

JANELLE HIGHLAND, MA

Parental Decision Making and Childhood Vaccination

Case Western Reserve University

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Extensive research has been done examining the decision making process related to health decisions. For the issue of childhood vaccination, the parental decision making process concerning choice of parents to vaccinate their children has received considerable attention. Debate about parental choice and vaccination has at times been contentious, but those on either side of the debate are interested in the welfare of their children. The research done on parental choice and vaccination has looked at how the decision making process between parents who choose to vaccinate and those who do not may differ, how these decisions are made, the psychosocial factors that may influence decision to vaccinate, and how the decision making process can be influenced. Others have looked at the methods parents use when making the decision to vaccinate or not, and how they estimate risk. In this chapter, there will be a review of research on the decision making process, a discussion of common themes surrounding this process, and a review of the recent HPV vaccine and MMR vaccine controversies. It is important to note that within these models and in the examples, a core theme is the concept of risk. The models show how people conceptualize and weigh the risk that vaccination can pose for them and their children, and the examples show what factors influence the perception of risk.

Models of the Decision Making Process:

Research examining the decision making process for parents mulling over vaccinating their children has focused on examining the factors that contribute to their final decision, the thought processes of parents making these decisions, and predicting vaccination behaviors. Social cognition models have been used in research on vaccination practices, and often look at

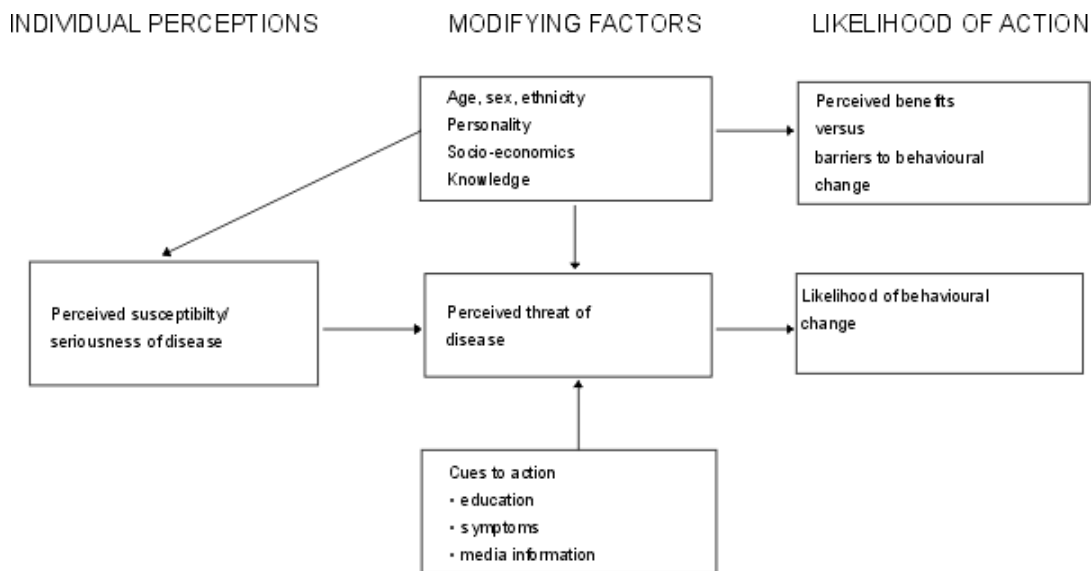
vaccination decision as the outcome of weighing perceived risks (Sturm et al 2005). Of these theories, the Health Belief model has been the most widely applied (Sturm et al 2005). Researchers are also using theories from social psychology and cognitive research examining decision making and perception of risk (Meszaros et al 1996; Sturm et al 2005). Of particular interest are theories on cognitive heuristics or “mental shortcuts” that people use when making complex decisions (Sturm et al 2005). Some of the biases identified in decision making, omission bias, availability of an accessible and memorable event, protected values, and avoidance of ambiguity or ambiguity aversion, and their application to research on parental decision to vaccinate their children are explained further below. This section will begin with an explanation of the health belief model and its application to vaccination research and will follow with a discussion of cognitive heuristics and biases.

