

Innovations in communication: the Internet and the psychology of vaccination decisions

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This paper provides a psychological perspective on the possible effect of the Internet on the decision against vaccination. The reported importance of the Internet in health decisions is still low, but rising; especially the amount of interactive use of the Internet is increasing, e.g. due to the use of social media. It is argued that the fact that individuals do not report the Internet to be an important source of information does not necessarily mean that the information obtained in their Internet searches is not influential in their decisions. Evidence is summarised here regarding the (anti-)vaccination information on the Internet, and its influence on risk perceptions and on vaccination intentions and behaviour in relation to the encoded information. The conclusion suggests that scholars should strive to explain the underlying processes and potential mediators of vaccination decisions to increase the effectiveness of health communication. In reference to a definition of evidence-based medicine, a great future challenge lies in evidence-based public health communication based on interdisciplinary research involving public health, medical research, communication science and psychology.

Vaccine-preventable diseases are a great challenge to public health in the European Union (EU) [1]. Societies and public health profit from vaccinations. However, vaccination has become a victim of its success [2]: Many Europeans no longer perceive a threat from a number of vaccine-preventable diseases, while the risks of suffering from various side effects of vaccinations have become more central to their decision. Anti-vaccination arguments that question the safety of vaccines are disseminated through various channels, especially the Internet [3]. A recent example is the quick spread on the Internet of the idea that influenza (H1N1)2009 vaccines contain a substance that causes the Gulf War Syndrome [4]. As a result, Europeans might decide against receiving vaccinations for themselves or their children. Analyses show that the decrease in vaccination rates due to anti-vaccination movements has led to epidemic outbreaks with severe health consequences and long-term damage to the trust in specific vaccinations, for instance the measles-mumps-rubella

(MMR)-scare in the United Kingdom (UK) [5]. As a consequence of suboptimal vaccination coverage the World Health Organization (WHO) failed to reach the goal to eliminate measles until 2010; the new target is measles elimination by 2015.

This paper takes a first step in exploring the role of the Internet in influencing anti-vaccination decisions from a psychological perspective and examines how vaccination risk perception and decision process are affected by information on the Internet. The main points were also presented at the 2010 Eurovaccine conference [6]. From a psychological point of view it is assumed that during the pre-decisional phase of the decision process, the problem at hand (to vaccinate or not) is identified and the person making the decision acquires the necessary information, e.g. via an Internet search (see Figure 1) [7]. In the selectional phase, potential outcomes of the alternatives are evaluated (appraisal, e.g. the risk of suffering from side effects after vaccination). Finally the decision is made. In the post-decisional phase the decision needs to be implemented and the person making the decision receives feedback (e.g. about the actual occurrence of side effects). All information is stored in the memory and will influence future decision processes. This paper focuses mainly on information search, its influence on risk perceptions, vaccination intention and finally behaviour.

The Internet as a source of health information

The study 'e-health Trends in Europe' investigated who searches the Internet for health-related information, how often and how. Two independent surveys, separated by an interval of 18 months, were conducted in 2005 and 2007 with representative samples (N=14,956) from seven European countries: Denmark, Germany, Greece, Latvia, Norway, Poland, and Portugal. The results revealed an increase in this time period from 42% to 52% of the population who surf the Internet for health information [8]. There is a tendency towards a more interactive use of information especially among 'digital natives' (i.e. those who grew up with the Internet). However, it is also striking that in comparison

to other available information the Internet is perceived to have a very low importance for health decisions; the most important source are health professionals, followed by conventional media [8]. The fact that individuals report that they do not consider the Internet to be an important source does not necessarily mean that the information obtained in their frequent Internet searches does not influence their decisions. Internet information may still have an influence, if rather subtle. Psychological research underlines that informational influence on perceptions and behaviour is not always conscious, consider for example accessibility effects, the influence of affect, automatic information processing, implicit learning, etc. [9]. Thus, in order to assess the potential influence of the Internet we need to consider (i) the information obtained on the Internet, (ii) its influence on risk perceptions as predictors of vaccination behaviour [10,11] and (iii) vaccination intentions and behaviour in relation to the processed information.

