SMALLPOX VACCINE RECOMMENDATIONS: IS TRUST A SHOT IN THE ARM?

by

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(Under the direction of Dr. Marsha Davis)

ABSTRACT

This study examines how the public's trust and confidence in the Department of Homeland Security to manage a smallpox outbreak influences their willingness to cooperate with government recommendations. A bioterrorist event in the U.S. presents an extraordinary requirement for risk communication planning, preparation and practice. A deeper understanding of how trust and confidence lead to cooperation will be useful in guiding the government's communication to the public during a bioterrorism event and will offer practical guidance to risk communicators and public health professionals on how to maximize cooperation with government recommendations during a smallpox outbreak.

INDEX WORDS: bioterrorism, trust, risk communication

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B.S., Georgia Institute of Technology, 2001

M.S.S.P., Georgia Institute of Technology, 2003

A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2011

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December 2011

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CHAPTER 1

INTRODUCTION

During a public health emergency, it is critical that risk communication messages convince the public to cooperate quickly with governmental directives to avoid drinking the water, shelter-in-place, and take vaccinations or medications. Distrust of the government and its directives often stands in the way of this cooperation. Although common sense would indicate that securing trust in the public health system is essential, it has been grossly underappreciated. The result of this work aims to contribute to the growing body of research into how trust influences cooperation, and to provide useful recommendations to public health and risk communicators on how to best structure health messages to maximize public cooperation with government vaccine recommendations.

In a time of increasing distrust of the government, the public health system is challenged with protecting the health of a largely skeptical citizenry. The successful management of public health threats such as bioterrorism, avian influenza, and H1N1 demand the rapid mobilization of the public to cooperate with government recommendations. The extent of the public's cooperation with governmental directives in a crisis situation such as a bioterrorist attack may depend heavily on the public's trust in the government and its relevant risk management institutions to effectively manage such crises.

However, public trust in government agencies has steadily declined among Americans over the last 50 years (Chanley, Rudolph, & Rahn, 2000). In the early 1960s, nearly 75% of Americans

said they trust the government in Washington just about always or most of the time. By 2010, just 22% of Americans said they trust the government in Washington. In fact, public trust in government and political institutions has been decreasing in all of the advanced industrialized democracies since the mid-1960s (Dalton & Wattenberg, 2000). Further, favorable ratings for federal institutions have fallen significantly over the past 10 years (Pew Research Center, 2010). Given these sharp declines in the public's trust in its government, and an emerging body of research on the importance of trust in cooperation, it is time for the U.S. public health system to recognize the importance of the public's trust in the system's ability to protect their health. If the public does not believe the government is ready to deal with a public health threat they will not trust the directives and guidance given by those in charge.

In addition to a broader environment of distrust, the public's acceptance of vaccine recommendations is susceptible to influence by vocal anti-vaccine groups. The current anti-vaccine movement was sparked by a 1998 article in the British medical journal The Lancet linking Autism to MMR vaccine (measles, mumps and rubella). Unfortunately, the mythical link between vaccines and autism has proven remarkably resilient. According to the CDC's National Immunization Survey, in 2008 nearly 40 percent of American parents of young children refused or delayed giving them at least one routine shot – up from 22 percent in 2003. Allegations of harm from vaccination have raised parental, political, and clinical anxiety to such levels that outbreaks of infectious diseases not seen for a generation are occurring in communities with low vaccination rates. "Vaccines are victims of their own success" is the shorthand now used to reflect the reality that, in the absence of vaccine-preventable disease, many fear vaccines more

than the diseases known to them only vaguely. Indeed, the majority of practicing physicians are young enough to have no personal experience with most vaccine-preventable diseases.