Health Belief Model

The Health Belief Model (fig. 1) proposes that people make their health decisions based on their perceived susceptibility to disease, their perceived severity of the disease, their perception of benefits versus costs, and cues to action (Janz & Becker 1984). The perceived susceptibility to disease can be described as the subjective perceived risk of contracting a disease (Janz & Becker 1984). The perceived severity of disease is the subjective feeling concerning the seriousness of disease including medical and social consequences. The perception of benefits versus costs is the evaluation of the effectiveness of different actions that can be taken to reduce the disease threat (Janz & Becker 1984). Cues to action are those things which signal a person to take action in receiving care such as the advice of a friend, an ad in the media, or the advice of a healthcare professional (Janz & Becker 1984). The “perceived barriers to care” part of the

model includes emotional, economic, or social, physical, etc. factors that prevent one from seeking care. It encompasses the tangible costs that influence decision to seek care (Janz & Becker 1984) Using the Health Belief Model, the decision to vaccinate can be seen as a “function of perceived susceptibility to and severity of disease as well as concern about vaccine benefits and risk” (Meszaros et al 1996). The Health Belief Model is also used to predict health behaviors. If people are seen as fitting certain characteristics, then it is believed that one can possibly predict their behavior.

Fig 1: Health Belief Model

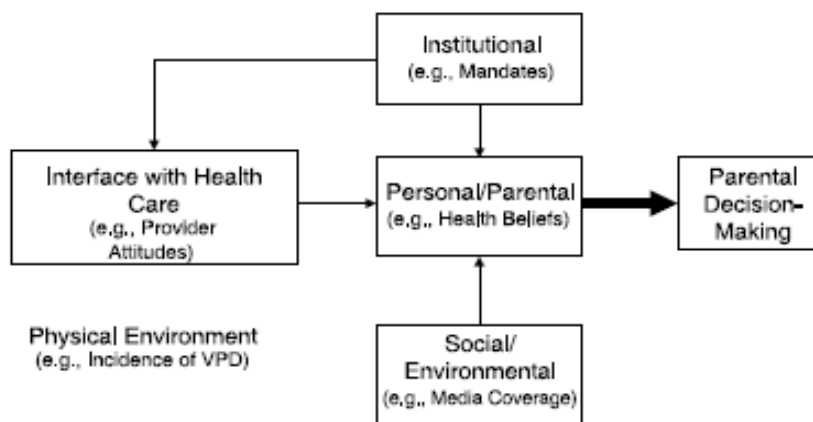


From Glanz ,et al 2002

In the literature on the parental vaccination decision making process, one set of authors have articulated a model based on the Health Belief Model that summarizes many of the factors that contribute to the decision to vaccinate. In their model, the Conceptual Model of Parental Decision Making (fig. 2), they include Institutional, Personal, Socio-environmental, and Interface with Health Care as different factors which influence a parent’s decision to have their

child vaccinated or to not vaccinate (Sturm et al 2005). This approach articulates the factors which contribute to one's perception of susceptibility to disease, disease severity, the benefits and risks of treatment, and cues to action. The institutional component of the model encompasses the government, its agencies and policies. The social-environmental factor includes cultural attitudes and beliefs about vaccination and immunization including lay and expert knowledge. The personal and or parental part of the model includes the beliefs of a parent related to vaccination and vaccine preventable diseases (Sturm et al 2005).

Fig 2: Conceptual Model of Parental Decision Making



From Sturm et al, 2005

Interface with Health Care:

The interaction that a parent or family has with their health care provider is an important determinant of health decision making. Studies looking at the acceptability of vaccines have noted that advice from a physician about a vaccine can weigh heavily on parents' final vaccination decision (Dinh et al 2007). For example, Gust et al found that for parents who were resistant to vaccinating their children or delayed vaccination, the advice of a physician was the main factor that changed their minds (Gust et al 2008).

Personal/Parental Beliefs Related to Vaccination:

The personal beliefs that a parent holds about vaccines, the process of vaccination, and immunity can affect whether how they view the risk of their vaccination choice, how they view their child's susceptibility to disease, and the effect that vaccination can have on them.

Anthropologist Emily Martin conducted a study that examined how the American public viewed the immune system. Among her other conclusions, she found that the way the public conceptualizes the immune system and how it works differs dramatically from the scientific understanding of immunity. She found that the public is somewhat conflicted about vaccination due to the way they perceived impact it has on the immune system. Vaccines were believed to have the effect of training or educating the immune system while at the same time representing a burden on an immune system that should be able to fend off disease by itself if a person is healthy (Martin 1994). The idea that that a vaccine can be a burden on a healthy immune system is due in part to the nature of the vaccine itself. The vaccine can be as source of disease or contagion because it may contain components of the original virus or because of the substances used to preserve the vaccine (Martin 1994). An example of this belief can be found in a study examining the acceptability of the five-in-one vaccine, Diphtheria, Pertussis, Tetanus, Hib (Haemophilus Influenza type B- a cause of bacterial meningitis), and polio, Tickner et al elicited women's opinions on the vaccine. Some of the women expressed the concern that the vaccine present too much of a burden to the vulnerable immune systems of infants, and that it had the potential to overwhelm (Tickner et al 2007). They felt that a vaccine that protected against one virus instead of five may reduce the potential for illness.

