vaccination and anti-vaccination positions (that is, on what we shall refer to as the pro/anti continuum), while others consider that VH includes strong opposition to vaccination. Third, authors argue that VH is due to ignorance, misperceptions or disinformation, and others that it may result from too much information. One author even states that VH is driven basically by emotions and irrationality and vaccine refusers should be liable for the harm they cause to others. Fourth, VH is sometimes described with a neutral tone, or even praised, but it has also been described (metaphorically?) as a “condition” more or less “severe” that should be “diagnosed” among people at risk and as a weed deeply rooted in the defects of human nature.

Finally, while some empirical studies report that VH is more frequent among people with a high socioeconomic status (SES), others report the opposite or observe no relation, especially regarding...
Such inconsistent results are disturbing for social scientists, as SES is supposed to strongly shape our beliefs, attitudes and behaviours, in meaningful ways.

These different attitudes tend to assort into specific profiles; for example, those who consider VH an old phenomenon that encompasses anti-vaccination attitudes often attribute it to ignorance, misinformation or irrationality, while those who describe it as a new attitude, distinct from strong opposition to vaccination, also argue that it is positively correlated with vaccine-related knowledge.

More generally, VH is not really an empirical concept, as the term “concept” traditionally refers to a general mental representation derived from the variety of perceived objects and defines what is common to them — the features necessary and sufficient for membership in the class/concept — through comparison, reflection and abstraction. The current definitions of VH, rather than delineating a set of core elements, cover a wide range of heterogeneous, and even sometimes contradictory, elements.

Two issues raised by the VH definitions: what is VH, and where to position it?

A belief/attitude, a behaviour, or a decision-making process?

It is not fully satisfactory to define VH as a behaviour, as it is associated in the literature with various and non-specific behaviours and outcomes (due to reluctant conformism and vaccine-specific behaviours). Moreover, VH is not the only possible explanation for each of these different outcomes: acceptance might also be due to strong support, refusal to strong opposition, and delay to procrastination, oversight, or ignorance. Nevertheless, VH may be associated with other kinds of behaviours, such as information seeking, and the notion of attitude can be defined in many different ways (including a positive or negative evaluation, or a disposition to act). This ambiguity regarding the nature of VH may create problems in dealing with it: when researchers design an intervention aimed at promoting vaccination or a specific vaccine, for example, should they target an attitudinal or a behavioural outcome?

Nevertheless, beyond this ambiguity, it would be probably more useful to consider VH as a decision-making process (how/why do people come to accept/refuse/delay vaccination) which is influenced by various contextual factors (including “local vaccination cultures” and leads to a variety of behavioural outcomes. From a public health perspective, behavioural outcomes are important targets in terms of prevention. But it is worth studying VH even among people who have not yet refused or delayed any vaccines, because they are more likely to do so in the future, and public health experts would like to prevent that.

The decision-making process we are referring to may be easy or simple (without hesitancy) or practically automatic amongst both pro-vaccine and anti-vaccine people because they have strong convictions about vaccines in general. On the contrary, this process may be difficult, more uncertain and more worthy of interest among people who have doubts — that is, who are genuinely hesitant. Thus, although VH can be considered to be an intermediate position between the pro- and anti-vaccine positions in terms of vaccine assessment (positive/negative), it is not in terms of the decision-making process. Moreover, a still different group, those with no definite opinion, little knowledge and little interest about vaccination issues and who randomly forget or delay some vaccines, share the same intermediate position on the anti/pro continuum, but they show the same
behavioural pattern as people who are uncertain but very interested and committed in vaccination issues, prone to information seeking and long and balanced decision-making.

In other words, the behavioural outcomes generally associated with VH may reflect the genuine inconsistency of uncommitted people, as described above, but may also reflect a decision-making process that is not guided by a general attitude toward vaccination, but that instead takes the specificities of each vaccine/context into account, among people strongly committed to vaccination issues.

**VH and the anti/pro continuum.**

To a certain extent, keeping VH on the anti/pro continuum is convenient, as VH can be conceived as a temporary attitude of individuals who have not yet chosen between the anti- and pro- attitudes and who can more easily be convinced to endorse the latter than strong opponents. One might then hope to help people to move along this continuum through interventions designed to bring them what they lack: self-efficacy, knowledge or trust of the authorities.

Nevertheless, using this continuum to describe VH is not self-evident. First, from a statistical point of view, it is quite odd to choose to describe a population by representing it on an axis where most individuals are supposed to be clumped in an intermediate position. It is usually more informative to use axes that contrast individual positions.

Moreover, that vaccine-hesitant people are neither pro- nor anti-vaccination does not necessary imply that they endorse intermediate attitudes regarding vaccination in general. We can use an analogy with politics to illustrate this point. One may claim that there are hesitant voters: instead of being either leftists or rightists and always voting according to their orientation, they may make an informed choice for each election, depending on the candidates, their election platforms, and the context and territory level: they may choose to vote for a leftist candidate for the municipal election and a rightist candidate for the presidential election, and to stay home from the elections for European Parliament members. Such hesitant voters are neither leftists nor rightists, but claiming they are centrists would be highly arguable. The standard left-right clivage appears irrelevant to describing their behaviour. Similarly, the anti/pro continuum about vaccination may not be relevant for describing VH.

Finally, these people’s attitudes are claimed to be strongly vaccine-dependent, for they may accept one vaccine, be suspicious of another and strongly reject a third. Positioning them along a continuum corresponding to attitudes toward vaccination in general thus appears quite inappropriate.

**A theoretical model for VH**

**The indifference/commitment axis.**

As specified above, considering VH a decision-making process helps to distinguish two very different kinds of VH: first, that of people with poor knowledge of and indifference to vaccination issues, and erratic vaccination behaviours, and, second hand, that of people who are very interested and committed to vaccination issues, prone to information seeking and long and balanced decision-making. From a psychological point of view, this axis echoes the notion of locus of control: some
people believe that they can control events related to their life (internal locus of control), while others endorse a more fatalistic attitude, tending to believe that their life is driven by forces outside themselves (others, fate or luck: external locus of control).\(^{31}\)

From a sociological point of view, this axis echoes two cultural features of contemporary societies, concepts known as “risk culture” and “healthism”. Risk culture is a concept coined by the British sociologist Anthony Giddens.\(^{32}\) According to him, people in contemporary societies are encouraged to exert autonomy over their own lives, to use available expert knowledge to stay continuously aware of risks and opportunities in their daily life, to assess risks and benefits in order to make their future secure. Authorities promote risk culture, as it is easier to govern rational and autonomous individuals, whose rationality makes them more predictable.\(^{33}\) This is especially true concerning health, which has become a super value: the rhetoric of self-empowerment conveyed by health promotion praises enterprising and entrepreneurial individuals who exercise control over their own behaviours and use information spread by health authorities to maximise their life expectancy. This specific cultural feature is described as healthism.\(^{34,35}\) Thus the indifference/commitment axis can also be viewed as measuring the extent to which individuals are committed or indifferent to contemporary healthism.

The link between healthism and VH is quite obvious in several studies. Gilkey et al.\(^{26}\) observed that forgoing vaccines was more common among parents more attentive to their children’s health and nutrition, and others underline the weight of rational assessment and the importance of perceived control among people who were reluctant to be vaccinated against the H1N1 influenza.\(^{16,27}\) Moreover, when Opel et al.\(^{11}\) built a questionnaire designed to identify VH, they not only used existing items but also conducted focus groups to create new items. Because parents frequently claimed that they prefer to rely on their own research on vaccines to come to an informed decision, rather than deferring to their child’s doctor, the authors added the following item: “It is my role as a parent to question shots”. We believe this item captures an aspect of commitment to risk culture. Conversely, and rather remarkably, parents’ reluctance to get their child immunised has been used as a typical example to illustrate contemporary healthism.\(^{36}\)

**The trust issue.**

According to Giddens, contemporary individuals are exhorted to become the “entrepreneur” of their own life, but they must do so in a context characterised by trust issues, as many — if not all — aspects of our daily lives depend on machines or systems that are distant from us and beyond our understanding. Giddens’s analysis is based on a concept of trust borrowed from the psychologist Erik Erikson: depending on people/things that are not under our direct scrutiny or not fully understandable to us induces anxiety, and we must trust them, trust a whole expert system, through a leap of faith. As our societies are characterised by overspecialisation and the disembedding of social relationships, trust issues become essential.\(^{32}\) Moreover, in Giddens’s perspective, the contemporary controversies regarding vaccination or other health-related issues are not the causes of distrust, but only consequences of a wider structural phenomenon.

Trust issues are also crucial in Beck’s analyses of contemporary risk societies, especially regarding science and knowledge. According to him, our societies are characterised by reflexive scientisation:
scientific scepticism has been extended to science itself and fuelled the disenchantment of science. As a result, there is a process of demonopolisation/feudalisation of scientific knowledge, with conflictual equalisation tendencies in the gradient of rationality between experts and lay people. Sciences, quasi-sciences and pseudo-sciences are competing sources that produce a flood of overspecialised, hyper-complex and contradictory findings. Consequently, distrust toward science is no longer a sign of ignorance or even obscurantism, but is endorsed by highly educated individuals. Beck also pointed out the increasingly important issue of conflicts of interest, i.e., situations in which scientists or experts are perceived as untrustworthy because of their financial links to industries. In this context, people who endorse risk culture and decide to take their health in hand are confronted with discordant sources of knowledge: they may distrust “official” sciences and experts, and put their faith in “alternative” sources of information or medical practice (such as homeopathy or acupuncture).

Vaccination-related issues have not escaped from these structural features of contemporary societies, especially the crisis of legitimacy faced by science, expertise and medical authorities. Vaccination may involve trust as a leap of faith, experienced through relationality and familiarity with a physician [5,38]. An annual survey conducted by the IRSN (Institute of Radiation Protection and Nuclear Safety) illustrates this crisis of legitimacy; it found that, generally speaking, the French people do not trust the way authorities manage various kinds of risks, nor do they trust the information given to them. For example, only 38% of the French had confidence that what authorities did about the H1N1 episode in 2009 was for their safety, and only 34% believed that the information released was true.

Trust is generally considered as a crucial component of people’s attitudes toward vaccination, including VH. For example, trust is a key dimension in the questionnaire developed by Opel et al to assess VH. More precisely, lay people may not distrust vaccines per se, but rather distrust the health authorities who are believed to be strongly influenced by vaccines producers. This feature of contemporary societies is closely related to healthism, and some authors have even combined these concepts: in such cases, healthism refers to individuals who seek to control their (children’s) health, who want to become its informed and rational entrepreneur, but who also express strong doubts about medical authorities and mainstream medicine and are more prone to turn to alternative experts, including on vaccination issues. This relation between empowerment and distrust is also explicitly promoted by some groups critical of vaccines, which claim that “trusting blindly can be the biggest risk of all.” Moreover, several previous studies have already found a positive correlation between VH and use of alternative medicines (such as acupuncture, homeopathy or naturopathy), as well as distrust of colon cancer screening.

**VH in a two-dimension map.**

Thus we propose to add to the risk culture/healthism axis a second axis, assessing lay people’s attitudes toward health authorities and mainstream medicine (see Figure 1).
Commitment to risk culture / healthism (horizontal axis) and distrust/trust toward health authorities (vertical axis).

These two axes can be used to represent different types of VH. For example, in their study of major motives for non-acceptance of the A/H1N1 flu vaccine, Velan et al. found several contrasting profiles, including people whose motives suggested passiveness, inaction and dependence (“I did not think about it”, “I somehow did not manage to do it”…), corresponding here to the lower-left quadrant (erratic VH), and people who made their decision after a process of reflection (“after some deliberation I have decided not to do it”, “I realised that the disease is not serious, that it is not spreading”), corresponding here to the lower-right quadrant. Specific views regarding VH could also be positioned here: for example, in Marshall’s view, VH is due to a lack of faith in authorities, combined with misperceptions, emotion-driven reactions, and gullibility toward rumours spread by anti-champions and celebrities, corresponding to the lower-left quadrant.