The current anti-vaccine movement is not the first in this country. Since vaccination began in the late 18th century, opponents have claimed that vaccines do not work, that they are or may be dangerous, that individuals should rely on personal hygiene instead, or that mandatory vaccinations violate individual rights or religious principles. Before the era of modern vaccines, the widely used smallpox vaccine carried risks of relatively frequent and severe adverse reactions. To this day, medical experts consider smallpox vaccine, which contains a bovine virus called vaccinia "the least safe vaccine available". Serious complications, including postvaccinial encephalitis and death, are rare, but milder reactions such as rashes, fatigue, headache, fever, and painfully tender arms, are common. Of course, when this vaccine was introduced during smallpox outbreaks in the past, smallpox was a tangible disease threat that was more feared by the public than the risks of the vaccine. However, even when the deadly potential of disease was visible to the public, anti-vaccinationism existed as early as the beginning of the 20th century in the United States. Opposition to compulsory vaccination was often due less to health concerns, rather reflecting social divisions and political tensions of the time and place. In fact, America's turn-of-the-century war against smallpox sparked one of the most important civil liberties struggles of the twentieth century. Recognizing the battles of free speech several decades later, Justice Oliver Wendell Holmes Jr. wrote "Free speech stands no differently than freedom from vaccination".

On May 8, 1980, the World Health Assembly declared, "The world and all its peoples have won freedom from smallpox, which was a most devastating disease sweeping in epidemic form

through many countries since earliest time, leaving death, blindness and disfigurement in its wake". The smallpox eradication program severed smallpox from its human host – a monumental public health achievement. Alas, the campaign did not annihilate the virus. As immunization levels around the world fell after 1980, the virus took on a new and ominous existence in the laboratory. The WHO had authorized two laboratories to keep frozen stocks of the variola – the CDC in Atlanta and the Research Institute for Viral Protections in Moscow. By the time the Soviet Union collapsed in 1990, British and American intelligence agencies had believed for some time that the USSR had been developing weapons-grade variola – fears that were confirmed in the mid-1990s. Concerns about weaponized smallpox virus intensified after the terrorist attacks of September 11, 2001, soon followed by the anthrax attacks.

Soon after the anthrax attacks, President George W. Bush announced his administration's plan to protect the nation from a smallpox attack. The plan included compulsory vaccination of a half-million U.S military personnel, followed by a voluntary campaign of a roughly equal number of frontline hospital workers and members of public health departments. After that, the plan called for voluntary vaccination of some 10 million firefighters, police, and other first responders. The military vaccination campaign went smoothly, but the voluntary civilian campaign failed quickly, with only 38,000 health workers agreeing to be vaccinated. While this episode of public mistrust had few short-term consequences, it does raise grave concerns about future bioterrorism initiatives and the ability of the government to encourage the public to take protective action.

Cooperation with vaccine recommendations is a complex decision contextualized by both a shared national consciousness of social and medical controversies of the past, as well as the

present wave of public distrust of vaccine and government action in general. A successful government response to a bioterrorism threat will demand a public health system that is able to communicate rapidly and effectively with its citizenry. New social media and the emergence of a post-deferential society challenge traditional sources of information. No longer do rumors of adverse side effects from vaccine spread via word of mouth in local communities. A bottomless archive of information and misinformation about vaccines is just a few keystrokes away.

However, rather than becoming defensive in the face of an increasingly questioning public, the public health community must recognize the importance of being open to learning the concerns that will affect the acceptance or rejection of recommended health services. The risk communication literature can share many lessons on public trust with public health. Such work has identified openness and honesty, concern and care, and knowledge and expertise as determinants of precious public trust. Now is the time for the public health system to invest in its most precious resource, public trust.

This study aims to examine how the public's trust and confidence in their government's ability to manage a smallpox outbreak influences their willingness to cooperate with government vaccine recommendations. A bioterrorist event in the U.S. presents an extraordinary requirement for risk communication planning, preparation and practice. A deeper understanding of how trust and confidence lead to cooperation will be useful in guiding the government's communication to the public during a bioterrorism event and will offer practical guidance to risk communicators and public health professionals on how to maximize cooperation with government recommendations during a smallpox outbreak. In addition, this study will explore the relationship between

smallpox risk perceptions and trust of a relevant risk managing institution. If, as some argue, trust is strongly related to risk perception, trust may prove to be a key to the development of more effective risk communication techniques during a bioterrorism attack.