Social/Environmental Factors

Within the United States and abroad, the attitude toward vaccination is generally favorable. This is reflected by our preference toward vaccines as the means to ensure immunity in our population as opposed to other methods. The above discussion of immunity also is applicable to the discussion of environmental and social factors because it is informed by cultural attitudes toward vaccination. Our peers have the ability to influence our choices on vaccination, and our knowledge of vaccines and the problems associated with them is informed by or peers and family. In Tickner et al 2007, she asked the participants about what influenced their decision to vaccinate, and many responded that it was due to the opinions of their families and friends (Tickner et al 2007).

Institutional

One's opinion about the government can affect their view of vaccines. If parents have a positive view of the government, then they are more likely to support vaccine policies. If they have a negative view of the government, then they are less likely to view vaccination policy as being beneficial, and to see it as a means of the government to restrict personal choice and freedom (Martin, 1994). Mistrust in the government about non-vaccine related issues can affect how people perceive vaccination. For example, in a study by Casiday, she found that parents in the United Kingdom who expressed feelings that the government handled the Iraq war and other issues poorly also expressed concerns about the government's ability to handle other issues, including dealing with the MMR controversy (Casiday 2007). Some social scientists have linked feelings of mistrust in the government as being part of general feelings of unease about the complexity of modern society which forces us to rely on others for the management of some aspects of our lives (Hobson-West 2007).

Numerous research articles have addressed the role that the parents' perception of their children's susceptibility to disease has on their choice to vaccinate their children; and in these articles it is possible to see how the above described factors fit in with the Health Belief Model (Sturm et al 2005). Parents have been demonstrated to be less likely to decide to vaccinate their children or intend to vaccinate if they view their children's vulnerability to contracting a disease to be low. The susceptibility of the children to contracting a disease can be seen as a product of biological, social, and environmental factors. Environmental factors like where a family lives, where their children go to school, and potential environmental exposures contribute perception of susceptibility. Social factors like the behavior of a child, who they interact with, the disease and vaccination experiences of those in the parent's social circle, Biological factors like the health of a child including their immunity, the disease that they may be at risk for, the previous exposure to disease, etc are contributing factors. Additional contributing factors can include a parent's past experience with disease and their perceived ability to control their child's susceptibility to disease, which are reliant on the social, economic, and environmental factors.

Cognitive Biases

Cognitive biases are more frequently being used to explain vaccination decision making processes and are based on cognitive heuristics. The use of cognitive heuristics has become more popular due in part to inadequacies seen in social cognitive models like the Health Belief Model (Ogden 2003) and because these heuristics are seen as having the potential to better describe and predict the vaccination decision process (Sturm et al 2005). Largely developed by Daniel Kahneman and Amos Tversky, cognitive heuristics "reduce the complex tasks of assessing probabilities and predicting values to simpler judgmental operations (Tversky & Kahneman

1974).” They are simple rules that can be used to make judgments when information is incomplete or ambiguous. These cognitive shortcuts often produce accurate decisions, but occasionally they can cause systematic biases or errors, resulting from the fact that heuristics may not be able to predict the outcome of a situation or value of an option accurately in all circumstances due to varied factors, but they are widely applied. In the literature on vaccination decision making, these cognitive biases are used to explain the decisions made by people in regards to vaccination, i.e. if these biases are represented (or not) in the decisions of those choosing not to vaccinate. There are many heuristics and biases, but this chapter focuses on the biases most referred to in research on vaccination decision making.

Omission over Commission:

One of the heuristics that has been examined the most in the context of vaccine decision making is the omission bias. In 1990, authors Ilana Ritov and Jonathan Baron demonstrated in their study the presence of omission bias in the thinking of research participants asked about vaccinating a hypothetical child in several different scenarios (Ritov, 1990). Omission bias, or the tendency to favor omission over commission, is the preference to not act versus to act in situations when the outcomes of either choice is virtually the same, potentially making both commission and omission equivalent (Ritov 1990). The difference between omission and commission can vary depending on context. Omission and commission can be seen as distinct from each other in knowledge leading to action (omission may be due to lack of knowledge), intent, meaning, and acceptability in most situations, and often omission is seen as favorable to commission (Ritov 1990). However, Ritov and Baron state that when intent and knowledge are the same for commission or omission, i.e. an omission or commission would be done to achieve the same outcome and the information driving an omission or commission is the same, then

commission or omission can be seen to be morally equivalent, and omission is no longer favorable to commission (Ritov 1990). Additionally, when there is knowledge of the consequences of the omission and commission and a decision has to be made between them, favorability of omission over commission should also no longer be valid. They note, however, that the even under these circumstances, there still may be a preference for omission over commission.