This map also underlines that although health promotion policies aiming at encouraging people to take their health in their own hands may move people further along the horizontal axis, health promotion may nonetheless fuel VH, at least among some populations, unless they are positioned high on the trust axis.

Nevertheless, talking about vaccine hesitant people may be a misuse of language, as VH also strongly depends on vaccine-specific factors; thus specific vaccines, rather than individual profiles, could be also positioned along our two axes. In other words, instead of considering whether or not people are vaccine-hesitant, we should consider whether a specific context/vaccine fuels their propensity to VH. For example, people are probably more likely to endorse an active attitude, seeking information and assessing risk and benefits, when they are confronted with new vaccine, such as the H1N1 or the HPV vaccines, while they may be more prone to follow their physician’s advice routinely and passively for some childhood vaccines or that against seasonal influenza. Moreover, the level of confidence in health authorities about any specific vaccine obviously depends on the extent of media coverage of existing controversies regarding its potential side effects. In the UK, for example, the MMR vaccine would have been positioned in the upper-left
quadrant before the MMR/autism controversy began, along with the vaccine against seasonal flu. On the contrary, the HPV vaccine could be considered as relatively new and less controversial (upper-right quadrant), while the H1N1 vaccine was both new and controversial (lower-right quadrant)\textsuperscript{15}.

**Conclusion**

In this paper, we have discussed some of the ambiguities and contradictions of the notion of vaccine hesitancy. We have argued that it is currently more a catchall category than a real concept. This lack of consistence is likely to hamper both research and interventions. Therefore, as a supplement to the previous work carried out by the SAGE working group, we propose grounding the notion of vaccine hesitancy in an explicit theoretical framework that takes some major structural features of contemporary societies into account. We consider VH to be a kind of decision-making process that depends on people's level of commitment to healthism/risk culture and on their level of confidence toward health authorities and mainstream medicine.

This framework abandons the anti/pro vaccination continuum. We do not claim here that the vaccine-hesitant do not have opinions about vaccination in general, nor that such opinions do not influence their behaviours toward a specific vaccine. Nevertheless, we believe that these general opinions are not a key determinant of their vaccination behaviours, especially in comparison with the two other dimensions discussed here.

We also believe our approach opens new avenues for research on VH. For example, it would be useful to consider various kinds of VH that may be correlated to individuals' socioeconomic status (SES), as the social differentiation of health behaviors may reflect the social differentiation of health-related cognition, including knowledge, attitudes and beliefs\textsuperscript{42}. Erratic VH is more likely to be displayed by people with low SES, while rationalised VH may be more frequent among the educated middle classes\textsuperscript{43}.

Finally, as even highly educated people may show VH, we should not focus only on lay people. We should also study extensively VH among health professionals, and especially among general practitioners, who still play a key role in promoting vaccination, and who also display some kinds of VH\textsuperscript{5,8,17}. We should also study their interactions with their patients. In some cases, health professionals may fuel patients’ VH (directly, when homeopaths and naturopaths express convincingly their doubt regarding vaccination to their patients\textsuperscript{40}, or indirectly, when pro-vaccine physicians refuse to accept into their practices families who are reluctant to vaccinate their children\textsuperscript{25}), but sometimes vaccine-hesitant patients may raise doubts in their physician’s mind\textsuperscript{38}.

More generally, we should study the interactions between the various participants involved in immunisation policies, from public health experts to lay people: is there a ‘hesitancy cascade’, with waves of influences from political hesitancy to provider hesitancy to public hesitancy, and is there a feedback effect in some cases (patients’ VH reinforcing physicians’ VH, which in turn fuels VH among other patients)?
Competing Interests
The authors have declared that no competing interests exist.

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Vaccine Narratives and Public Health: Investigating Criticisms of H1N1 Pandemic Vaccination

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Abstract
Vaccine hesitancy is often understood and explored on the level of individual decision-making. However, questions surrounding the risk and efficacy of vaccination are evident in wider public discourse; social narratives of vaccination inform and impact on the individual level. This paper takes a narrative analysis approach from the sociology of health to examine data drawn from a wider study on global public health responses to the H1N1 pandemic. The paper concentrates upon criticisms to mass vaccination as recounted within the Council of Europe’s debate of the handling of H1N1. It shows that three narratives were particularly dominant: problematizing the use of vaccination as a public health response; criticising the efficacy of the vaccines; and, questioning the safety of the strategy. This debate presents an important case study in understanding the way in which vaccines are problematized within the public discourse.
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Related Articles
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Introduction
Mass vaccination has been widely recognised as a key public health achievement. However, vaccine hesitancy – bound up in uncertainty or lack of confidence in the safety and effectiveness of vaccination – may serve to undermine comprehensive coverage. Vaccine hesitancy is often examined on the scale of individual decision-making, or through referring to questions of ethics and freedom of choice. However, when considering the problem of vaccine hesitancy, social scientists of medicine would note that the public discourse surrounding vaccines – the way in which vaccines are represented and publicly understood – forms another important piece of the puzzle. It is not just individuals, but rather wider social representations of vaccination, which underpin vaccine hesitancy. Individual ‘choices’ are produced in the context of narratives and public conversations about the efficacy and safety of vaccine use. The ways in which vaccines are described and discussed in the public domain impacts upon private decision-making. Understanding these narratives is therefore pivotal to the wider understanding of the problem of vaccine hesitancy.

This paper examines the case study of the Council of Europe’s public criticism of mass vaccination during the H1N1 Influenza Pandemic. In December 2009, Council of Europe parliamentarian and epidemiologist Wolfgang Wodarg presented a recommendation to the Council of Europe entitled ‘Faked Pandemics: A Threat to Public Health’. Following subsequent months of debate, the Council of Europe passed a motion decrying the WHO’s public health reaction to H1N1. Criticism of the H1N1 vaccine was central to these findings. Such contestations can have an important effect on the public discourse, for example through media attention and public discussion of vaccination. The Council of Europe’s criticisms were a source of extended media commentary, and public scrutiny over the use of vaccines during the H1N1 pandemic continues. This paper draws upon social scientific analyses of vaccine narratives and illustrates the ways in which the Council of Europe’s account of H1N1 vaccines both reflected and influenced the wider societal discourses on vaccine uptake.

This paper utilises narrative analysis from the sociology of health to draw out the way in which vaccines were discussed and criticised. Narrative analysis allows for the identification of ideological and discursive constructions, including constructions surrounding the social ‘reality’ underpinning vaccine use. Narrative texts, as linguistic and discursive processes, are of fundamental importance in forming subjectivities and making the social world intelligible to those who live in it. The analysis of texts is important in understanding representations of disease, as narrative texts both present and constitute cultural interpretations of reality, providing insight into the social discourse underpinning this phenomena. The narratives and quotes discussed here are drawn out of a wider project which examined the global health management of the 2009-2010 H1N1 Pandemic.
As part of this, a comprehensive analysis was made of all publicly available documents produced and published through the course of the Council of Europe’s discussions surrounding the WHO’s management of H1N1. This paper particularly utilises data gleaned from the textual analysis of expert testimony, parliamentary debates, parliamentary reports, and documents produced by the Council of Europe during their examination of the World Health Organization’s management of the H1N1 Pandemic, focussing on statements concerning the use or misuse of vaccines in combating H1N1.

Sociological analyses of vaccine resistance and hesitancy can be dated from Stern’s key early work in the sociology of vaccine uptake, which articulates the irrational motives, beliefs, and the vested interests of those who resist the use of vaccines. Critical to this field is the idea that, as Hobson-West rightly notes, vaccine resistance is a communal activity. Although vaccine resistance and hesitancy is made up of individual acts of refusal or uncertainty, resistance itself is found in the ‘anti-vaccination movements’, as structured social movements as well as contemporary social norms of ‘questioning’ vaccines. The voices of counter-vaccination can often be heard through the media, particular patient advocacy groups, and public discussions of the harms of immunization. Dew suggests that narratives surrounding vaccines which run counter to the public health discourse are generally rooted in scepticism of science, and may include: the fact that medical practice is held in suspicion due to inherent uncertainty and iatrogenesis; concerns over the competence, experience, or interest of individual medical practitioners, and; concerns over the side-effects of vaccination. The Council of Europe’s public discussion of the H1N1 vaccine contained elements of each of these common tropes. In particular, concerns over safety and side-effects formed substantial components of the arguments developed by the Council of Europe critics. However, additional arguments – which may also be seen as recurring themes within the counter-vaccine discourse – were also evident in this case.

The narratives that marked the case of the Council of Europe’s criticism of H1N1 vaccines were the following: 1.) Arguments surrounding trust and the decision to utilise mass vaccination as a public health tool in the case of H1N1; 2.) Criticisms of the efficacy of the vaccines themselves, including scepticism of the efficiency of vaccines in general, and the H1N1 vaccine in particular; and 3.) Questions surrounding the safety of these vaccines. Understanding these narratives can lead to a greater appreciation of ways in which the public health community can address vaccine hesitancy.

**Trust and Vaccination as an Effective Public Health Response**

Scepticism or concern about vaccination is bound in problems of trust and mistrust. At the individual level, as Dew notes, this involves a particular patient’s trust in their medical practitioner, or in ‘medicine’ as a broader institution. The question of trust was also central to the Council of Europe’s contestation of H1N1 vaccination. In the case of the H1N1 pandemic, the Council of Europe argued that the World Health Organization was responsible for proposing vaccines as a management strategy. Rather than problematising trust in medicine or medical professionals, this case shows the problematisation of trust in public health structures and the World Health Organization.

For the WHO, influenza vaccination was understood as a pivotal public health strategy. Early
mistrust in the H1N1 vaccines were regarded by the WHO as a problem given that, as the Special Advisor for Pandemic Influenza and Deputy Director-General Keiji Fukuda stated: ‘vaccines are really one of the prevention methods against infectious diseases which is best in terms of efficacy, [and] the safest’. Given concerns that, as one member of the press put it to Marie-Paul Keiny, WHO Director of the Initiative for Vaccine Research, ‘the [H1N1] vaccination campaign could actually create problems for the reputation of vaccines’ the WHO strove to emphasise the safety and efficacy of H1N1 vaccines. The WHO upheld the dominant public health discourse surrounding the efficacy of vaccination.

The criticisms of the Council of Europe actors highlighted the problem of trusting the WHO. It was suggested by Paul Flynn (Council of Europe Rapporteur on the matter of the handling of H1N1), Hancock (representative for the UK), and Wodarg, that the WHO acted in an untrustworthy manner in having ‘cried wolf’ over H1N1, and the ‘credibility’ and ‘accountability’ of the WHO had been undermined by the affair, which was considered to be just one of ‘a whole series of scares’. These narratives were underpinned by the major political concern that the Council of Europe’s criticisms were addressing – that the mass vaccination campaign had been costly, since as Frahm (representative for Denmark) put it, the WHO’s recommendation had ‘forced countries to spend billions on unnecessary supplies’ of antivirals and vaccines.

For the Council of Europe, the WHO’s decisions (and lack of credibility) had been a direct result of influence by pharmaceutical manufacturers. It was argued that the costly vaccination campaign had merely served to profit vaccine makers and that industry was able to ‘directly influence’ public health decisions surrounding H1N1. It was argued that there was ‘great commercial pressure’ to manage the H1N1 through the use of vaccines and other pharmaceuticals, and that ‘who pays the piper calls the tune’. Scepticism over the motives of key actors – the WHO and the producers of vaccines – was a key narrative. Action surrounding the H1N1 Pandemic reflected the globalised and rapid action surrounding the pandemic threat (as an urgent global problem, rather than scheduled vaccination regimes), and thus centred upon the role of the WHO. However, the issue of trust and accountability is more widely evident in issues of vaccine hesitancy. For instance, the Council of Europe actors’ scepticism was bound in concern of the greed and corruption of vaccine manufacturers. The concept of profit motives undermining the efficacy and safety of vaccines is recurring discourse in debates surrounding vaccine use. Building trust, not just in terms of scientific objectivity but in terms of wider institutional structures, is therefore fundamental to perceptions surrounding vaccination.