CHAPTER 2

LITERATURE REVIEW

Communication during Crises and Disasters

The kind of communication that surrounds a bioterrorist event is very different in scope and nature than many traditional models of risk or crisis communication. The risks associated with such an event are generally unfamiliar to the public, levels of uncertainty are high, and such events require more cooperation between elected officials at local, state, and national levels, as well as the emergency management and Homeland Security infrastructure. A new model of communication known as crisis and emergency risk communication (CERC) has emerged in recognition that in an era of bioterrorism as well as other emerging global threats to public health communication must be strategic, broad based, responsive, and highly contingent (Reynolds & Seeger, 2005). CERC merges traditional notions of risk communication and crisis communication into a blended framework that outlines specific kinds of communication activities at various stages of a crisis. A brief description will be given below of the two traditional notions of communication that are blended to form the CERC model, as well as a description of the CERC model and its application to a smallpox bioterrorist event.

Risk communication is a mature area of research and practice that informs many public health campaigns. Covello (1992) defines risk communication as "the exchange of information among interested parties about the nature, magnitude, significance, or control of a risk". In practice, it most often involves the production of public health messages regarding health risks and environmental hazards. Recognized as an example of thought leadership in the risk

communication field, Sandman's (1993, 2002) model of risk as a function of hazard (defined as technical assessment of risk) and outrage (defined as a cultural view of risk) has framed many of the efforts to communication about various public health risks. His detailing of the factors associated with outrage has provided a helpful framework for assessing the public's response to risk, as well as a guide for how to structure risk messages. Credibility is important to the believability and effectiveness of messages. Risk messages should include some self-efficacy action that can be taken to reduce the risk (Edbert & Parrot, 2001). Risk messages should be clear and simple, appeal to reason and emotion, and offer solutions to problems (Freimuth et al., 2000). Much of risk communication as practiced in public health incorporates these features in public messages, usually carried in the mainstream media, as general persuasive campaigns. They seek to inform the public and change behavior in ways that protect and improve the public health and safety.

Whereas risk communication is focused on identifying risks to the public and persuading the public to adopt more healthy, less risky behaviors, crisis communication involves messaging to "prevent or lessen the negative outcomes of a crisis and thereby protect the organization, stakeholders, and/or industry from damage" (Coombs, 1999). It is usually associated with public relations and is grounded in efforts to strategically manage and frame public perceptions of an event so that harm is reduced for both the organization and stakeholders. Simply put, crisis communication seeks to explain the specific event, identify likely consequences and outcomes, and provide specific harm-reducing information to affected communities in an honest, candid, prompt, accurate, and complete manner (Reynolds & Seeger, 2005).

Over the last decade, efforts have been made to combine notions of risk communication and crisis communication into a practice described as crisis and emergency risk communication (Reynolds, 2002). This blended form of communication emphasizes the developmental features of crisis and the various communication needs at various points in the ongoing development of an event (Reynolds & Seeger, 2005). As the event progresses from precrisis, to crisis, to postcrisis stages, CERC prescribes specific message ingredients and processes to meet the information needs of the public, minimize uncertainty, and promote action.

The communication efforts surrounding the 2002 smallpox vaccination campaign to educate the public more broadly about smallpox, communicate the risk of vaccinations, and generally promote vaccination to specific publics, illustrates the CERC framework as a tool to educate and equip public health professionals for the expanding communication responsibilities of public health in emergency situations (Veil, Reynolds, Sellnow, & Seeger, 2008). After the anthrax attacks, the threat of a smallpox attack emerged within the larger backdrop of a potential bioterrorism threat that could result in a widespread public health crisis. Initially, there was an immediate audience of those most at-risk such as U.S. military personnel, frontline hospital workers, members of public health departments, emergency workers, and first responders. The immediate communication needs were to reduce uncertainty, allowing these audiences to gain a basic understanding of the event and the risk of smallpox. Beyond this, public health communicators issued specific recommendations about how to avoid or reduce harm, what symptoms might indicate concern, and where to go for vaccination. Finally, the post-crisis stage involves assessment, learning, and often critical questioning regarding the cause of the crisis, the

appropriateness of responses and who should take the blame and responsibility (Seeger, Sellnow, & Ulmer, 1998).