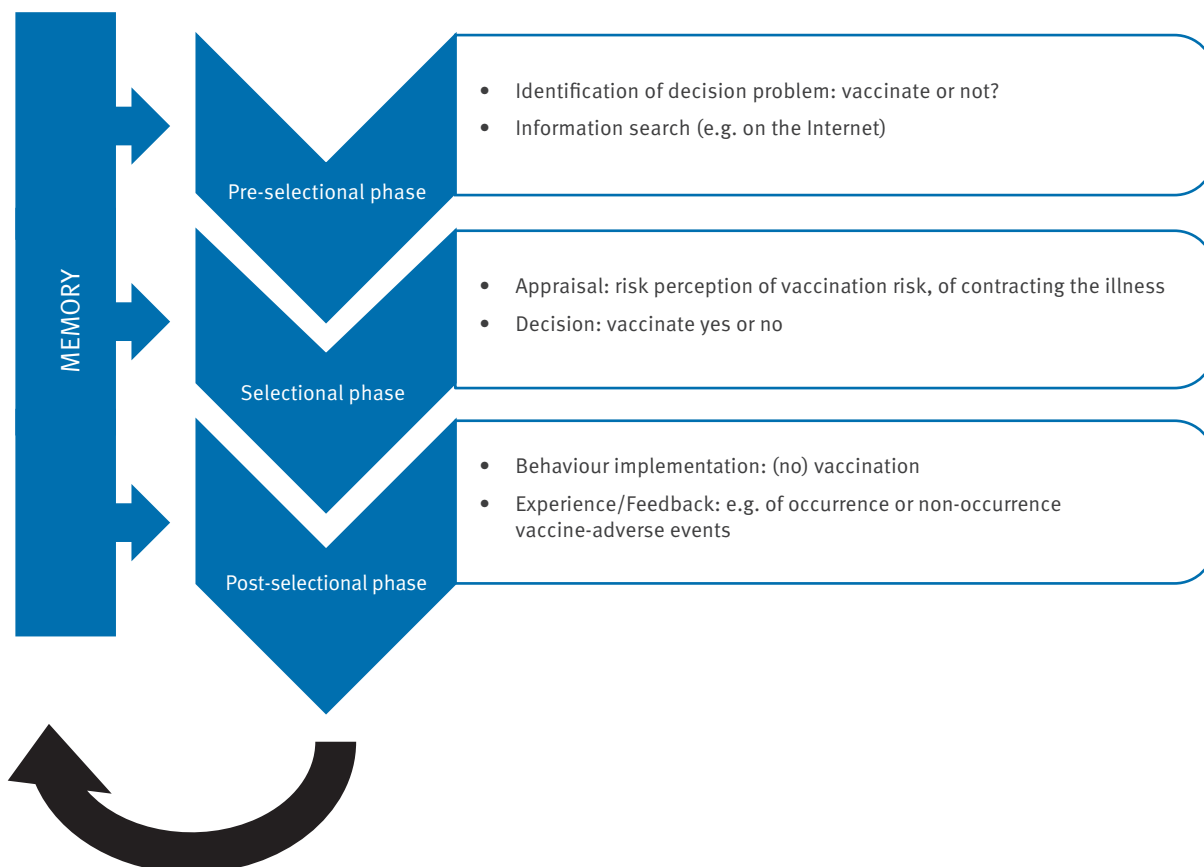
(Anti-)vaccination information on the Internet

In general, the probability with which correct information about infectious disease prevention can be found on the Internet varies dramatically: In a study concentrating on Australia, Canada, the UK and the United States (US), Internet searches for the term ‘hand cleaning’ during the pandemic in 2009 led to the WHO recommendations on preventive actions in 75–80% of the