The Efficacy of Vaccination

There is now a wide literature within the social sciences suggesting that the perception and management of risk is central to contemporary life at both the societal and the individual level. The notion of risk is particularly key to the issue of vaccine hesitancy – here, a lack of vaccine uptake is a choice (rather than a problem of lack of access), and this choice is underpinned by an understanding of the relative advantages and disadvantages of vaccine use. In assessing the benefits of vaccination, questions of efficacy are central. One of the ways in which vaccines are
problematized is through challenging notions of efficacy, either at the general level or in regard to a particular type of vaccination. Such narratives of (in)efficacy were central to the Council of Europe actors’ representation of the H1N1 vaccination campaign.

The Council of Europe critics contested the need for administering vaccination against H1N1. The decision to undertake a mass immunisation campaign against the pandemic strain was decried as ‘without sufficient justification’ and unnecessary (Circene, representative for Latvia). This suggestion was reinforced – with the benefit of hindsight – by comparisons between countries that undertook vaccination and those that did not. So for example, it was argued that ‘[t]he country that spent the least was Poland, which rejected the idea that this disease was dangerous and which has suspicions about the safety of the vaccine…’ where, compared the Britain’s comparatively larger spending on pharmaceuticals ‘…the number of deaths per million from swine flu in Britain was about twice the number in Poland’ (Flynn). It was suggested that vaccination was therefore not an effective public health response to H1N1.

In addition to specific criticisms of the efficacy of the H1N1 vaccine, the critics also suggested that vaccination more generally does not act as an efficient public health measure. For example, Tom Jefferson from the Cochrane Institute was called in to provide expert testimony on the case. Dr Jefferson argued that ‘vaccines and antivirals have a weak or non-existent evidence base against influenza’. Such statements undermined the fundamental concept that influenza vaccination is an effective global health action. Likewise, it was argued that ‘the performance of the [influenza] vaccines in healthy adults is nothing to get excited about’ given that ‘we need to vaccinate 100 healthy adults to prevent one set of symptoms’. Other public health measures were described as having ‘a much better evidence base than vaccines’.

The strategy of emphasising the lack of efficacy of vaccine use is a key narrative in problematizing vaccination. In the case of H1N1, it was suggested that vaccines were a costly and ineffective strategy against the pandemic. This uptake of narratives serves to minimise the ‘benefit’ aspect of the risk-to-benefit estimate that is central to estimations of the utility of vaccination.

**Vaccine Safety**

Vaccine hesitancy at the individual level highlights the important role of the relative (perceived) weight of the risk of vaccination to the benefits incurred. Perceptions of the severity of the disease being vaccination against are weighed up against perceptions of adverse reactions to vaccination. Counter-vaccination movements are particularly prone to discourses of risk and uncertainty – vaccines are characterised as unsafe due to the risks of severe or lasting medical consequences. Unlike the short term and acute reactions acknowledged by the medical community, counter-vaccine narratives commonly emphasise long-term and severe reactions to vaccination.

Narratives that problematized vaccine safety were therefore central to the Council of Europe critics’ discussions. It was argued that ‘several independent medical experts raised warnings regarding excessive vaccination…[where]…there was no clinical scientific evidence to justify this’. The safety of vaccination was questioned and problematized.

In the case of H1N1, an important point of contention revolved around the novel manufacturing
method, which was used, it was argued, due to the concern over quickening production and furthering profits. It was suggested that the vaccines ‘primarily follow[ed] economic strategies and was not to optimise public health needs’. This method, it was argued ‘involved higher risks than usual vaccines…[since]…some adjuvants were added and injected of which we know, that they stimulate the immune system manifold, which means that they could possibly lead to autoimmune diseases (such as multiple sclerosis) and immunological complication’.

Several other potential adverse effects were cited. For example the ‘fast growing cancer-like cells’ were highlighted. While such statement were allusions rather than definitive statements, the problematisation of vaccine safety was evident in this account. It is also significant, because while (for example) allusions to the possible carcinogenic nature of the vaccines was not greatly emphasised within the Council of Europe’s hearing on the pandemic, such statements had been mobilised by the media and actors within the anti-vaccination movement, and may therefore inform wider perceptions about the safety of this vaccine and by extension, vaccines more generally.

Conclusions

In order to understand the ways in which individuals make decisions regarding vaccine use, it is important to access the public discourse surrounding vaccination. Such narratives incorporate ideas about vaccinations which, while contrary to medical and scientific viewpoints, underpins the public understanding of vaccines. As such, it is important to see vaccine hesitancy as much a result of public discourse as it is a problem of individual decision-making.

The Council of Europe’s criticisms of the use of vaccines during the H1N1 Pandemic reflect many dominant discourses – lay understandings of vaccination and public representations of vaccination -that may inform vaccine hesitancy. Contestations such as this one, and the ways in which such debates are subsequently picked up by the media, have the potential to significantly shape the public discourse. Simultaneously, this debate mirrors and mobilises common sentiments surrounding vaccines.

Key to the Council of Europe’s account were three issues: the problem of trust in relation to the decision to use vaccines to combat H1N1, the problem of efficacy in terms of vaccines generally and the H1N1 vaccine specifically, and the problem of the risk posed by mass vaccination and the safety of the H1N1 vaccines. Examining the vaccine counter-narratives provides information that may be considered in addressing vaccine hesitancy. Trust building will be central to the task of impacting upon the public debate. Likewise, effective communication of issues of risk and trust – in ways that speak directly to the existing public understanding of vaccines – is also vital. Consequently it is important to acknowledge vaccine hesitancy as a problem not just of the individual level, but critically also of the social.

Competing Interests

The authors have declared that no competing interests exist.
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Tags: vaccine hesitancy

**Measuring Vaccine Confidence: Introducing a Global Vaccine Confidence Index**

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Abstract

Background.
Public confidence in vaccination is vital to the success of immunisation programmes worldwide. Understanding the dynamics of vaccine confidence is therefore of great importance for global public health. Few published studies permit global comparisons of vaccination sentiments and behaviours against a common metric. This article presents the findings of a multi-country survey of confidence in vaccines and immunisation programmes in Georgia, India, Nigeria, Pakistan, and the United Kingdom (UK) – these being the first results of a larger project to map vaccine confidence globally.

Methods.
Data were collected from a sample of the general population and from those with children under 5 years old against a core set of confidence questions. All surveys were conducted in the relevant local-language in Georgia, India, Nigeria, Pakistan, and the UK. We examine confidence in immunisation programmes as compared to confidence in other government health services, the relationships between confidence in the system and levels of vaccine hesitancy, reasons for vaccine hesitancy, ultimate vaccination decisions, and their variation based on country contexts and demographic factors.

Results.
The numbers of respondents by country were: Georgia (n=1000); India (n=1259); Pakistan (n=2609); UK (n=2055); Nigerian households (n=12554); and Nigerian health providers (n=1272). The UK respondents with children under five years of age were more likely to hesitate to vaccinate, compared to other countries. Confidence in immunisation programmes was more closely associated with confidence in the broader health system in the UK (Spearman’s ρ=0.5990), compared to Nigeria (ρ=0.5477), Pakistan (ρ=0.4491), and India (ρ=0.4240), all of which ranked confidence in immunisation programmes higher than confidence in the broader health system. Georgia had the highest rate of vaccine refusals (6 %) among those who reported initial hesitation. In all other
countries surveyed most respondents who reported hesitating to vaccinate went on to receive the vaccine except in Kano state, Nigeria, where the percentage of those who ultimately refused vaccination after initially hesitating was as high as 76%). Reported reasons for hesitancy in all countries were classified under the domains of “confidence,” “convenience,” or “complacency,” and confidence issues were found to be the primary driver of hesitancy in all countries surveyed.

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The data collection was supported by the Global Public Health Polling Network jointly managed by ORB International, UK and Gallup Pakistan, affiliates of WIN-Gallup International. The analysis of the data was supported by the Bill & Melinda Gates Foundation.

**Related Articles**

The article is part of the *PLOS Currents Outbreaks* “Vaccine Hesitancy Collection”.

**Background**

Understanding the dynamics of vaccine confidence is of great importance for global public health. Few published studies permit global comparisons of vaccination sentiments and behaviours against a common metric. To help address this knowledge gap, this article presents the findings of a multi-country survey of confidence in vaccines and vaccination programmes in Georgia, India, Pakistan, Nigeria, and the United Kingdom (UK) – these being the first results of a larger project to map vaccine confidence globally.

While more detailed local studies are important to inform appropriate interventions, we have observed significant global dynamics that influence vaccine confidence and the spread of vaccine sentiments. Studying these large-scale phenomena requires surveys at an international scale. The intention of our current global mapping effort, therefore, is not to distract from invaluable local details, but rather to pull back the lens of observation, so that signals of change can be detected and responded to as appropriate, and trends can be identified and studied in relation to each other, so that global dynamics can be discovered and understood.

**Defining Vaccine Confidence**

Public confidence in vaccines is, above all, a phenomenon of public trust. Fittingly, the Oxford English Dictionary defines “confidence” as “the mental attitude of trusting in or relying on a person or thing”. In the context of vaccination, confidence implies trust in the vaccine (the product), trust in the vaccinator or other health professional (the provider), and trust in those who make the decisions about vaccine provision (the policy-maker).

These trusting relationships are important because, in accepting vaccination, the public relies on the integrity, competence, and good faith of public health and government authorities to recommend vaccines appropriately, of private-sector actors to manufacture effective and uncontaminated products, and of health providers to administer them safely. The definition of trust as the “optimistic acceptance of a vulnerable situation in which the trustor believes the trustee will care for the trustor’s interest” is relevant here. Both trust and confidence are important for understanding
perceptions of vaccines. Trust fundamentally depends on perceptions of competence and motive.\textsuperscript{3} Importantly, trust and confidence in vaccines are dynamic and contextual and depend on perceptions of competence and motive of the provider—both vaccine producers as well as health professionals—as well as the politicians who determine the policies.

There are many related terms used in the vaccine confidence literature,\textsuperscript{4,5,6,7} which has increasingly looked at vaccine hesitancy as a possible indicator of waning confidence. In March 2012, the WHO Strategic Advisory Group of Experts (SAGE) on Immunisation convened a Working Group\textsuperscript{8} in recognition of the growing prevalence of vaccine questioning and hesitation, which sometimes lead to vaccine delays and refusals. In the context of the working group research and deliberations, three key domains of influence driving vaccine hesitancy were defined: confidence (trust in the safety or efficacy of the vaccine), convenience (ease of access), and complacency (perception of the risk of disease and importance of immunisation).\textsuperscript{9} In the research addressed in the paper, we examine overall confidence in the health system generally as well as immunisation, then investigate vaccine hesitancy and its reasons, and finally query whether hesitancy led to acceptance or refusal of a vaccine or vaccines. We categorise the reasons for hesitancy reported into the domains of confidence, convenience, and complacency.

Individuals may lack confidence in the safety or efficacy of vaccines for a variety of reasons. They may lack confidence as a result of negative experiences with the product, providers, or those making the policy decisions. They may hold religious or philosophical beliefs that lead them to prefer traditional rites, prayers, or homeopathic remedies over biomedical interventions.