At the core of all CERC principles is the absolute necessity of trust in the entity delivering messages and managing the event. As the public demands a rapid response to an event, a spokesperson must balance the tension between being fast with information and being accurate. The extent to which the public perceives the entity as being diligent and credible, versus withholding information or flat out lying, will largely be determined by how trustworthy the public perceives the spokesperson.

Trust and Public Health Recommendations

Lack of trust can cause health programs to fail with harmful consequences. Measles outbreaks in the United Kingdom and the United States and the spread of polio across Africa from Northern Nigeria in the past decade are recent examples where lack of public trust lead directly to increased disease. Public trust in health interventions and in authorities who provide them are essential to a social framework in which public health interventions and positive health outcomes can thrive. Following the recent avian influenza and H1N1 pandemic (2009), public trust in government authorities has emerged as a clear predictor of compliance with officially recommended protection measures. Findings from a study examining the role of trust in H1N1 vaccination highlight the unique importance of trust in vaccination behavior. Results from a recent longitudinal survey of adults in Switzerland shows that public trust in medical and political authorities was an important predictor of compliance with officially recommended H1N1 protection measures such as getting vaccinated, washing hands, and wearing a mask

(Gilles et al. 2011). Trust in medical organizations measured at the beginning of the pandemic predicted actual vaccination status six months later during the 2009 H1N1 pandemic. In fact, no other variables explained significant amounts of variance in vaccination status.

Institutional Trust

In the past decade, empirical research devoted to trust has begun to flourish in various fields of the social sciences such as psychology (Kramer, 1999), marketing (Geyskens et al, 1999), risk management (Trumbo & McComas, 2008; Siegrist, Cvetkovich, and Roth, 2000), and public health (Meredith et al, 2007). Results of this research have demonstrated the importance of trust for cooperation. However, this corpus of trust research has also spawned a confusing variety of measures and constructs that has frustrated progress towards a more useful understanding of trust. Researchers may indeed celebrate this diversity as a signal that trust plays a number of central roles in civic culture, from how individuals perceive technological risks to explaining the level of political legitimacy enjoyed by democratic regimes. However, a practitioner can be frustrated as they seek to answer the straightforward question of "What can I do to increase the public's trust and confidence in my institution and its messages?" Although it is now widely recognized that trust in institutions plays an important role in responses to risk communication, there have been many debates regarding what constitute and what contribute to such trust. Institutional characteristics such as perceived competence, objectivity, fairness, consistency, faith, commitment, and caring have all been identified as core components of institutional trust (Renn & Levine, 1991; Kasperson et al., 1992).

Some have criticized researchers for making discussions about trust unnecessarily difficult. Metlay (1999) argues that some researchers have the tendency to distinguish additional shades of meaning in the concept of trust, although it is not at all clear whether the public distinguishes between the different theoretical features of trust, or that they are indeed empirically discernable. Metlay developed and administered a survey to measure attitudes relevant to trust with the goal of increasing public trust and confidence in The Department of Energy programs for managing radioactive waste. Metlay's study of judgments of trust in the Department of Energy suggests that trust is not complex and multifaceted, but a rather simple concept based on two distinct components: 1) an affective component composed of a tightly interconnected set beliefs about institutional behavior, and 2) perceptions of how *competent* the institution is, or similarly, how much confidence the individual has in the institution.