Applying this to the case of vaccination choice, someone displaying an omission bias would be more accepting of harm caused by the choice to not vaccinate than harm caused by the decision to vaccinate. Ritov and Baron, the research participants were more reluctant to vaccinate when it was possible that the vaccine could cause bad outcomes even though they knew that deciding not to vaccinate would cause worse outcomes; more children dying from the flu than those who would die because of vaccine side effects. Their decision could be explained by the feeling that many of the participants had that they would be more responsible for the deaths of those who received the vaccine because they made the decision to vaccinate (Ritov 1990).

In other research looking at the omission bias, similar patterns have been found. Asch et al and subsequent research by Meszaros et al, they examined the decision making process in a survey based study asking parents about the DPT (diphtheria, pertussis, and tetanus) vaccination (Asch et al 1994; Meszaros et al 1996). They found differences in the willingness to accept deaths from the vaccine in non-vaccinators and vaccinators; with vaccinators being more likely to accept deaths due to the vaccine (Asch et al 1994; Meszaros et al 1996). Lucy Serpell and John Green conducted a study on the parental intent and decision to vaccinate using the MMR

vaccine and provided an additional potential explanation for the omission bias for vaccination. They believed that because the decision to not vaccinate is reversible, it was a way for parents to leverage uncertainty about the vaccine. Parents could reserve the decision to vaccinate their children until more information became available.

Availability:

One tool that people use when making a risky decision is the availability of an accessible and memorable event or 'availability' (Serpell & Green 2006). Availability is the number of examples that can be recalled and the ease of recollection which is then used to predict the outcome for a particular event (Serpell & Green 2006). The availability heuristic can be somewhat problematic. When rare events are repeated, the perception of the likelihood of an event occurring can become inflated, leading to inaccuracy in predictions of outcomes. An example given in Serpell and Green to illustrate this point is the media coverage of the MMR controversy. The attempts of the media to provide balanced coverage of the controversy in the UK increased the perception of the public that there was equal evidence supporting both sides of the debate (Clarke 2008; Serpell & Green 2006). In the coverage, parents whose children may have been effected by the vaccine were five times more likely to be represented in the media, increasing the perception that the rare event of a possible negative consequence of vaccination was more likely (Serpell & Green 2006).

Ambiguity Aversion:

When people are unable to measure the exact risks associated with an action, they are less likely to act, leading to an ambiguity aversion (Serpell & Green 2006). This inability to measure

exact risks can be attributed in some circumstances to the perception that there is missing salient information, and this can lead to inaction until they can find the missing information and to feelings of dissatisfaction if the information isn't available (Ritov 1990). The effect of the ambiguity aversion has been studied by Ritov and Baron, who looked at the effect that missing information for the participants examining the hypothetical flu vaccine scenarios. Ritov and Baron found that participants who were reluctant to vaccinate and found out that there was additional information increased their reluctance to vaccinate. Meszaros et al, found that the estimates of people identified as “vaccinators” that they would vaccinate their children fell when additional information was provided about the vaccine death rate which introduced ambiguity (Meszaros et al 1996). In studies of the media coverage of the MMR vaccination coverage controversy, some have argued that the balanced coverage lead to the perception that there was an argument going on in the medical community about the vaccination with support on each side. This made parents less sure of their personal choice due to lack of a clear consensus based opinion in the medical community (Serpell & Green 2006). Additionally, Meszaros et al posited that parents who are skeptical about medical or scientific information may be more susceptible to ambiguity aversion (Meszaros et al 1996).

Protected Values:

Protected values are values that are “absolute and not amenable to intervention” (Sturm et al 2005). These are values viewed to be fundamental, and encompass values for the natural environment, human and animal rights, etc. (Ritov & Baron 1999). Protected values are believed to be relevant for actions not omissions, are not related to the quantity of a particular outcome, and are reliant on the participation of an actor in an action no matter what the

outcomes (Ritov & Baron 1999). In the case of research on parental decision making and childhood vaccination, there are risks such as the possibility of damaging side effects or death that some parents are not willing to risk for their children or other children. Studies have shown that people who display this heuristic are more likely also display omission bias (Sturm et al 2005). In Ritov and Baron's 1990 study, they found that research participants were more likely to choose the hypothetical flu vaccine option that had no risk of side effects from its use, but was also the least effective at protecting against flu (Ritov 1990). In their 1999 study, they looked explicitly at the connection between protected values and omission bias. They found consistent differences in action choice among several options offered in hypothetical scenarios in those with protected values and those without. They also found a generational difference between younger participants and older participants; older participants were more likely to demonstrate an omission bias (Ritov & Baron 1999).