Vaccine confidence is not merely an individual phenomenon, but a social and political phenomenon as well. When vaccine-hesitant individuals reach a critical mass in a population, and do not receive adequate attention and engagement from health authorities on the specific issues they may have with a vaccine, they may form coalitions of varying looseness or consensus. Examples include coalitions\textsuperscript{10} which pressured the Indian government to suspend an HPV vaccine demonstration project, and another which pressured the suspension of the HPV vaccine recommendation in Japan.

Vaccine confidence metrics can provide valuable cues to changing public sentiment about vaccines and the potential for consequent changes in vaccine coverage. More refined studies can provide needed local detail to understand the drivers of shifts in confidence and inform the appropriate response needed.

Measuring vaccine confidence is an emerging science. In developing our Vaccine Confidence Index (VCI), we have taken cues from other social science tools that measure confidence more generally. The closest analogue to the VCI is the Consumer Confidence Index (CCI), which measures consumer confidence, defined as the degree of optimism about the state of the economy – deemed important because consumers’ confidence is reflected in their spending and saving behaviour, which in turn impacts the larger economy. The CCI is dependent on larger social, national, and regional economic issues. The Vaccine Confidence Index (VCI) is analogous to the CCI in that it too places a finger on the pulse of a set of public sentiments, which influence vaccination behaviours, with consequences for the whole population. In the case of the VCI, the sentiments in question are confidence in vaccination and the entities with which it is associated, and, like the sentiments measured by the CCI, vaccine sentiments are influenced by broader social dynamics.
The VCI can likewise be a potentially useful tool for researchers and policy-makers, and could provide an empirical basis for monitoring vaccine confidence over time in a number of regions. We report here the results from the first five countries surveyed as an initial pilot of a Vaccine Confidence Index. These findings indicate the viability of this approach to measure vaccine-related confidence (that is, sentiments as they influence vaccination behaviours), and illustrate the relationships between these sentiments and public attitudes towards health services more broadly. These confidence metrics are currently being rolled out in additional countries, contributing to our global mapping of vaccine confidence, which will be updated over time and strengthened with more local level confidence mapping.

**Country Backgrounds**

The five countries chosen for the initial launch of the Vaccine Confidence Index have each faced a confidence crisis, and they have addressed these confidence challenges with differing levels of success.

Nigeria was the site of one of the most significant episodes of a vaccine confidence crisis that had substantial public health consequences. In August 2003, a polio vaccination boycott was announced in five northern states and persisted in Kano State for eleven months, only being resolved in July 2004. The boycott seeded a resurgence of polio in Nigeria as well as outbreaks across three continents (Figure 1),\textsuperscript{11} and cost over $500 million.\textsuperscript{12} Poliovirus incidence peaked in 2006, with 1143 confirmed cases, but has since dropped back down, now at its lowest-ever levels, with only 6 confirmed cases of wild polio virus reported at the end of 2014.\textsuperscript{13}
Fig. 1: “A Warning from History”

Published originally in the November 2012 Report of the Independent Monitoring Board of the Global Polio Eradication Initiative, this figure presents the spread of poliovirus from Nigeria following the 2003-2004 boycott.

As the rumours were building up in northern Nigeria just over a decade ago, the India polio programme also encountered distrust, including similar rumours of sterilisation, among marginalised and underserved communities in the states of Uttar Pradesh and Bihar. Years of targeted efforts to build trust and confidence, in the vaccine as well as in the polio programme as an institution, were key contributors to India’s being declared polio free a decade later in January 2014.

In 1998, the UK was the epicentre of perhaps the most infamous confidence crisis in recent memory, which led to widespread anxieties, declines in vaccine acceptance and consequent measles outbreaks, following the publication of now-debunked research by Andrew Wakefield suggesting links between the MMR vaccine and autism. MMR vaccine coverage reached a nadir in 2003 in England, and it took years of routine opinion surveys to better understand the nature of public concerns, followed by community engagement and trust building, before the MMR vaccine coverage rate finally returned to pre-1998 levels in 2014, 15 years after the publication which prompted the public panic.

In 2002, Georgia experienced a suspected adverse event following a Hepatitis B vaccination, which prompted negative media and public anxiety. While confidence levels and Hepatitis B vaccine acceptance have improved following the initial decline, they have still not reached pre-2002 levels.15
In Pakistan, a ban on polio vaccination in North and South Waziristan has persisted since June 2012 linked to a demand to stop Drone strikes. Not only has polio vaccination become highly politicised, but the ban in Waziristan has fuelled both local and international polio outbreaks – including an outbreak of the Pakistani strain in Syria, already burdened by a civil war and broken health systems. Pakistan's own confirmed polio cases jumped from 74 in 2012 to 193 in 2013, and then to 305 in 2014, and the total number of Wild polio virus (WPV1) in neighboring Afghanistan doubled from 14 cases in 2013 to 28 cases in 2014, largely due to cross border transmission from Pakistan.

Methods

The generation of data on vaccine confidence reported and analysed here was made possible through an agreement between The Vaccine Confidence Project at the London School of Hygiene & Tropical Medicine and “Global Public Health Polling Network” jointly managed by ORB International, UK and Gallup Pakistan, affiliates of WIN-Gallup International. The Global Public Health Polling Network incorporated a set of questions on vaccine confidence, developed by the Vaccine Confidence Project, into larger surveys being conducted in the many countries in which WIN-Gallup International operates. The fieldwork was conducted by ORB International in the UK and (with the assistance of Dr. Ibrahim Yisa) in Nigeria, and by Gallup Pakistan, C Voters, and GORBI in Pakistan, India, and Georgia respectively. The resulting dataset offers not only a broad (and growing) international sample of vaccination sentiments and behaviours, but also includes extensive data on respondents’ social context and other attributes, collected as part of the larger surveys in these countries. Data collection methods in each of the five countries surveyed are described below.

Data collection in Pakistan consisted of face-to-face in-house interviews in Urdu with 2609 respondents, selected by multi-stage random area probability sampling, between 31 March and 7 April 2014, in Punjab, Sindh, Khyber Pakhtunkhwa, and Baluchistan. Findings were then weighted according to rural and urban population share in each province, based on the 1998 Population Census.

Data collection in the UK consisted of online interviews with 2055 respondents, between 23 and 24 April 2014, in England, Scotland, and Wales. To compensate for the effects of self-selection of respondents choosing to participate in the survey, findings were then weighted on demographic variables, according to census figures.

Data collection in India consisted of computer-assisted telephone interviewing (CATI) of 1259 respondents, selected from a random sample of phone numbers covering all regions of India, between 9 and 11 April 2014. Findings were then weighted according to the known census profile. Interviews were conducted in the relevant local languages: Hindi, Punjabi, Urdu, Gujarati, Marathi, Kannada, Malayalam, Tamil, Telugu, Odiya, Bangla and Asamiya.

In Nigeria, both households and health providers were surveyed. Data collection in Nigerian households consisted of face-to-face interviews (using personal digital assistants [PDAs]) with 12554 respondents from Enugu, Jigawa, Kaduna, Kano, and Lagos, selected from master sample frames for enumeration areas defined by the National Bureau of Statistics (NBS). Survey materials
were translated into Yoruba, Igbo, and Hausa. Findings were then weighted according to information about these enumeration areas, also provided by the NBS.

A total of 1272 providers in Nigeria were also interviewed in the 968 facilities participating in the survey. Providers were defined as health workers trained to provide obstetric care and child care services, on the assumption that these individuals have final responsibility for obstetric and child health care.

Data collection in Georgia consisted of computer assisted personal interviewing (CAPI) of 1000 respondents, selected using multi-stage stratified sampling based on quotas for age, gender, and education, carried out between 23 August and 1 September 2014. Survey materials were translated in to Georgian and Russian.

In our analysis, for respondents without children under five, only a general question was asked about perceptions of vaccine coverage. (see Figure 6, appendix) More detailed questions focused on the subset of respondents who were parents of children under 5 (except in Georgia, where parents were defined as having children under 15). We examine relationships between vaccination behaviour and opinions on vaccination and government health services more broadly, reported instances of vaccine hesitancy and their reasons, ultimate decision about whether to vaccinate, and variation in responses based on country contexts and demographic factors. Reasons for hesitancy given by vaccine-hesitant respondents were classified as relating to confidence (concerns about the safety or efficacy of the vaccine, previous bad experiences, or preference for alternative health approaches), convenience (access issues), complacency (perceptions that the vaccine was unimportant or unnecessary), or other responses categorised as “other/don’t know/no reason.”

Results

Overview

The numbers of respondents in each country were: India (n=1259); Pakistan (n=2609); UK (n=2055); Nigeria Households (n=12554); Nigeria Providers (n=1272), Georgia (n=1000).

Figure 2 shows a breakdown of respondents in each country by whether they had children under five, if so, whether they had ever hesitated to vaccinate their child, and if so, whether they ultimately had the vaccine or did not have the vaccine. Georgia shows the highest percentage (60%) of vaccine refusers among those who reported hesitancy, followed by Nigeria Households where 22.7% of households reporting hesitancy refused vaccination.

Table 1: Survey Size and Prevalence of Hesitancy and Refusal

Vaccination behaviours of hesitancy and refusal are presented both in absolute numbers, and as proportions. Hesitancy is presented as a proportion of respondents with children equal to or under five (RCU5), except for Georgia(*) which represents under 15 years of age, and refusal is presented as a proportion of respondents who hesitated.
The UK sample contained fewer respondents with children under five years of age (RCU5s) than the other countries surveyed. UK RCU5s were more likely to hesitate to vaccinate, compared to RCU5s in other countries. In Georgia, by contrast, hesitants made up a smaller proportion of RCU5s, but of those who hesitated, a majority reported not receiving the vaccine. In all countries but India, RCU5s were more likely (compared to respondents who did not have children under five) to believe that all or most people in their community get their children vaccinated, and less likely to say they “don’t know” how many get their children vaccinated.

**Association with Confidence in Other Services**

In all five countries surveyed, overall confidence in immunisation was high; outside of the UK where confidence in emergency services was slightly higher than in immunisation programmes, confidence in immunisation services was higher than confidence in family planning services, in health workers and in the general health system (see Figure 2).
Public confidence in immunisation programmes was more closely associated with confidence in the broader health system in the UK (Spearman’s $\rho=0.60$), compared to Nigeria ($\rho=0.55$), Pakistan ($\rho=0.45$), and India ($\rho=0.42$), which all had higher confidence in immunisation services than in the health system generally. In all countries but the UK, immunisation services received stronger confidence ratings than the health system. Providers in Nigeria expressed very high confidence in both immunisation programmes and family planning services, and as a result health provider confidence in immunisation programmes in Nigeria showed a very strong association ($\rho=0.68$) with confidence in the health system (see Figure 3). Indeed, Nigerian health providers’ high confidence ratings for all services resulted in this group of respondents showing the strongest associations between confidence in immunisation programme and confidence in all other services (compared to the confidence expressed by the general public in any of the countries surveyed).
These contingency tables illustrate the varying association between confidence in immunisation programmes and confidence in the broader health system in India, Pakistan, the UK, and households and providers in Nigeria.

Public confidence in immunisation programmes was more closely associated with confidence in emergency services in the UK (ρ=0.55), compared to India (ρ=0.45). In India, confidence in immunisation services exceeded confidence in emergency services, whereas in the UK emergency services received slightly greater confidence than immunisation services (see Figure 7, Appendix).

Public confidence in immunisation programmes was more closely associated with confidence in family planning services in India (ρ=0.58) and Pakistan (ρ=0.56) than in Nigeria (ρ=0.43), where lower confidence in family planning (average confidence score of 0.5) persisted among those with high confidence in immunisation (average confidence score of 1.6). Among Nigerian providers, the association between confidence in immunisation programmes and confidence in family planning services was very high (ρ=0.76). Confidence in immunisation programmes was stronger than confidence in family planning services in all countries (see Figure 8, Appendix).