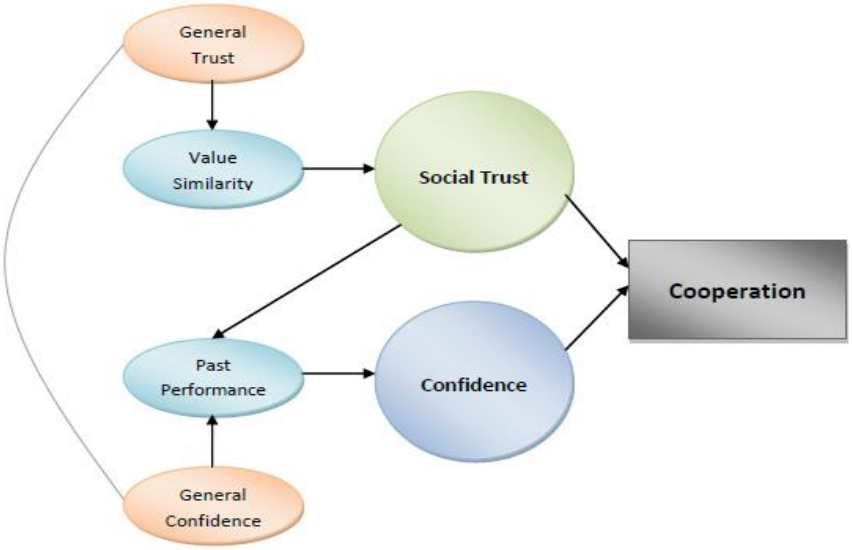
Empirical studies in the field of social psychology are consistent with Metlay's identification of two components of trust. Such studies have demonstrated that the information perceived by a person tends to be divided into two types, morality and performance information (Skowronski and Carlston, 1989; Peeters and Czapinski, 1990). In the conceptual framework of the Trust, Confidence and Cooperation model described below, morality information is equivalent to actions reflecting the values of a person (or person-like entity such as an institution), and performance information is simply the behavior of a person (or institution).

The Trust, Confidence and Cooperation Model

Although most studies of trust and risk management have been a theoretical, results from previous studies support the general hypothesis that trust and confidence are important factors in

generating cooperation (Siegrist, Earle & Gutscher, 2003). Based on a thorough review of the trust literature, in a wide variety of domains, a dual-mode model of cooperation based on social trust and confidence has been proposed. The Trust, Confidence and Cooperation (TCC) model proposes two pathways to cooperative behavior based on two dimensions of institutional trust - social trust and confidence (Earle, Siegrist & Gutscher, 2007). The model postulates that social trust is based on shared values, a judgment of similarity between an individual and the institution. Social trust can be indicated variously by measures of a person's judgment of the institution's commitment, concern, caring, honesty, and fairness. These shared values, it is argued, can be taken to mean good intentions on part of the institution relative to those of the trusting person. The second pathway to cooperation shown in the model is through confidence, defined as the belief that, based on experience or evidence, certain future events will occur as expected (Earle, Siegrist & Gutscher, 2007). In the conceptual framework of the TCC model, the basis for institutional confidence is past performance as indicated by measures of evidence, experience and competence. Applying the constructs from this model, this study will examine the influence of each of these two pathways on cooperative behavior in an experimental study.

Figure 1: The Trust, Confidence and Cooperation Model



Apart from the trust and confidence one may have in a particular entity or institution, researchers have long recognized the concept of general trust and general confidence as personality traits. Some people show a stronger general tendency to trust than other people, and experiments suggest that persons with high general trust cooperate more than persons with low general trust (Yamagishi, 1988). The construct general confidence expresses the conviction that everything is under control, uncertainty is low, and that the world should unfold as expected. It is expected, for example, that a car will not break down or that electricity will be available whenever it is wanted. General confidence can be viewed as a positive expectation regarding future events (Siegrist, Gutscher & Earle, 2005). People with high levels of general confidence tend to attribute better past performance to those (people, objects, institutions) they judge than people with low levels of general confidence. Within the framework of the dual-mode model of cooperation (TCC), it is hypothesized that general trust as well as general confidence will

indirectly effect levels of cooperation. This study will examine the influence of general trust and general confidence on cooperative behavior, as well as their correlation with other relevant constructs.

Test of the TCC Model of Cooperation

Siegrist, Earle & Gutscher (2003) tested the TCC model in the context of electromagnetic fields (EMF) risks potentially posed by cell phone base stations and the confidence individuals have in cell phone companies to manage those risks. Structural equation modeling procedures and data from a random sample of 1,313 participants were used to test the model. Results of the study support the proposed dual-mode model of cooperation based on trust, with both social trust and confidence having an impact on cooperation. The model explained 41% of the variance of the latent variable cooperation.