Additional cognitive biases that have been explored in relation to vaccination decision making in hypothetical and real life scenarios include the naturalness bias and the optimism bias (Dibonaventura & Chapman 2008). The naturalness bias is a preference toward things that seem to be more natural than those things that do not. The optimism bias is the tendency to be more optimistic about ones circumstances or the likelihood of positive events occurring than not.

Common Childhood Vaccinations and Vaccination Choice:

The vaccines most commonly recommended by doctors for children are: DTaP, MMR, Varicella, Hepatitis B, Hepatitis A, IPV (Polio), Hib, Influenza, Meningitis, and Pneumonia. The Hib or *Haemophilus influenzae* vaccine is used to prevent bacterial meningitis. The HPV vaccination is new, added to the list of vaccines recommended by the CDC in 2006 and is

recommended for girls ages 11-12 and catch-up vaccination between ages 13-26. These vaccinations, excluding HPV, are commonly administered at a period starting at birth through the first two years of a child's life with additional vaccination given at older ages for groups of children with health needs that require additional vaccination or catch-up vaccination for those who didn't receive vaccines at early ages.

Vaccination choice and behaviors among parents varies. Parents may decide to fully vaccinate all of their children, choose to vaccinate their children with certain vaccines and to exclude others, vaccinate just some of their children, or decide that they will not vaccinate at all. Some parents may also choose to modify the vaccination schedule, deciding to delay vaccination until their children are older. Modification of the vaccination schedule is often due to concerns about the safety of vaccination or concerns about the health of a child. Below is a chart (adapted from Weiner, in this textbook), that lists the common vaccinations, including HPV, and the regular schedule for the vaccinations.

Fig 3: Childhood vaccination schedule

Schedule for the most commonly recommended childhood immunizations											
Age	Hep-B	Pneumoccal Conjugate	DTaP	HiB (Haemophilus Influenza Type b)	Meningococcal	Hep-A	Influenza	IPV (Polio)	MMR (Measles Mumps Rubella)	Chicken Pox (Varicella)	HPV
Birth	x										
2 months	x	x	x	x				x			
4 months	x	x	x	x				x			
6 months	x	x	x	x			x	x			
12 months	x	x	x	x		x	x	x	x	x	
15 months	x	x	x	x		x	x	x	x	x	
18 months	x		x			x	x	x		x	
24 months	x	x			x	x	x				
4-6 years	x	x	x		x	x	x	x			
11-12 years	x		x	x	x			x	x		x
13-14 years	x	x	x			x	x		x		x
15 years	x	x	x		x	x	x		x		x
16-18 years	x	x	x			x	x		x		x
	Special Groups										
	Assessment at 11-12										
	Catch-Up Immunization										
x	Vaccination period										

There have been debates about the efficacy and safety of these vaccines at various points in history. These vaccines may face opposition in part because the diseases they prevent are not perceived as infections that many are susceptible to due to their near eradication and fears that the effects of the vaccines are worse than the diseases.

For example, chickenpox is viewed to be a common childhood infection with little negative effects (Gust et al 2008). The immunity conferred by the Varicella vaccine is viewed to be short term, lasting ten years, while infection with the virus is viewed to provide lifelong immunity. For some parents who decide to delay or refuse Varicella vaccination, they seem to be weighing its risks and benefits; they are deciding to risk infection than deal with any unforeseen consequences of the vaccine (Gust et al 2008). The commonality of the illness

coupled with the perception that vaccination could disrupt the processes of the body leads in part to the negative view that some hold toward this vaccine (Gust et al 2008; Martin 1994).

MMR vaccine controversy:

History

In 1998, physician Andrew Wakefield and his collaborators published a paper in the journal *The Lancet*, alleging a possible connection between the measles mumps rubella vaccine to developmental and neurological disorders. They conducted a study in the United Kingdom examining the presence of lesions in the bowels of twelve children who were experiencing developmental and neurological disorders. The proposed link that Wakefield and his associates described was based on previous research into the connection between bowel disorders and autism. The theory they cited is the “opioid excess” theory for the development of autism which poses that disruption in normal bowel function allowed for increased absorption of peptides produced in the bowel from the breakdown of food. These peptides would then have opioid like effects on the central nervous system and would disrupt normal brain function and development (Wakefield et al 1998). Using the claims of the children’s parents and physicians that the developmental problems seen in the children did not appear until after they were vaccinated, coupled with the presence of bowel disorders in the children as well as these developmental disorders, Wakefield and his colleagues inferred that the disruption in normal bowel function was caused by the MMR vaccine (Wakefield et al 1998). They cited other studies that noted the development of neurological problems in children after being vaccinated with MMR as well as the association of autism and rubella. However, Wakefield et al also stated that they did not

prove a causal association between the MMR vaccine, the bowel syndrome, and the neurological problems seen in the children (Clarke 2008; Wakefield et al 1998).