Public confidence in immunisation programmes was more closely associated with confidence in community health workers in the UK (ρ=0.58) than in Pakistan (ρ=0.48), Nigeria (ρ=0.53), or India (ρ=0.36), and in all countries confidence was higher in immunisation services than in community health workers. As in the other comparisons described above, Nigerian providers expressed high confidence both in immunisation programmes and community health workers, leading to a strong association between confidence ratings for each (ρ=0.67). Confidence in immunisation programmes was stronger than confidence in community health workers in all countries, though only by a small margin for the UK public. (See Figure 9, Appendix).

**Confidence as a Sentiment Linked to Behaviours of Hesitancy and Refusal**

Since vaccine confidence has been defined here as a sentiment or mental attitude that increases the likelihood of hesitating and/or refusing to vaccinate, it is important to ask how this relationship is
reflected in these data. Figure 4 illustrates, in each country for which the requisite data are presently available, the variation in the probability of vaccine hesitancy among RCU5s, depending on reported level of confidence in immunisation programmes. In every country, we observe a clear trend in which lower levels of confidence are associated with higher levels of hesitancy. There is considerable variation between countries in the probability of hesitancy at a given confidence level. For example, reporting no confidence at all in immunisation programmes is associated with a 17% hesitancy rate in India, compared to 50% in Pakistan. It should be noted that reported confidence in immunisation programmes is merely the most obvious single variable in this dataset to interpret as “vaccine confidence,” and other variables and combinations of variables would naturally be incorporated into a refined “Vaccine Confidence Index” metric.

**Fig. 4: Relationship between Vaccine Confidence and Vaccination Behavior**

Probability of having hesitated to vaccinate in the past, according to expressed level of confidence in immunisation programmes, in each country for which the requisite data are available. Dotted lines indicate average hesitancy rate for RCU5s, irrespective of confidence in immunisation programmes.

**Reasons for Hesitancy**

Reasons for hesitancy given by vaccine-hesitant respondents were classified as relating to confidence, convenience, complacency, or other/don’t know (DK)/no reason (NR). Overall, the highest percentage of reasons for hesitancy was due to confidence issues. Figure 5 shows the distribution of hesitant respondents in each country, categorised by their reason for hesitancy (confidence, convenience, complacency, or other), and by ultimate behavioural outcome (vaccine acceptance or refusal).

**Table 2: Reasons for Hesitancy**

Reasons for hesitancy were classified using the categories of confidence, convenience, and complacency.
### Key Findings at the Nigerian State Level

Focusing on findings from the Nigerian states of Enugu, Jigawa, Kaduna, Kano, and Lagos, it is still possible to see the effects of the 2003-2004 boycott, ten years on. In Kano state, the site of the longest-lasting boycott, hesitancy rates are not exceptionally high, but unlike in other states, a high percentage (74%) of hesitants went on to refuse vaccination (see Table 3). These preliminary findings indicate some variation in “obstinacy” (tendency of hesitants to ultimately refuse), particularly evident in Kano and Enugu states.

#### Table 3: Hesitancy and Refusal Rates at Nigerian State Level

<table>
<thead>
<tr>
<th>Country</th>
<th>Confidence</th>
<th>Convenience</th>
<th>Complacency</th>
<th>Other/DK/NR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Georgia</td>
<td>69%</td>
<td>6%</td>
<td>8%</td>
<td>17%</td>
</tr>
<tr>
<td>India</td>
<td>49%</td>
<td>18%</td>
<td>3%</td>
<td>31%</td>
</tr>
<tr>
<td>Nigeria</td>
<td>36%</td>
<td>20%</td>
<td>18%</td>
<td>26%</td>
</tr>
<tr>
<td>Pakistan</td>
<td>33%</td>
<td>20%</td>
<td>6%</td>
<td>41%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>79%</td>
<td>6%</td>
<td>13%</td>
<td>1%</td>
</tr>
</tbody>
</table>
Hesitancy is given in absolute numbers and as a proportion of respondents with children under five years of age. Refusal is given in absolute numbers and as a proportion of hesitants.

<table>
<thead>
<tr>
<th>State</th>
<th>With Child £ 5 yrs (RCU5)</th>
<th>Hesitants</th>
<th>Hesitants as % of RCU5s</th>
<th>Refusers</th>
<th>Refusers as % of Hesitants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enugu</td>
<td>841</td>
<td>44</td>
<td>5.23 %</td>
<td>13</td>
<td>29.55 %</td>
</tr>
<tr>
<td>Jigawa</td>
<td>637</td>
<td>101</td>
<td>15.86 %</td>
<td>10</td>
<td>9.90 %</td>
</tr>
<tr>
<td>Kaduna</td>
<td>701</td>
<td>96</td>
<td>13.69 %</td>
<td>16</td>
<td>16.67 %</td>
</tr>
<tr>
<td>Kano</td>
<td>604</td>
<td>31</td>
<td>5.13 %</td>
<td>23</td>
<td>74.19 %</td>
</tr>
<tr>
<td>Lagos</td>
<td>904</td>
<td>36</td>
<td>3.98 %</td>
<td>8</td>
<td>22.22 %</td>
</tr>
<tr>
<td>Total</td>
<td>3687</td>
<td>308</td>
<td>8.35 %</td>
<td>70</td>
<td>22.73 %</td>
</tr>
</tbody>
</table>

Limitations

There are a number of limitations in this first of a series of country vaccine confidence studies. First, survey methods varied somewhat between countries. For example, in Nigeria data were collected by face-to-face interviews conducted within households, while in the UK the survey was completed online. These different formats could have impacted responses.

Although the same core questions were repeated across the five countries, the full set of questions posed in the survey was not precisely the same in every country. This limited the breadth of comparisons possible, where, for example, surveys in India and the UK asked respondents about their confidence in emergency services, but other countries did not. Furthermore, in Georgia the local team did not include the questions on confidence in immunisation programmes or other health services so this phenomenon could not be considered in the comparison. Also respondents in Georgia were asked whether they had children under 15 years of age, as opposed to five years of age as in other countries surveyed.

These factors might introduce unaccounted-for variation in findings between countries. Therefore comparisons between country contexts should be made with some reserve, at least with these early results. Nonetheless, one of the striking results of these surveys is the remarkable consistency in trends observed across most or all countries, as discussed further below in the conclusions section.

Conclusion

The first conclusion to draw from these findings is that medium-to-high confidence in vaccines and immunisation programmes is the norm, and vaccine hesitancy and refusals are relatively rare. Nonetheless, even small groups of hesitant or refusing individuals can severely undermine an immunisation programme in certain circumstances, such as when political actors in Nigeria and Pakistan mobilised local boycotts that have had both national and international repercussions. This begs the question, “How much confidence is enough?”

Second, the finding that higher confidence in immunisation programmes correlates with lower vaccine hesitancy and lends support to the premise that confidence in vaccination is connected to confidence in the broader system with which it is associated.

Thirdly, confidence issues constituted the most prevalent reasons for vaccine hesitancy and refusals (except in Georgia). Although the survey questions were designed by those within The Vaccine
Confidence Project, and those coding free-form “other” responses were not blinded, the questions allowed ample opportunity for respondents to give answers other than those related to confidence, and the classification of answers within the confidence/ convenience/ complacency framework was agreed by independent coders.

Returning to the question of “how much confidence is enough?” there is no clear watershed confidence level that is consistent across every country – in India and the UK, hesitancy rises sharply between “a lot” and “a little” confidence, whereas in Pakistani and Nigerian households the distinction between “a little” and “not very much” appears to have more impact on behaviour. Linguistic differences between these countries may result in different translated meanings of “a little” and “not very much”. Alternatively, it is possible that contextual or demographic variables mediate between confidence sentiments and vaccination behaviour, and variation in these mediators gives rise to the between-country variations observed here.

At the societal level, the question of, “how much confidence is enough?” can be posed in terms of a “tipping point.” In other words, is there a critical proportion of the population that must remain vaccine-confident for the system as a whole to remain resilient to a “crisis of confidence,” in which doubt becomes prevalent enough that it becomes self-reinforcing? Is there a crucial point beyond which previously-confident laypersons begin questioning the vaccine, healthcare providers become less willing to promote it, and policy-makers consider withdrawing a recommendation for an effective and safe vaccine for fear of public disapproval? Is it more dangerous if a small part of the population to lose a great deal of confidence, or if a larger group becomes only slightly less confident? And, again, what contextual factors heighten the risk of a crisis at any given level of vaccine confidence?

Answering these questions will require data gathered from multiple countries, over time, which redoubles the need for confidence surveys at the global scale. This global vaccine confidence mapping initiative is the beginning of a longer-term effort, which will be refined and expanded to multiple countries. In effect, we are attempting to launch a large cohort study of as many countries of the world as possible. If the cohort is large enough, and the timescale is long enough, then it will become possible to relate “incident cases” of vaccine confidence crisis to the “exposures” measured through surveys of confidence and relevant contextual and demographic factors, permitting ascertainment of the “risk factors” for crises with both quantitative rigour and qualitative depth.

We expect that this Vaccine Confidence Index and the insights it generates will help inform the strengthening of local and global vaccine confidence in the years to come.

**Competing Interests**
The authors have declared that no competing interests exist.

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assistance with part of the Hausa translation.

Appendix 1

Supplemental Figures
Figure 6: Perceptions of vaccine coverage
This figure compares perceptions of how many people get vaccinated among those respondents without children under 5 (outer ring) to those reported by those with children under five RCU5s (inner circle).

Fig. 7: Confidence in Immunisation Programme and Emergency Services
These contingency tables illustrate the varying association between confidence in immunisation programmes and confidence in emergency services in India and the UK.
These contingency tables illustrate the varying association between confidence in immunisation programmes and confidence in family planning programmes in India, Pakistan, and households and providers in Nigeria.
Fig. 9: Confidence in Immunisation Programme and Community Health Workers

These contingency tables illustrate the varying association between confidence in immunisation programmes and confidence in community health workers in India, Pakistan, the UK, and households and providers in Nigeria.

References

  Reference Link
  Reference Link
  Reference Link
  Reference Link
• Global Polio Eradication Initiative

Tags: vaccine hesitancy
Factors Associated with Intention to Receive Influenza and Tetanus, Diphtheria, and Acellular Pertussis (Tdap) Vaccines during Pregnancy: A Focus on Vaccine Hesitancy and Perceptions of Disease Severity and Vaccine Safety

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Abstract

BACKGROUND: Improving influenza and tetanus, diphtheria and acellular pertussis (Tdap) vaccine coverage among pregnant women is needed.

PURPOSE: To assess factors associated with intention to receive influenza and/or Tdap vaccinations during pregnancy with a focus on perceptions of influenza and pertussis disease severity and influenza vaccine safety.

METHODS: Participants were 325 pregnant women in Georgia recruited from December 2012 – April 2013 who had not yet received a 2012/2013 influenza vaccine or a Tdap vaccine while pregnant. Women completed a survey assessing influenza vaccination history, likelihood of receiving antenatal influenza and/or Tdap vaccines, and knowledge, attitudes and beliefs about influenza, pertussis, and their associated vaccines.

RESULTS: Seventy-three percent and 81% of women believed influenza and pertussis, respectively, would be serious during pregnancy while 87% and 92% believed influenza and pertussis, respectively, would be serious to their infants. Perception of pertussis severity for their infant was strongly associated with an intention to receive a Tdap vaccine before delivery (p=0.004). Despite perceptions of disease severity for themselves and their infants, only 34% and 44% intended to receive antenatal influenza and/or Tdap vaccines, respectively. Forty-six percent had low perceptions of safety regarding the influenza vaccine during pregnancy, and compared to women who perceived the influenza vaccine as safe, women who perceived the vaccine as unsafe were less likely to intend to receive antenatal influenza (48% vs. 20%; p < 0.001) or Tdap (53% vs. 33%; p < 0.001) vaccinations.