However, to get a good fit, a modification was necessary. The initial model lacked a path from social trust to confidence and did not yield a good fit to the data (Comparative Fit Index = 0.87). The addition of a causal path from social trust to confidence significantly improved the fit of the new model. For the revised model, the χ^2 dropped significantly ($\Delta\chi^2(1) = 398.88$, $p<0.001$). A plausible explanation offered by the investigators is that, in the context of EMF risks, people do not possess sufficient information, and therefore strongly rely on social trust for confidence assessments.

Figure 2: Results from a Test of the TCC Model of Cooperation

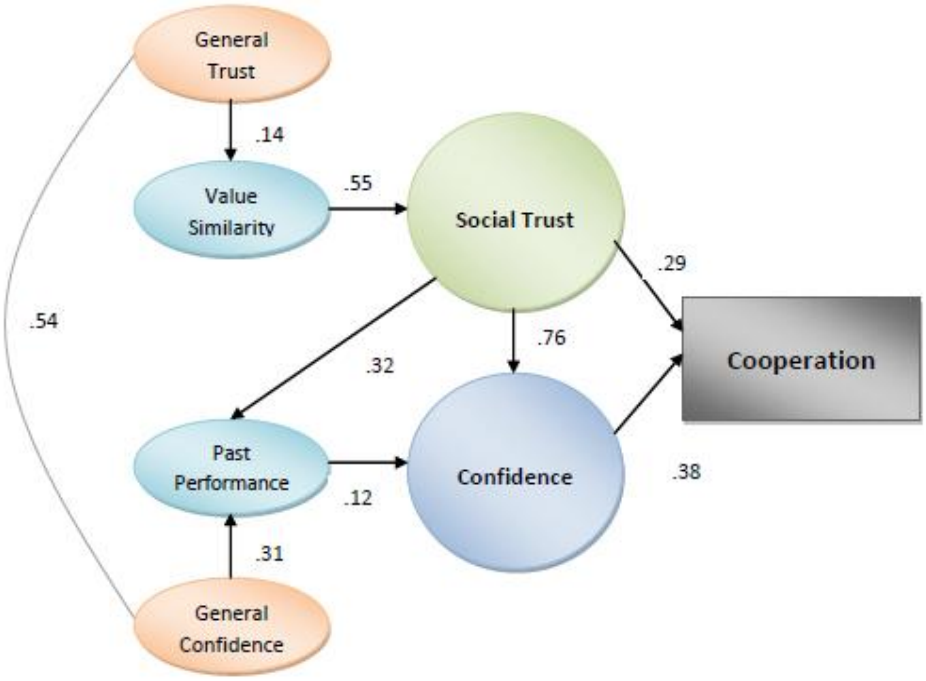


Figure 2: Values represent standardized estimates (N=1,313). All coefficients are significant ($p<0.01$)

Risk Perception and Trust

There is general agreement that trust in risk management institutions may be an important factor in perception and acceptance of risks. Wynne (1980) first raised the issue and argued that with technological risks some of the difference between "expert" and "lay" perspectives on risk could be traced to differing evaluations of the trustworthiness of the institutions responsible for managing the risk. For example, the research shows that for gene technology, those who had social trust in companies, as well as those who trusted scientists, perceived less risk and more benefits in association with this technology than people not having social trust (Siegrist, 1999; 2000). In the domains of nuclear or hazardous waste disposal and chemical plants, a number of

studies have shown that trust has a strong influence on the perceptions of risk associated with related technologies (Basset et al., 1996; Groothuis & Miller, 1997). Other researchers have found significant associations between trust and risk-indexes based on risk assessments of different hazards (Cvetkovich, 1999; Greenberg & Williams, 1999). The field of risk communication was developed during the 1980s to devise ways of bridging the public-expert risk judgment gap. Since then, some have argued that risk communication has not lived up to its promise, and that the primary reason for this failure has been a lack of attention to the key role of trust in risk communication.