The controversy gained steam when Wakefield proposed that the MMR vaccine should no longer be used and that children be vaccinated using separate vaccines for measles, mumps, and rubella instead during a press conference for the study. This statement resulted in a media storm that led to a decrease in the number of parents electing to have their children vaccinated with the MMR vaccine. The media played a large role in the controversy, and research has been conducted into how it impacted the discussion about the MMR vaccine (Clarke 2008). Reports about parents' negative experiences with the vaccine while intended to provide a balanced coverage of both sides had the unintended consequence of creating bias against the vaccine. At the height of the controversy, MMR vaccination rates for children in the United Kingdom dropped dramatically (Clarke 2008). In 2004, many of the researchers, excluding Dr. Wakefield and another, who worked on the 1998 study issued a retraction in the Lancet, in part because of the negative impact their interpretation had on vaccination acceptance (Murch et al 2004). Although subsequent research done by others has failed to show that there is causal link between measles vaccines and the MMR vaccine and autism, Wakefield and others continue to support the link between bowel function disruption and autism. Recent legal decisions in the United States have ruled that there is no connection between the MMR vaccine and autism.

Effects of controversy:

In a recent study, Tickner et al evaluated the role the MMR controversy had on parental decision to vaccinate their children (Tickner et al 2006). They describe what they call the MMR effect, a demonstrated decline in the use of the MMR vaccination that occurred after the scandal

but has since begun to turn around and a possible negative effect on other combined dose vaccines (Tickner et al 2006). As mentioned before, the media coverage on the MMR vaccine caused some ambiguity about the safety of the vaccine and omission bias against the vaccine. Part of the central argument about the MMR vaccine was that it was the administration of multiple vaccines at one time may have caused the bowel disruption responsible for the onset of developmental and neurological disabilities. People extrapolated this danger to include other combined dose vaccines even though there was no evidence to support it leading to the suboptimal use of vaccines

HPV Vaccination:

The human papillomavirus (HPV) is a sexually transmitted infection responsible for seventy percent of all cervical cancers and ninety percent of cases of genital warts. There are over forty different kinds of HPV, but the types that can cause cancer are types 16, 18, 31, and 45 (Zimet et al 2008). Infection rates of the virus are extremely high; epidemiological studies have shown that at least fifty percent of all adults will contract HPV within their first two years of being sexually active and it is the most common sexually transmitted infection (Lenselink et al 2008). Before the introduction of the first human papillomavirus vaccine, Gardasil, in 2006 and more recently Cervarix, researchers have been examining the potential acceptability of vaccines for STI's. In general, the rates of acceptance for STI vaccinations and HPV vaccinations that are elicited as part of research studies are high, but there also parents who did not accept the vaccine (Zimet et al 2008). Those who accepted the vaccine often stated that the primary reason for doing so was to protect their children and others, and those who did not (Mays et al 2004; Waller et al 2006).

Most research on the acceptability of the HPV vaccines before and after their creation has been focused on gauging how the vaccine would be received by parents, due to the fact that in order for it to be broadly effective in generating immunity in the population, it would have to be administered to children before they become sexually active (Fisher et al 2008; Zimet et al 2008). The research is also aimed toward encouraging acceptance of the vaccine and the creation of policies to support effective implementation of vaccination programs. Although this research into the acceptability of the HPV vaccine, mostly survey and focus group based, has been conducted worldwide in many contexts, there have been some general factors that influence the acceptability of the vaccine in parents' eyes which can be seen in the literature. Acceptability of the vaccine varies with: information about the vaccine and its side effects, the parents' perceived ability to control their children's vulnerability to infection, the perceived susceptibility of their children to the infection, the perceived severity of the infection, the perceived efficacy of the vaccination, and the personal health beliefs and experiences of the parents (Constantine & Jerman 2007; Zimet et al 2005).