hits [12]. Thus, the probability to find reliable information was relatively high. In contrast, in a different analysis only 51% of the information sources that were found regarding the relation between the MMR vaccine and autism gave the correct answer [13]. Moreover, in a study in the US in 2009 analysing the first 10 hits that parents received on Google.com for either of the three search terms ‘vaccination’, ‘vaccine’, and ‘immunization OR immunisation’, 21 of the total 30 results were immunisation sites, of which five were classified as anti-vaccination; a combined sample with hits from the Canadian Google.ca returned a total of eight anti-vaccination websites from the first 30 hits [3]. The number of anti-vaccination websites obtained varied depending on the search term: 71% of sites returned for the term ‘vaccination’ but none of the sites found with the term ‘immunisation’ were classified anti-vaccination. The less specific the search term, the more anti-vaccination web-sites can be found [14]. Recent work suggests that the parents’ knowledge about vaccination determines the complexity of a search term [14]: the more complete (in reference to an integrated expert model) their knowledge was, the more complex were the search terms that were proposed for an online information search (e.g. MMR vaccine as opposed to vaccination). This means that the people with less knowledge on the topic, who are more likely to conduct searches [14], will do so using less complex search terms which lead to more anti-vaccination websites.

FIGURE 1

Psychological view on a vaccination decision



In terms of page content, all eight vaccine-critical Internet sites analysed by [3] were concerned with vaccine safety and claim a causal relationship between vaccinations and illnesses of unknown origin, e.g. multiple sclerosis, autism, asthma and sudden infant death syndrome. Arguments are continually repeated, for example: vaccines erode immunity (seven of eight), create only temporary or ineffective immunity (seven of eight), contain many ingredients and preservatives that will make you sick (eight of eight), overwhelm children's immune systems, especially when administered in combination (three of eight). At the same time, treatments superior to vaccination are promoted, e.g. homeopathy (seven of eight). In addition, anti-vaccination websites are very well connected, as they all provide links to similar sites [3].

A key feature on seven of the eight examined websites was the inclusion of emotive appeals, such as pictures and stories of children who were supposedly harmed by vaccinations. An example for such descriptions of personal experiences, posted on a German website, reads as follows: 'My four year-old daughter received the five-in-one combination vaccine at nine months, she then had a fever for two weeks, was apathetic and had screaming fits, since then she has suffered from atopic dermatitis and many allergies. My son is now four months old and I don't know if I should get him vaccinated or not (...)'. Parents appear to have a preference for personal information when searching on health related topics, i.e. information from parent to parent: even parents-to-be already search for such information, mainly through internet forums (bulletin boards) where they can post questions that are then answered by other parents [15]. In this way, a communication tree is created documenting all posted questions and their subsequent answers. The information that was found in a German content analysis of a baby forum in 2008 revealed that only 19% of the postings contained scientific information while 68% had personal and emotional content [15]. The above-mentioned analysis of anti-vaccination web-sites [3] explicitly excluded sources that contain large amounts of personal narrative information, e.g. news groups, forums, and social media such as Facebook or Twitter. There is, for example, an anti-vaccination profile from New Zealand on Facebook with nearly 14,500 people 'liking' the page in April 2011, which implies that 14,500 users receive anti-vaccination updates, often several times a day. Moreover, during the influenza A(H1N1) pandemic 22.5% of tweets contained personal experiences about the illness or the vaccination [16]. Thus, past analyses probably largely underestimate the availability of (anti-)vaccination narratives on the Internet.

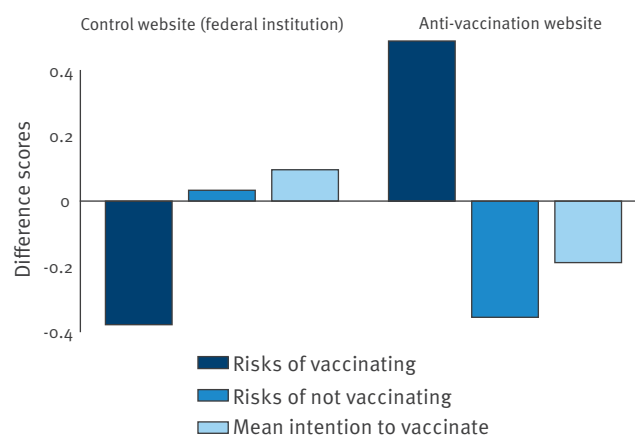
In summary, a Google search leads to vaccine-critical sites in about one of five hits on immunisation; these sites provide an abundance of critical arguments as well as emotive appeals against vaccination. Additionally, participation in social media or online forums grants access to a plethora of personal narrative information.

In the following, I will outline how this kind of information influences risk perceptions and vaccination intentions.