Perceived risk, defined as the judgment of probability that harm will occur if no preventative action is taken, is a central construct in many theories of health behavior. Such theories suggest the risk a person perceives from a health threat will be associated with their willingness to engage in behaviors to protect them from that threat. However, much of the research investigating the relationship between risk perception and protective behaviors has been characterized by conceptual and methodological problems (Leppin and Aro, 2009). A review of empirical research on risk perceptions and newly emerging infectious diseases such as severe acute respiratory syndrome (SARS) and avian influenza, finds that just half of the 16 studies reviewed refer to any theoretical concept or model. Such findings highlights the need for testing risk perceptions in comparison to and/or in concert with other constructs outlined in common health behavior theories to advance understanding of how decisions about protective behaviors are made.

Measuring Risk Perception

In addition to conceptual and methodological issues, there are measurement concerns surrounding risk perception research. Valid measurement of risk perception is essential to test behavior theories, to develop interventions to correct inaccurate perceptions, and to evaluate the success of such interventions. Not surprisingly, studies examining the correlation between perceived risks and vaccination behavior show that risk perceptions successfully predict subsequent influenza vaccination. A recent meta-analysis of vaccination behavior found a correlation of 0.28 between a risk magnitude scale and vaccine behavior (Brewer et al., 2007).

However, there is uncertainty among researchers as to how perceived risk should be assessed. Should risk scales ask about cognitive judgments such as risk probability or risk magnitude? Or, does perceived risk phrased in terms of feeling at risk, or beliefs about risk better predict subsequent behavior? Weinstein et al. (2007) investigated the ability of several types of risk perception measures and other constructs from health behavior theories to predict influenza vaccination. They chose to examine influenza vaccination because they felt it was a behavior in which risk perception should play a particularly large role, as it has relatively few obstacles, and except for health care providers, there are no major reasons for being vaccinated other than avoiding illness. The main purpose of their investigation was to test the hypothesis that affective risk measures would better predict vaccine behavior than more commonly used cognitive risk measures. The results support their hypothesis, with questions asking about feeling at risk and feeling vulnerable predicting behavior ($r=0.44$, $p<.001$) better than questions about risk probability ($r=0.25$, $p<.001$). Thus, the "feeling at risk" construct appears to capture the aspect of risk perception responsible for vaccination behavior better than scales asking people to judge

risk magnitude or probability. Therefore, risk perceptions of smallpox will be measured with three questions asking about feeling at risk.

This study will explore the relationship between risk perceptions of smallpox and trust in a relevant risk management institution. As described above, the importance of social trust for the explanation of risk perceptions of potential hazards has been demonstrated in several domains such as nuclear waste (Flynn, Burns, Mertz & Slovic, 1992), gene technology (Siegrist, 2000), and environmental health risks (Flynn, Slovic & Mertz, 1994). In most studies the correlation between trust and perceived risk were in the range between 0.2 and 0.4. However, Siegrist, Cvetkovich & Roth (2000) found up to 70% of the variance of risks perceived from technologies such as nuclear power and pesticides could be explained using institutional trust as a predictor.

Perhaps the most outspoken critic of the function of trust in risk has been Sjöberg (2001). Sjöberg argues that the relationship is only 'weak to moderate' and argues that the concept of trust may be getting more praise than it deserves. The results of Sjöberg work suggest measurement may be a key factor influencing the strength of the observed relationship, with single trust items usually explaining less variance than multi-item Likert scales. Furthermore, Sjöberg (2001) showed that specific trust questions explain much more variance than general trust. However, Siegrist, Gutscher and Earle (2005) provide strong evidence for the hypothesis that general trust and general confidence have an impact on the perception of risks associated with new technologies. It is clear that the relationship between trust and risk in other domains needs further investigation. Therefore, in addition to examining the relationship between risk perceptions of

smallpox and trust in specific entity (The Department of Homeland Security), this study will also examine the influence of general trust and general confidence on smallpox risk perceptions.