CONCLUSIONS: Results from this baseline survey suggest that while pregnant women who remain unvaccinated against influenza within the first three months of the putative influenza season may be aware of the risks influenza and pertussis pose to themselves and their infants, many remain reluctant to receive influenza and Tdap vaccines antenatally. To improve vaccine uptake in the
obstetric setting, our findings support development of evidence-based vaccine promotion interventions which emphasize vaccine safety during pregnancy and mention disease severity in infancy.

**Funding Statement**

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**Related Articles**

The article is part of the *PLOS Currents Outbreaks “Vaccine Hesitancy Collection”*. 

**Introduction**

Respiratory infections like influenza and pertussis during pregnancy can pose serious risks to mother and infant,\(^1\,2\,3\,4\,5\,6\,7\,8\) Pregnant women are at increased risk of complications from influenza, and infants are not recommended to receive an influenza vaccine until 6 months of age.\(^9\) For pertussis, infants under 2 months of age, prior to the recommended age for vaccination, have the highest rates of hospitalization and death.\(^10\) Antenatal vaccination against these diseases not only protects mothers, but studies have suggested protection can be conferred to infants through maternal-fetal transfer of antibodies through the placenta.\(^12\,13\) Influenza vaccination during pregnancy can also protect against adverse fetal outcomes like preterm birth and small for gestational age as well as respiratory illnesses during infancy.\(^14\,15\)

Antenatal influenza vaccination recommendations have been in place since the 1960’s\(^16\) , and in the U.S., the Centers for Disease Control and Prevention (CDC) began recommending tetanus, diphtheria, and acellular pertussis (Tdap) vaccination during pregnancy, preferably in the third or late second trimester, in 2011.\(^17\) Based on previous research among pregnant women and healthy adults, both vaccines are considered safe during pregnancy.\(^18\,19\,20\,21\,22\,23\,24\) Despite CDC recommendations, coverage estimates for both vaccines remain suboptimal in the U.S. The influenza vaccine coverage rate estimated by CDC among pregnant women is the U.S. for the 2012 – 2013 season was 50.5%, and while coverage rates for antenatal Tdap vaccination are not yet available, estimates range between 2.6% – 10% (CDC, unpublished data, 2012).

Vaccinating pregnant women is a challenge. Studies exploring barriers to vaccinating women in the obstetric setting suggest that logistic barriers such as lack of storage space, knowledge gaps regarding vaccine safety or vaccine recommendations, and vaccine hesitancy all contribute to immunization decision-making.\(^25\) The aim of this descriptive analysis is to identify factors associated with an intention to receive influenza and/or Tdap vaccines during pregnancy among women who remained unvaccinated against influenza within the first three months (September – November) of the putative 2012/2013 influenza season in the U.S.
Methods

Pregnant women included in these analyses were enrolled as part of a larger group-randomized trial entitled the “Emory MOMVAX study” to evaluate the effectiveness of a comprehensive, evidence-based vaccine education and promotion package on increasing antenatal influenza and Tdap vaccination in the obstetric setting. Women were recruited between December 11, 2012 and April 22, 2013 from 11 obstetric practices in Georgia participating in the Emory MOMVAX study. Recruiting women who remained unvaccinated against influenza by December likely increased the number of vaccine-hesitant women in our sample since women more likely to seek or accept vaccinations would have already received an influenza vaccination.

Following provision of informed consent, women were given a 28-item baseline survey in English to complete in the waiting area. These survey results are the focus of this paper. The survey included questions on demographics, influenza vaccine history, and knowledge, attitudes, and beliefs about influenza, pertussis and their accompanying vaccines during pregnancy. Perceptions of influenza vaccine safety were assessed through the level of agreement with the statement “Getting a flu vaccine while pregnant seems risky.” Perceptions of influenza and pertussis severity were assessed through the question “How serious do you think it would be if you got the following illnesses while pregnant?” Likewise, perceptions of influenza and pertussis severity during infancy were assessed through the question “After delivery, how serious do you think it would be if your newborn baby got the following illnesses within their first 6 months?” A team of clinicians, behavioral researchers, and communication specialists reviewed the questionnaire items to ensure clarity and adequacy of comprehension prior to administration.

Women were recruited by trained study personnel from the waiting areas of each participating practice. Eligibility criteria for participation were: being between 18 years and 50 years old, English-reading, currently pregnant, had not yet received a 2012 – 2013 seasonal influenza vaccine, and had not yet received a Tdap vaccine during their current pregnancy. After screening, written informed consent was obtained from each eligible woman interested in enrolling prior to administration of the baseline survey. While the intent was to complete the baseline survey prior to exposure to any intervention materials under evaluation in the MOMVAX study, if a woman was unable to finish the baseline survey prior to being called back for her scheduled appointment, she could complete the survey following her appointment. If, however, the woman returned to complete the baseline survey and indicated she had received an influenza and/or Tdap vaccine during her visit, she was no longer eligible for enrollment. At the time of enrollment and completion of the baseline survey, no attempts were made by the study personnel to provide any information about influenza, pertussis or their respective vaccinations.

The Institutional Review Boards of Emory University and the Medical Center of Central Georgia reviewed and approved this study. SAS version 9.3 statistical software (SAS Institute, Cary, NC) was used in 2013 for data analysis, including frequency calculations and proportion comparisons with chi-square and Fisher’s exact tests. Women for whom survey data were missing on any given variable were retained in the denominator for univariate frequency calculations; missing data occurring in <1% of women were excluded from bivariate analyses, unless otherwise noted. Bivariate associations with a p-value < 0.05 were considered statistically significant.
Results

One-thousand four-hundred and thirty-six women were screened between December 11, 2012 – April 22, 2013. [Figure 1]

Fig. 1: Schematic of study population included and excluded from baseline survey analyses.

Three-hundred eighty-eight women were eligible, and 325 women were enrolled and completed the baseline survey. Among 1,037 pregnant women screened, 609 (59%) and 212 (20%) were ineligible because they had already received a 2012 – 2013 influenza vaccine or a Tdap vaccine, respectively. The mean age of participants was 27.2 years and the mean parity was 1.1 children. Approximately 47% of participants were Caucasian/White and 41% were African American/Black. [Table 1]
Table 1: Maternal characteristics and associations with intention to receive antenatal influenza and Tdap vaccines

The proportion of participants reporting at least some type of private health insurance was approximately equivalent to the proportion reporting no insurance or coverage only by Medicaid (43.4% vs. 42.5%).

More than half (57%) of the women reported not having received a seasonal influenza vaccine in the past five years, while another 19% reported having only received a seasonal influenza vaccine once in the past five years. [Table 1] Sixty percent of participants considered their OB/GYN their
primary care physician, yet two-hundred sixteen (66%) reported never having received any type of vaccine in an OB/GYN doctor’s office. Thirty women (9%) reported having received a seasonal and/or H1N1 influenza vaccine in an OB/GYN’s office before. Over one quarter (26%) reported feeling hesitant (i.e. worried or concerned) about receiving vaccines recommended by their physician during pregnancy.

White women were significantly more likely to intend to receive a Tdap vaccine during their current pregnancy than women of other races, and intention to receive an influenza vaccine was significantly associated with the number of times treated by a healthcare provider in the past year. [Table 1] Intention to receive antenatal influenza and/or Tdap vaccines was also significantly associated with previous receipt of influenza vaccination in the past five years. There were no significant differences in proportions of women enrolled in control arm practices versus intervention arm practices on perceptions of disease severity during pregnancy, perceptions of disease severity for their newborn, intended likelihood of antenatal influenza vaccine receipt, intended likelihood of antenatal Tdap vaccine receipt, vaccine hesitancy, or perceptions of safety of influenza vaccination during pregnancy (data available upon request).

Two-hundred sixty five women (82%) agreed with the statement “Influenza is a concern for pregnant women,” and 238 (73%) believed influenza infection would be serious or very serious during pregnancy. Two-hundred sixty two (81%) believed contracting pertussis during pregnancy would be serious or very serious. Additionally, 87% and 92% believed influenza and pertussis, respectively, would be serious or very serious to their newborn within the first six months of life. Despite perceptions of severity, only 112 (34%) and 143 (44%) reported they were likely to receive an influenza vaccine or Tdap vaccine, respectively, during their current pregnancy. [Figure 2]

![Figure 2](image)

**Fig. 2:** A). Perceived severity of influenza and pertussis during pregnancy and intention to get vaccinated during pregnancy B) Perceived severity of influenza and pertussis during first 6 months of infancy and intention to get vaccinated during pregnancy

Perception of influenza disease severity for themselves or their newborns was not significantly associated with an intention to receive an influenza vaccine during pregnancy, but perception of pertussis severity for their infant was strongly associated with intention of antenatal Tdap vaccination (p=0.004). [Figure 2]

Regarding influenza vaccine safety, 149 women (46%) agreed with the statement “Getting an influenza vaccine while pregnant seems risky.” Compared to women who perceived the vaccine as
safe, women who had low perceptions of influenza vaccine safety were significantly less likely to intend to receive an influenza vaccine (48% vs. 20%; p < 0.001) or a Tdap vaccine (53% vs. 33%; p < 0.001) during their current pregnancy. [Figure 3]

While a lower perception of influenza vaccine safety was associated with a higher probability of non-intention to be vaccinated, substantial proportions of women who perceived the influenza vaccine as safe still did not intend to be vaccinated (52% and 47% for influenza and Tdap, respectively). [Figure 3]

![Figure 3: Perception of safety of influenza vaccine during pregnancy and intention to receive influenza or Tdap vaccinations during pregnancy](image)

**Discussion**

Antenatal vaccination against influenza and pertussis not only protects the mother from contracting these diseases, but it is also the first step towards protecting infants during their first 3 months of life. Efforts have been made in the U.S. by the American Congress of Obstetrics and Gynecology (ACOG) and other public health entities to stress the importance of influenza and Tdap vaccination during pregnancy. With nearly 60% of pregnant women screened for this study ineligible to enroll because they reported having already received a 2012 – 2013 influenza vaccine, efforts in promoting antenatal influenza vaccination have been successful. In contrast, this study suggests that among pregnant women who remain unvaccinated against influenza by December (when most women willing to get vaccinated probably would have already received the influenza vaccine), a hesitancy that surpasses general concerns about vaccine safety remains.

While results from this survey underscore findings from other studies which describe influenza vaccine hesitancy among pregnant women, the influenza-based findings presented here are juxtaposed with new insights on perceptions of Tdap vaccination during pregnancy. Most women enrolled in this study were aware of the dangers influenza and pertussis pose to themselves and their infants, yet over one-quarter indicated hesitancy about receiving any vaccines recommended during pregnancy. Nearly half of women perceived the influenza vaccine as unsafe during pregnancy, and more women were likely to receive a Tdap vaccine than an influenza vaccine for all levels of perceived disease severity for themselves. Since contracting influenza is more common and poses a greater threat to pregnant women than pertussis, it is concerning that more
women perceived pertussis as more serious during pregnancy than influenza. 

Even though 60% of participants consider their OB/GYN to be their primary care physician, only one-third reported ever receiving a vaccine from their OB/GYN. These data mirror findings from other healthcare utilization studies and illuminate a gap in both service and expectation in the adult immunization system. Continuing to make vaccination a routine part of women’s health can help normalize vaccination within the obstetric setting. As obstetric healthcare providers become more accustomed to and comfortable with providing vaccines, women (pregnant or otherwise) will have greater access to and possibly acceptance of vaccines.