Effects of the Internet on the perception of vaccination risks

In psychological theories of preventive behaviour the perception of risk (e.g. of a vaccine-preventable illness) is related to the omission and commission of preventive behaviour (e.g. vaccinations [11]). Numerous studies show that risk represents a general predictor of preventive health behaviour [10]. However, beliefs about the risk of the preventive action, e.g. the risk of suffering from vaccine adverse events, are rarely in the focus of psychological research [10] and have only recently attracted notice. An online study demonstrated that anti-vaccination information on the Internet has a particular impact on the perceived risk of vaccinating [17]: Participants were randomly assigned to real Internet sites, either a Swiss vaccine-critical or a neutral control site (of the German Federal Centre for Health Education, BZgA). The effect of vaccine-criticism was examined by assessing (via self-report measures) the perceived risks of vaccinating and not vaccinating as well as vaccination intentions before and after the information search. The results of this study show that even a short search on vaccine-critical Internet sites can lead to considerable changes in risk perceptions. After viewing the vaccine-critical site, risks of vaccinating were perceived to be greater than before, while the perceived risks of not vaccinating had decreased (Figure 2, [17]). Assessments of these parents' intentions to have their own children receive four of the vaccinations recommended by the German Standing

FIGURE 2
Changes in risk perceptions and vaccination intentions dependent on search environment, Germany, September 2008



The 223 participants who searched 5–10 minutes on an anti-vaccination website (right panel) perceived a higher risk of vaccination, a lower risk of not vaccinating, and their vaccination intentions for four recommended vaccinations decreased compared with their answers before the Internet search. The risk perception regarding vaccination was lower among participants who searched a control site from a federal institution; None of the other answers in this group changed after viewing of the control site [17].

Committee on Vaccination (STIKO) also indicated an effect of viewing the vaccine-critical site, as the mean intention to accept the four vaccinations decreased significantly. A reduction in the perceived risks of vaccinating after viewing the control site indicated that the displayed information apparently induced trust in the safety of the procedure. This group did not change their perception of the risks of not vaccinating.

To assess long-term effects of the vaccine-critical information, participants were contacted again five months after the initial study [18]: Participants (both groups) who had perceived higher vaccination risks after the initial study still perceived potential vaccination injuries to be more likely and more severe than participants who had perceived lower vaccination risks. In addition, participants who had perceived greater vaccination risks had repeatedly searched for vaccine-critical information during the five months (e.g. in discussions with their paediatricians or additional Internet searches with a focus on narratives and statistics). Moreover, parents who perceived the risks of vaccinating to be high after the information search had their children vaccinated with fewer vaccines than recommended or not at all in the five-month period. Conversely, children of parents who gained the impression during the information search that not vaccinating leads to considerable risk had received more vaccinations during the five-month period.

The anti-vaccination websites analysed in this study [17] contained significantly more narrative information than the control website. Reading narratives about vaccine-adverse events has been shown to be a critical factor of the effects of Internet anti-vaccination information. But what makes narratives so powerful? Study results show that personal and emotional descriptions of adverse events have an effect on readers' emotions – they cause the reader to feel threatened [17,19]. This emotion then influences perceptions of risks, which, in turn, affect vaccination intentions. The more narratives of vaccine-adverse events a person reads, and the more emotional these are, the greater the person perceives potential risks of vaccinating to be. Through this effect on risk perceptions, such narratives can negatively influence vaccination intentions [19].

Promoting vaccination on the Internet by successful communication strategies

When designing e-health websites and promoting messages for preventive behaviour, the core-message of vaccine-prevention appeals - 'Have your child vaccinated!' – can be formulated by using either a fear appeal ('Measles can lead to brain damage!') or a prevention appeal ('Prevent measles!'). Given that some parents fear vaccinations, should fear be fought with fear? Or are campaigns more successful when they build upon prevention appeals? Campaigns that are very successful when used on community billboards (e.g. 'Daniel, 10, brain-damaged after a measles infection', a successful campaign in a German federal state in 2009),