The amount of and type of information that parents have about vaccines has varying effects on their acceptance of the idea of vaccinating their children. In various studies, results pointed to a lack of knowledge about HPV and its potential to cause cancer (Waller et al 2006). In some of those studies, after parents were given information on HPV the number of parents who would consider vaccinating their children increased (Dinh et al 2007) while in others there was no report of a change (Lenselink et al 2008). A possible reason why an increase may have occurred is because it increased the perception of the severity of the infection. The side effects of the HPV vaccine are viewed to be minimal, but recent information has emerged alleging a link between HPV vaccination and the development of Lou Gehrig's Disease like symptoms in girls

who have received the vaccine (Kotz 2009). As of yet, there is no information to support a causal link between the development of these symptoms and the vaccination, but there are calls for further research. This new information could have the potential of creating omission bias or ambiguity aversion; the increased perception that the vaccine could cause harm may lead some to decide that it is better to forgo vaccination in favor of other methods that could be used to prevent the spread of HPV or it may cause some to be wary of the vaccine and choose to stay with the status quo or delay decision making (Meszaros et al 1996).

Parents' perceived susceptibility of their kids to becoming infected involves several factors. Parents make judgments about the susceptibility of their children based on their children's age at the time of the study, their perceptions of their children's behaviors and personalities, and the nature of the disease itself. Parents whose children were preadolescents at the time of the studies sometimes expressed the sentiment that their children were too young to vaccinate, and that they would wait until they became sexually active to vaccinate their children (Mays et al 2004). The parents are defining the risk of infection as coinciding with the onset of sexual behavior, but if vaccination is delayed until after the onset of sexual behavior, infection may have already occurred. Parents also expressed the desire to vaccinate their children when they are able to understand what the vaccine means, or when they are younger to prevent awkwardness caused by questioning about the vaccine (Noakes et al 2006).

Parents also made decisions about the susceptibility of infection based on assumptions of their children's behavior and personality (Mays et al 2004). Some expressed the sentiment that their child wouldn't need the vaccination because they were not likely to be engaging in sexual behavior or did not currently engage in sexual behavior (Mays et al 2004) The nature of the

disease as being a sexually transmitted infection influenced parents to be less likely to accept the HPV vaccine for their children. Because it is an STI, there are existing behavioral interventions in place like condom use or abstinence that people may prefer to the idea of using a medication. However these interventions may be inadequate. For example, although condom use has been demonstrated to reduce the likelihood that a woman will contract HPV during intercourse, it does not totally prevent the spread (Winer et al 2006). HPV is contracted through genital skin-to-skin contact during intercourse, and condoms do not provide enough coverage (CDC 2008). The disease is also not one that could be spread through casual contact like the kind typical in school environments, so some parents feel that the risk for infection is low and doesn't merit the use of a potentially more risky medical intervention (Brabin et al 2006; Zimet et al 2005).

The perceived efficacy and safety of the vaccine are another two factors cited by the literature as being the main concerns of parents considering vaccinating their children. In many of the studies, one of the chief concerns of parents was potential side effects of the vaccine. Concerns about side effects were related not only to physical consequences but also to the sexual behaviors of girls receiving the vaccine. In multiple studies, some parents talked about the fear that giving girls the vaccine would be seen as providing them with permission to become sexually active, with permission being granted by them or physicians (Brabin et al 2006; Dinh et al 2007; Waller et al 2006; Zimet et al 2005). Some of the parents in the study expressed this view while others thought that sexual activity and the vaccine would be unrelated. In one study, parents who said that they would vaccinate their children were more likely to not see the vaccine as promoting sexual behavior (Zimet et al 2005).

The personal health beliefs and experiences of parents also contributed to their decision to vaccinate or not vaccinate their children and have influence on children's opinions of vaccination. Those who had previous experiences with STI's themselves or knew of people who had STI's were more willing to vaccinate their children (Mays et al 2004; Waller et al 2006). Those who were more likely to vaccinate also perceived an STI as being more severe than those who did not choose to vaccinate (Zimet et al 2005). In one study, women indicated that for them, the experience of a Papanicolaou or pap smear test was traumatic enough that they would vaccinate their daughters to prevent them from experiencing the same thing (Mays & Zimet 2004; Waller et al 2006). In their study Zimet et al looked to see if there was an association between parental beliefs on vaccination and the beliefs of their children. They found that there was a concordance between parental and child beliefs on STI vaccination and that the beliefs of parents was predictive of children's beliefs (Zimet et al 2005).

Vaccination and Risk

For parents going through the process of deciding to vaccinate their children, a common concern may be how to determine and mitigate the risk inherent in the decision. Perceived risks associated with vaccination may be side effects and the efficacy of the vaccine, the severity of the disease and the vulnerability of their child to contract the disease (Mays et al 2004). Models like the Health Belief Model have been used to determine what factors influence people when making their health decisions, determine what factors encourage or discourage action, and to attempt to predict outcomes. Cognitive psychological theories like cognitive heuristics are being used to explore how these decisions are made, and how these shortcuts we use to estimate make decisions may lead to biases, and how these biases effect real life outcomes (Dibonaventura &

Chapman 2008; Ritov 1990; Ritov & Baron 1999). These theories examine how we conceptualize and estimate risk and benefits.