It is important to note the chronological context of this survey in relation to recent changes in antenatal Tdap recommendations in the U.S. While the U.S. Advisory Committee on Immunization Practices (ACIP) first recommended provision of Tdap at every pregnancy in October 2012, there were gaps between when this recommendation was made and when it was published. Since this survey was administered between December 2012 and April 2013, data were collected during the initial rollout of these new recommendations. By virtue of its timing, this survey provides a baseline assessment of pregnant women’s perceptions towards pertussis and Tdap in the U.S., thereby enabling changes in perceptions to be measured from this point forward.

This study has some important limitations. Since data were collected by self-report and not verified with medical records or vaccine registry data, there is potential for recall bias. Any recall bias which may have been introduced is assumed to have been non-differential with respect to characteristics likely to be associated with intention to receive antenatal influenza and/or Tdap vaccines. Additionally, while we excluded women who indicated having received an influenza and/or Tdap vaccine before completing her baseline survey, some women enrolled from intervention arm practices could have been exposed to the vaccine promotion materials under evaluation in the MOMVAX study prior to completing their baseline surveys. Since we did not find any significant differences between arms of the MOMVAX study on baseline measures of perceptions of disease severity, intended likelihood of vaccine receipt, vaccine hesitancy, or perceptions of safety of influenza vaccination during pregnancy, we do not believe limited exposure to promotional intervention materials related to the MOMVAX study prior to completion of the baseline survey had a differential impact on the women enrolled from intervention arm practices versus control arm practices. This study was also U.S.-based, so while results may be applicable to other countries, it may be important to replicate this type of survey among late-acceptors of antenatal influenza vaccines in other regions as well.

To further improve antenatal influenza vaccine coverage and to encourage antenatal Tdap vaccination, promotional efforts tailored specifically to late acceptors of influenza vaccination or vaccine-hesitant women is important. Other studies which have tested messaging techniques have started to emphasize this need to adapt messages based upon individuals’ preconceptions and attitudes towards vaccination. Since these results show that perceiving pertussis as serious for their infant is strongly associated with intention to receive an antenatal Tdap vaccine, explaining disease effects on infants may be an effective promotional strategy for women reluctant to receive vaccines. Continuing to promote, discuss, and offer influenza vaccine repeatedly and late into an influenza season is especially important for women who may be hesitant, but still interested in
receiving an influenza vaccine. Likewise, continuing to discuss and promote Tdap vaccination throughout pregnancy can remind and encourage women to receive a Tdap vaccination before delivery. Since patient education on antenatal vaccination is likely to come from obstetricians, continuing to develop and evaluate nuanced tools for promoting influenza and Tdap vaccines during pregnancy is needed.

**Competing Interest**

Allison Chamberlain, Katherine Seib, Paula Frew, Marielysse Cortés, Ellen Whitney, Ruth Berkelman, Saad Omer, Walter Orenstein, Fauzia Malik, Pat Cota and Lisa Flowers have no conflicts of interest to report. Kevin Ault has acted as a consultant on maternal immunization with the Centers for Disease Control and Prevention, the National Institute of Allergy and Infectious Diseases and the American College of Obstetricians and Gynecologists. He also serves on a data safety and monitoring committee with Novartis.

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Tags: Influenza · maternal vaccination · pertussis · vaccination · vaccine hesitancy

Why Are Young Adults Affected? Estimating Measles Vaccination Coverage in 20-34 Year Old Germans in Order to Verify Progress Towards Measles Elimination

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Print or Save PDF Citation XML

Authors

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Abstract

Background:
The introduction of measles vaccination into routine childhood vaccination programmes has led to a shift of disease burden and incidence among young adults. This was confirmed by the recent rise in measles cases and outbreaks throughout Europe. To prevent outbreaks and eliminate measles, one of the key objectives of the WHO Europe measles elimination framework is achieving overall vaccination coverage of ≥95% in the population on a district level.

In the absence of national registers, data on vaccination coverage in Germany is recorded at the age
of school entry, through insurance refund claim data and population studies. Vaccination status (VS) of young adults is largely unknown.

Methods:
We assessed measles vaccination coverage in young adults aged 20-34 years on a district level of the German Federal State of Rhineland-Palatinate. The knowledge and attitude towards immunization of unvaccinated to vaccinated young adults were compared using Likert questions. We used proportional allocation for stratified random sampling across 36 counties. We mailed a self-administered questionnaire with pre-paid return envelopes along with an offer to complete online. Prior to calculating coverage we tested for non-responder bias using logistic regression.

Results:
465 (28%) of 1,637 persons contacted responded (mail: 23%, online: 5%). More women responded than men (odds ratio (OR)=2.1; 95% confidence intervall (CI)=1.7-2.6) but age did not vary between responders and non-responders. Vaccination coverage was 90% (95%CI=87%-93%) for one and 56% (95%CI=51%-61%) for two doses. We found a statistically significant association between receiving two doses and age group. The 20-24 years age group had a 2.3 higher incidence rate ratio (95%CI=1.7-3.2) than the reference group of 30-34 year old to have received two doses of measles vaccination. The group of 25-29 year old had a 1.5 higher incidence rate (95%CI=1.0-2.1) than the reference group to have received two doses of measles vaccination.

Conclusions:
Coverage has failed to reach the WHO Europe elimination goal of 95% measles vaccination in the general population. Targeted approaches including enlistment of occupational health services and checking vaccination status during general practitioner (GP) visits are needed to increase vaccination uptake in this age group in order to achieve measles elimination.

Funding Statement
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Related Articles
The article is part of the PLOS Currents Outbreaks “Vaccine Hesitancy Collection“.

Introduction
Measles are a highly communicable viral disease manifesting with a characteristic maculopapular rash beginning on the third to seventh day after infection accompanied by cough, coryza and/or conjunctivitis. Severe cases can lead to pneumonia, meningitis, subacute sclerosing panencephalitis or death. Disease severity increases with age. No causal therapy is available; vaccination serves as primary preventive measure.

Europe has been struggling to fight measles in the last decades and has so far failed to achieve the goal of eliminating the disease. The year 2015 has been set as a new target for the elimination of measles in the European region. Yet in 2011 the number of measles cases were again rising
throughout Europe, with 36 out of 53 Member States in the WHO European Region reporting outbreaks, noting >26 000 cases in 2011. In France 5090 cases were being claimed in 2010 and more than 14000 cases in 2011.\(^1\)\(^2\)

From April 2012 to March 2013 a total of 8127 cases were reported from 30 contributing EU and EEA member states. During this 12 months period Germany, France, Italy, Romania, Spain and the United Kingdom accounted for 95% of the cases.\(^3\)

Measles are notifiable by law in Germany. The elimination of measles in Germany has progressed after introduction of vaccination thirty years ago, yet measles still pose a threat to the German public health with large-scale-outbreaks of up to several hundred cases in the recent years. The largest documented outbreak in the previous years was reported in 2006 with a number of 1452 cases.\(^4\) Further outbreaks were reported the same year, one being linked to an anthroposophic school.\(^5\)\(^6\) Also linked to an anthroposophic school were two outbreaks 2010.\(^7\)\(^8\) Apart from national outbreaks, measles were exported from Germany to Bulgaria causing a large-scale outbreak within a Roma population.\(^9\) Reasons for infection in a high-income country such as Germany are mostly missing immunization, philosophical objection against vaccination (e.g. anthroposophic believes), or travel-related from countries with a high number of measles cases. Philosophical objectors represent 3-5% of the German population\(^10\) yet only 1% of German parents indicate total refusal towards vaccination.\(^11\)

In the absence of national registers, standardized data on vaccination coverage in Germany is only obtained at the age of school entry, which is normally at the age of six. Coverage for measles (one dose) is consistently above 90%. However, introduction of measles vaccination into routine childhood immunization has shifted the pool of susceptibles to older age cohorts who have neither received vaccination nor obtained natural immunity through infection.

The outbreaks registered in Europe in the last years confirm an increase in cases among young adults who have had no previous vaccination against measles. Half of the cases in 2011 in Europe occurred among people aged ≥15 years, reflecting in a high proportion of adult cases in Germany.\(^12\) This age cohort of young adults is at higher risk of infection and at higher risk of developing severe disease. At child-bearing age, this age-group could further pass on the disease to infants (<11month) for whom vaccination is not recommended.

Due to the rise in cases in adults, the German Standing Committee on Vaccination (STIKO) extended the eligible age-group for measles vaccination in 2010. One dose of measles containing vaccine is recommended for unvaccinated adults or adults having received only one dose and born after 1970.\(^13\)

Data on vaccination coverage in adults are missing in Germany and progress towards the WHO elimination goal cannot be verified adequately, neither can health promotion campaigns be tailored to people-at-risk.

We therefore conducted a representative cross-sectional survey among 20-34 year old young adults to assess the vaccination status of this age-group in Rhineland-Palatinate (RP), a federal state in the Southwest of Germany. This will enable verification towards the measles elimination goal and if
necessary allow targeted measures to increase coverage.

**Methods**

The total population of RP is 4 Mio inhabitants\(^{14}\), with 1,3 Mio between the age of 20 and 34. Germans are required by law to be registered at place of residence and our sampling frame were the population registries of the counties of RP.

We used proportional allocation\(^{15}\) to calculate sample size and sampled randomly, stratified across the 36 counties to assure representativeness. Our sampling parameters were: an expected vaccination coverage of 50% (conservative assumption of expected vaccination coverage), precision of 10% and a 95% CI. This yielded a sample size of 385 which together with our expected response rate of 20% required 1925 addresses from the local county registries.

They were asked to randomly draw a number of participants allotted to their county, distributed equally between sex and age. Postal address, gender and age were submitted to the study team.

Participants were contacted by post. We mailed a self-administered pseudonymous paper questionnaire along with instructions how to complete an online form of the same questionnaire. Participants were therefore given the choice to either return the paper form or access an online-based questionnaire. An access token was included in the primary posting in order to mark multiple online entries.

Several means were used to increase overall response rate. Pre-paid return envelopes as well as an incentive, a small pen, was included in the posting. Additionally, a reminder letter was sent out if there was no response to the primary letter within 30 days of initial contact.\(^{16}\)

The questionnaire contained demographic characteristics (sex, age, country of birth and district). Vaccination status and source of vaccination status were ascertained. Likert questions were used to assess the level of agreement or disagreement on statements in relation to the protection conferred by immunization, the information policy regarding adverse-events following immunization and the knowledge concerning the immunization recommendation for young adults in Germany introduced in 2010.

Data was analysed using Stata 11. 95% confidence intervals were calculated using multivariate logistic or poisson regression with a p-value of <0.05 being considered significant for all statistical tests. Overall vaccination coverage for at least one and for two doses were calculated using binomial exact methods. To ensure the representativeness of the sample, a non-responder analysis was conducted comparing age and sex of those who had responded to those who had not responded (obtained by local council registries) using multivariate poisson regression with response as dependent variable.

Multivariate logistic regression was used to compare online with paper response as dependent variable (mode of reply) to examine the effect of vaccination status, age group and sex.

We also tested the effect of age group and sex on vaccination status using multivariate logistic regression. Respondents with missing source of vaccination status or unknown or missing vaccination status were excluded from analyses on vaccination coverage. Odds ratios were
calculated to compare the knowledge and attitude towards immunization of unvaccinated to vaccinated young adults.

The study protocol was approved by Medical Doctors Ethics Committee of Rhineland-Palatinate as well as the privacy officer of RP. Participants were advised that informed consent was given by completing and returning the questionnaire. Current data protection law was taken into account.