may have a less positive or even negative impact when used on the Internet, where they are likely to appear in the context of vaccine critical information. Thus, the effects of campaigns and appeals must be evaluated in the context in which they are used. A recent study assessed the effect of prevention and fear appeals on people who were exposed to a vaccine-critical Internet forum [20]: Vaccination intentions were lower when a fear appeal referred to the negative consequences of not vaccinating than when a prevention appeal encouraged protection against measles. Instead of increasing awareness about the risks associated with the illness and thereby positively affecting the intention to vaccinate, fear appeals had the opposite effect. Apparently, study participants were unable to identify the source of their negative emotions, resulting in decreased vaccination intentions. The findings raise the question of which campaign method is appropriate in the context of vaccine-critical information on the Internet: perceptions of illness-related risks could be increased or perceptions of vaccinations risks decreased. It is necessary to learn more about how perceptions of both of these types of risk influence vaccination intentions to make an informed campaign decision [20].

When focusing on the aim of decreasing the perceptions of vaccination risks, one possible means could be to inform the public about why the typical objections of anti-vaccination activists are false. This was done by a collaborative Internet publication of two German federal institutes (Robert Koch Institute, Paul Ehrlich Institute [21]). In this publication, vaccination risks are largely negated by explaining relationships in a generally understandable manner, empirical studies are quoted and the critical arguments invalidated to the greatest possible extent. The Internet allows fast and easy dissemination of the contents and everyone is free to adapt the phrasing to their needs – e.g. by placing particular emphasis on the negation of a risk (e.g. to persuade consumers of the safety of a vaccine). To analyse the effect of different degrees of risk negations, two experiments used variations of the same risk negations as used in the above publication [21], where single sentences within longer scientific explanations were negating risk either in a strong or in a weak manner (e.g. 'Specific vaccines can indeed produce illness-like symptoms; however, the complete illness will never appear (strong) / will appear extremely rarely (weak)'). Both studies showed that stronger risk negations paradoxically led to higher risk perceptions, while weaker negations led to lower risk perceptions (unpublished data). This effect also depends on how trustworthy the source of the information is. The Internet publication that negates typical objections of anti-vaccination activists [21] can also be found on the Internet sites of pharmaceutical companies. Pharmaceutical companies and public organisations are trusted to different degrees where vaccine-related questions are concerned: governmental institutions are considered to be the most and pharmaceutical companies the least trustworthy (unpublished data).

Trust in the information source has been shown repeatedly to be a relevant factor of the effect of risk communication [22]. Especially strong denials by a source that is not trustworthy increased the risk perception (unpublished data). The results imply that only minimal changes in risk negations might have noticeable effects on outcome variables. Decisions against vaccination might thus not only be influenced by anti-vaccination information, but also result from suboptimal risk communication.

Future perspectives

The omnipresence of easily accessible social media applications challenges prior approaches to aided decision making. Computerised decision aids are available that aim at 'presenting evidence on options, benefits and harms, helping patients to clarify which outcomes are important' [23]. The Internet is increasingly used to provide decision aids online. One future goal might be to develop e-health decision aids that merge an innovative social media system and a classical decision aid approach. Until such technological possibilities can be fruitfully applied, several basic questions have to be answered, such as how interactivity can be used to improve risk judgments [24] and whether changes in knowledge relate to changes in Internet information search and risk perception at all [14]. Such questions call for structured interdisciplinary research.

Scholars from the public health sector, medical research, communication science and psychology are concerned with the role of the Internet and its impact on health decision making. Each discipline works on a different level of resolution and with different intentions (e.g. examining the mere frequency of use of the Internet versus assessing processes behind decisions based on the obtained information). The need for more interdisciplinary research has been mentioned repeatedly [25] with a focus on communication science and public health. This perspective paper aimed at highlighting the value of psychology in this context. Public health communication will profit from more research on the actual influence of the obtained information instead of gathering self-reports about the relative importance of the Internet. If we strive for effectively using the Internet for public health, we need academic exchange and evidence-based interventions. We must cautiously evaluate new technical developments and innovative tools. Only if we consider the underlying processes and potential mediators can effective health communication take place. In reference to a definition of evidence-based medicine [26], a great future challenge exists in installing evidence-based public health communication as the 'conscientious, explicit and judicious use of current best evidence in making decisions' about the use of public health messages.

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