Within the debate about vaccination risk is conceptualized in a broader context and, questions are raised about risk and the responsibility for risk. In her study examining parental decision making and the MMR (measles, mumps, rubella) vaccine, Casiday examines how the risk associated with the vaccine is articulated by parents (Casiday 2007). She describes three schools of thought in the social sciences concerning risk, the cultural theory of risk, the risk society, and psychometric models of public risk perception. In the cultural theory of risk, risk thought to be socially constructed, and the identification and determination of risk is reliant upon ones social outlook, which is culturally determined (Casiday 2007). In the risk society theory, current conceptions of risk and actual risks are products of the modern era brought about by the industrial revolution. In this model, increased awareness of risk results from a reflexive interaction between the new forms of risk and the social and political means people devise to cope with them (Casiday 2007). The number of things that pose potential risk is seen as being large and not in the realm of personal control due to the complexity of modern society. Pyschometric models of public risk perception view people's perception of risk as being determined by many factors, i.e. social, psychological, institutional, that are able to be modeled and are quantifiable (Casiday 2007).

Pru-Hobson's take on the resistance to vaccination as a being response to the way that vaccination risk is discussed in the "dominant expert discourse" (Hobson-West 2008). The perception of risk and the act of deeming something as a risk is seen as a result of social and political processes (Hobson-West 2008). She identified several themes that emerged in her

research that contributed to the group members' perceptions of vaccination risk; unknowns, distribution of risk, risk as strategy, and questioning of the reliability of historical success narratives. The theme of risk as unknowns emphasized two points; the true risk of vaccines especially in terms of side effects is unknown and the mechanisms of the body and how it fights disease are unknowns. The theme of distribution of risk focused on the idea that the distribution of risk for contracting a disease and the risk for being exposed to side effects because of vaccines is not distributed equally and is the result social problems, and the belief that the individual is not seen as being important by policy planners. Risk as strategy contradicts the theme of risk as unknown because it argues that the risk of vaccines is known but hidden from the public and also argues that public perception of risk is manipulated to cause fear which can influence vaccination choice. There was also questioning of the reliability of the historical narratives of vaccine success through arguments made that the successes attributed to innovations in vaccination were actually due to improved sanitation (Hobson-West 2008).

From the perspective of parents, risk associated with vaccination whether biological or social in nature, is risk that they have to manage for their children. Parents frame risk in terms of the risk it may present to their children instead of a view of risk which encompasses society, or an epidemiological view (Casiday 2007). In her research, Pru Hobson-West examines the discourse of various groups in the UK who are against vaccination and how risk is conceptualized within that discourse. The risk of vaccination is seen by some of the parents as being individualized; that is, the risk of vaccinating or not vaccinating is assumed by the parents themselves, not by society (Hobson-West 2008). There is also the contention that, because people are individuals and as such have unique bodies and states of health, vaccines are inadequate as a one size fits all treatment (Hobson-West 2008). The responsibility for the

vaccination choice then lies with the parent including coping with any perceived possible outcomes of treatment (Casiday 2007; Hobson-West 2008).

Conclusion

Applied to vaccination choice, these theories and models can inform how and why parents make their choices. Vaccination is in most cases an effective and safe means of preventing the spread of infectious diseases, but for parents the decision that they make can be complicated. Parental vaccination decision is influenced by multiple factors. The perceived susceptibility of their child to illness, the perceived safety and efficacy of vaccines, their personal past experiences with vaccination and the experiences of others, the advice of professionals, their personal health beliefs, etc. all have an impact on a parent's decision. Making decisions on the behalf of their children can be difficult, and many parents whether they support vaccination or not decide to err on the side of caution, be it choosing to vaccinate or deciding not to.

Advice for Parents:

Parents making the decision to vaccinate or not vaccinate their children should weigh for themselves the risks and benefits of vaccination. The CDC provides guidelines for parents considering vaccinations. Below are some of their recommendations.

- Be informed in your decisions:
 - Review vaccination information, looking at the components of the vaccine, side effects, duration of immunity, and number of shots needed to ensure immunity, etc.
 - When looking for information about vaccination online, verify that it comes from a valid source.
 - Talk to your doctor about the benefits and risks of vaccines.

- Talk to your doctor about bad reactions:
 - Talk to your doctor if you, your child, or its siblings has ever had a bad reaction to a vaccine
 - Alert your doctor if your child has allergies or may have sensitivities to vaccine components.
 - If your child is moderately or severely ill talk to your doctor before your child is vaccinated
- Ask about conditions under which your child should be vaccinated.
- Report adverse reactions.

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