Results

From June 2012 to August 2012, a representative sample of 1,637 persons, equally distributed between gender and age, were contacted. Overall response rate was 28% (n=465). 23% (n=387) of the persons contacted responded by mail, 5% (n=78) used the online version of the questionnaire to reply. 63% of the participants were female (n=293), 37% male (n=169) and three gave no information on their gender. Data were complemented for the analysis using the list provided by the population registries. (Figure 1)

Mode of reply (online vs. paper) did not vary by age group (20-24: OR=0.9; p=0.8; 95%CI=0.5-1.8; 25-29: OR=1.3; p=0.4; 95%CI=0.7-2.4; 30-34: reference group) or sex (OR=1.1; p=0.7; 95%CI: 0.6-1.8). There was no difference of vaccination status between online and paper participants: no vaccination (OR=0.8; p=0.7; 95%CI=0.3-2.2), one vaccination (OR=1.2; p=0.5; 95%CI: 0.7-2.3) or two vaccinations (reference group). The only difference we found was that online respondents were less likely to know their vaccination status (OR=3.5; p=0.002; 95%CI=1.6-7.8).

Age did not vary significantly among responders and non-responders (20-24: odds ratio (OR) = 0.8; p = 0.2; 95%CI= 0.6-1.1; 25-29:OR= 0.9; p = 0.3; 95%CI:0.7-1.1; 30-34: reference), yet more women responded than men (OR=2.1; 95%CI=1.7-2.6).

455 out of all 465 responders answered the question on source of vaccination status. Of those, 80% (n=362) obtained the information from their vaccination card and 2% (n=8) had consulted their GP. (Table 1)

Table 1: Source of information on vaccination status, if known (n=455)
Of the total of 455 participants who provided the source of vaccination status, we excluded those participants with missing or unknown vaccination status leaving 415 participants for the analysis on vaccination status. (Figure 2)

**Table 2: Vaccination status of the study population**

<table>
<thead>
<tr>
<th>Vaccination status</th>
<th>Total number (n)</th>
<th>Percentage (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measles vaccination (1x or more)</td>
<td>374</td>
<td>90%</td>
<td>86%-92%</td>
</tr>
<tr>
<td>Measles vaccination (2x)</td>
<td>234</td>
<td>56%</td>
<td>51%-60%</td>
</tr>
<tr>
<td>Unvaccinated</td>
<td>41</td>
<td>10%</td>
<td>7%-13%</td>
</tr>
</tbody>
</table>

Distribution of vaccination status by sex and age-group identified a higher crude number of vaccinated women than men. (Table 3)

**Table 3: Vaccination status (one or more doses) by age-group and sex**

<table>
<thead>
<tr>
<th>Vaccination status</th>
<th>Sex</th>
<th>20-24 years</th>
<th>20-24 years</th>
<th>25-29 years</th>
<th>25-29 years</th>
<th>30-34 years</th>
<th>30-34 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total number (n)</td>
<td>Percentage uptake (%)</td>
<td>Total number (n)</td>
<td>Percentage uptake (%)</td>
<td>Total number (n)</td>
<td>Percentage uptake (%)</td>
</tr>
<tr>
<td>Measles</td>
<td>Male</td>
<td>55</td>
<td>96</td>
<td>29</td>
<td>83</td>
<td>41</td>
<td>79</td>
</tr>
<tr>
<td>Vaccination status</td>
<td>Sex</td>
<td>20-24 years Total number (n)</td>
<td>20-24 years Total number (n)</td>
<td>25-29 years Total number (n)</td>
<td>25-29 years Total number (n)</td>
<td>30-34 years Total number (n)</td>
<td>30-34 years Total number (n)</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-----</td>
<td>-------------------------------</td>
<td>-------------------------------</td>
<td>-------------------------------</td>
<td>-------------------------------</td>
<td>-------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>vaccination (1x or more)</td>
<td>Female</td>
<td>87</td>
<td>99</td>
<td>78</td>
<td>88</td>
<td>84</td>
<td>89</td>
</tr>
<tr>
<td>Measles vaccination (2x)</td>
<td>Male</td>
<td>46</td>
<td>96</td>
<td>12</td>
<td>67</td>
<td>18</td>
<td>62</td>
</tr>
<tr>
<td>Unvaccinated</td>
<td>Female</td>
<td>72</td>
<td>99</td>
<td>51</td>
<td>88</td>
<td>35</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>2</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>14</td>
<td>0</td>
</tr>
</tbody>
</table>

In poisson regression we did not find differences in vaccination status between the sexes for either “at least one” or two doses of measles vaccination. There was no statistical difference between the age groups for “at least one vaccination” (results not shown).

However, we found a statistically significant association between receiving two doses and age group. The 20-24 years age group had a 2.3 higher incidence rate ratio (95%CI=1.7-3.2) than the reference group of 30-34 year old to have received two doses of measles vaccination. The group of 25-29 year old had a 1.5 higher incidence rate (95%CI=1.0-2.1) than the reference group to have received two doses of measles vaccination. (Table 4)

Table 4: Poisson regression of age group and having received two doses of measles vaccination

<table>
<thead>
<tr>
<th>Receiving two doses of measles vaccination</th>
<th>Incidence rate ratio</th>
<th>p-value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-24 years</td>
<td>2.3</td>
<td>&lt;0.001</td>
<td>1.7-3.2</td>
</tr>
<tr>
<td>25-29 years</td>
<td>1.5</td>
<td>0.037</td>
<td>1.0-2.1</td>
</tr>
<tr>
<td>30-34 years</td>
<td>reference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex (male= reference)</td>
<td>1.1</td>
<td>0.328</td>
<td>0.9-1.5</td>
</tr>
</tbody>
</table>

Within the group of the unvaccinated, 85% agreed or strongly agreed that vaccines induce effective protection against infectious diseases, 5% disagreed that immunizations protects against infectious diseases. No significant difference to the group of the vaccinated could be observed. Nevertheless 73% of the unimmunized indicated that they agreed or strongly agreed with the statement that the general public was not informed well enough on adverse events following immunization (AEFIs). 20% disagreed or strongly disagreed that the general public was not well informed on AEFIs. No significant difference to the group of the vaccinated could be observed.

46% of the unimmunized indicated that they had no opinion on the issue whether unvaccinated adults or adults having received only one dose of measles containing vaccine should be immunized against measles.

23% answered that they disagreed or strongly disagreed that unvaccinated adults should receive measles immunization. 31% indicated that they agreed or strongly agreed that unvaccinated or one-dose-vaccinated adults should receive measles immunization. Agreement with the statement was associated with a statistically significant four times higher OR of being vaccinated. (Table 5)

Table 5: Univariate logistic regression of Likert response on having received at least one dose of measles vaccination
<table>
<thead>
<tr>
<th>Likert question</th>
<th>Number of vaccinated (n=374)</th>
<th>Number of not vaccinated (n=41)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immunization induces effective protection against infectious diseases.</td>
<td>344</td>
<td>34</td>
</tr>
<tr>
<td>Agree or strongly agree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do not “Agree or strongly agree”*</td>
<td>27</td>
<td>6</td>
</tr>
<tr>
<td>Total respondents</td>
<td>371 (3 missing)</td>
<td>40 (1 missing)</td>
</tr>
<tr>
<td>Odds ratio: 2.3</td>
<td></td>
<td>95%CI: 0.7-6.1</td>
</tr>
<tr>
<td>p-value. 0.234</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The general public is not informed well enough on AEFIs.</td>
<td>238</td>
<td>30</td>
</tr>
<tr>
<td>Agree or strongly agree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do not “Agree or strongly agree”*</td>
<td>35</td>
<td>11</td>
</tr>
<tr>
<td>Total respondents</td>
<td>373 (1 missing)</td>
<td>41</td>
</tr>
<tr>
<td>Odds ratio: 0.7</td>
<td></td>
<td>95%CI: 0.3-1.4</td>
</tr>
<tr>
<td>p-value: 0.234</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unvaccinated adults or adults having received only one dose of measles containing vaccine should be immunized against measles.</td>
<td>239</td>
<td>12</td>
</tr>
<tr>
<td>Agree or strongly agree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do not “Agree or strongly agree”*</td>
<td>9</td>
<td>27</td>
</tr>
<tr>
<td>Total respondents</td>
<td>373 (1 missing)</td>
<td>39 (2 missing)</td>
</tr>
<tr>
<td>Odds ratio: 4.0</td>
<td></td>
<td>95%CI: 1.9-9.0</td>
</tr>
<tr>
<td>p-value: &lt;0.001</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* includes “no opinion”

**Discussion**

We minimized sampling bias by providing detailed instructions to population registries. To avoid study participants from providing deviant answers the questionnaire was developed being non-judgmental and data-protection issues were stressed in the cover letter. Nevertheless, a questionnaire based survey is susceptible to refusal bias especially by philosophical objectors. The latter are generally un- or undervaccinated. A refusal to participate would lead to overestimated vaccination coverage. Philosophical objectors are however a minority in the German population (3-5%) and their effect on overall coverage in this survey is negligible. A response bias by providing counterfactual answers could have occurred in case participants were reluctant to confide secrets or for reasons of social desirability.

Beyond a possible refusal of philosophical objectors to respond, there might be a selection bias towards those with a greater health-seeking behaviour, hence a higher tendency for vaccinated individuals to respond to this survey which in return might lead to an overestimation of the vaccination coverage. To encounter this and ensure that a representative sample of the society responds, participation was encouraged by sending an incentive with the questionnaire, a pre-paid return envelope and by sending out a recall letter. In case of a missing vaccination card, recall bias was possible as vaccination against measles might not be remembered correctly. Study participants were encouraged to contact their GP about their vaccination status or contact their parents or legal guardians. 82% of answers were based on either vaccination cards or GPs information.

One fifth of our study population chose to respond online. No difference was found in response
between the two groups with regard to age, vaccination status or, interestingly, sex. Frequent use of internet is common among young adults of both sexes and adding online questionnaires should be considered as a cost-saving method when addressing this age-group to increase response in surveys.

Our results show that unlike today, where measles vaccination coverage for two doses at school entry is assessed to be 92.1%, measles vaccination recommendations were not sufficiently implemented during the childhood of the investigated age-groups. This is especially true for the 30-34 year age group whose members are more than two times less likely to have received two doses of measles vaccination compared to the 20-24 year olds. These findings were confirmed by a recent survey which also reports that measles vaccination coverage in Germany is higher in younger age groups. Reasons might be high wild-type virus circulation, decreased acceptance of vaccination or missing knowledge of recommendations.

In addition, measles might be considered as a harmless childhood disease by the general public, and possibly even by paediatricians. The majority of parents of our target age group were highly likely to have had measles during childhood. Measles are more severe among young adults. Disease in this age group was not seen frequently in the past as the greatest disease burden was within children; hence parents might have deemed vaccination of their children as unnecessary.

Our survey showed that 90% of adults between 20 and 34 were vaccinated at least once and 56% received two doses of measles vaccine. The WHO Europe measles elimination framework recommends vaccination coverage of ≥95% with two doses of measles-containing vaccine at the subnational administrative level to interrupt virus transmission. In order to reach that goal, targeted approaches are needed to promote vaccination for these identified age-groups. The results of our study indicate that the majority both unimmunized and immunized are confident concerning the protection induced by immunization, though the majority also agreed that the general public was not informed well about AEFIs, possibly leading to skepticism towards immunization. Almost half of the unimmunized in our study had no opinion on measles vaccination for adults; one out of four indicated that measles vaccination was not needed as an unvaccinated adult. The knowledge on this differed significantly between unvaccinated and vaccinated individuals, which might indicate a lack of awareness of the recommendations on measles immunization for adults introduced in Germany in 2010. Every contact with health services should be used to check patient’s vaccination status, inform all patients about the actual risk of adverse events following immunization and offer measles immunization to unvaccinated or one-time-only-vaccinated young adults. Awareness should be raised among physicians, especially GPs, gynaecologists and paediatricians in contact with parents visiting the health facility to get their child vaccinated, as they are presumably the most likely to be in contact with this age-group. The adult population at work could be approached by their occupational health services to check up on their measles vaccination status and thus avoid loss of work.

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