Knowledge and Risk Perception

In their review of the available empirical studies, Earle, Siegrist and Gutscher (2007) find that the empirical studies supported neither the strong relationship cited by some researchers, nor the weak relationship promoted by Sjoberg. Instead, the results suggest that the trust and risk perception relationship is complex and contextual. For example, Siegrist and Cvetkovich (2000) found that the relation between trust and perceived risk is stronger when knowledge is weaker for a variety of hazards (ex: biotechnology, fertilizers, and herbicides). On the other hand, no significant correlations were found between trust and judged risks for hazards about which people were knowledgeable (ex: smoking, fire fighting). Thus, it seems that in the absence of sufficient knowledge, decisions and judgments of risk may be guided by trust in those responsible for managing the hazard. The extent to which trust in the institution responsible for managing a hazard influences risk perceptions during a bioterrorism release of smallpox has not been explored, but could offer practical guidance to risk communicators as they attempt to communicate crucial information about the nature, magnitude, significance, control, and management of a hazard that public may know very little about. This study will explore the extent to which trust influences risk perceptions during a smallpox outbreak and whether knowledge of smallpox influences this relationship.

CHAPTER 3

METHODS

Prior to the main experimental study conducted with a nationally representative sample of U.S. adults, a two step treatment validity study was conducted with a group of University of Georgia students to: 1) identify specific message statements that are most clearly identified with each of the two trust dimensions specified by the TCC model, and 2) test whether exposure to each message condition results in increased scores on the respective trust dimension between a pretest and posttest.

Treatment Validity Study: Methods

A two step treatment validity study was conducted with University of Georgia students in June 2011. The first phase of the treatment validity study was conducted to assess whether specific message statements were clearly identified as either trust or confidence enhancing, and to assess perceptions of the Department of Homeland Security's involvement in coordinating a response to a smallpox outbreak. The second phase of the treatment validity study tested the message conditions for how well messages uniquely enhanced trust and confidence dimensions.

University of Georgia instructors of undergraduate and graduate summer courses were contacted and asked if they would be willing to allow access to their students to participate in a brief survey on a public health issue. Students of participating instructors were invited to voluntarily participate in a brief survey for the last 20 minutes of class. Students were told that participation was completely voluntary, no extra credit or incentive would be given, and students choosing not

to participate would not be penalized. The investigator briefly explained the study topic and reviewed informed consent with all participants.

Treatment Validity Study: Results

Phase I: A total of 27 students (M_{age}=22.3; 79% Female) completed the first phase of the treatment validity study. All five message statements (two trust and three confidence statements) were correctly identified as either trust or confidence enhancing by most respondents. Four of the statements (2 trust, and 2 confidence) were correctly identified by at least 92% of respondents, and one confidence statement was correctly identified by 85% of respondents. When asked to rate six federal agencies on their level of involvement in coordinating a response to a smallpox outbreak on a scale of 1-10 (1=not at all involved, 10=completely involved), respondents rated CDC the highest with a mean score of 9.8 (S.E. = 0.0878). The Department of Health and Human Services was the second highest rated (M_{avg}=9.2, S.E.=0.262) followed by the Department of Homeland Security (M_{avg}=8.4, S.E.= 0.262). The Department of Defense (M_{avg}=7.1, S.E = 0.367), Food & Drug Administration (M_{avg}=6.0, S.E = 0.459) and the Central Intelligence Agency (M_{avg}=5.9, S.E.= 0.451) were rated to have the lowest involvement by respondents.

Phase II: For the second phase of the treatment validity study, 42 students (M_{age}=21.2; 69% Male) received one of two message conditions and completed measures of trust(similar values), trust(shared values), confidence(past performance), and confidence(competency). It was determined that a Cronbach's α reliability estimate of ≥0.70 would support reliability of each scale (Cronbach, 1951). The internal consistencies achieved on the 4 scales achieved excellent

reliability. The "Similar Values" scale resulted in the highest score of $\alpha = 0.904$, which was followed by the "Past Performance" scale ($\alpha = 0.851$), "Shared Values" ($\alpha = 0.849$), and the "Competency" scale ($\alpha = 0.825$).

An independent samples t-test revealed no significant differences between conditions on composite scores for trust and confidence. However, the results indicate that respondents were able to identify correctly whether the message condition they read described "values relevant to the government's response to a smallpox outbreak" vs. describing "the government's past performance and competency in dealing with an event such as a smallpox outbreak". Those in the values condition rated their statement as describing values significantly more than those in receiving the confidence condition ($F=5.595$, $df = 40$, $p< .05$). Similarly, respondents receiving the message on confidence rated their statement as describing performance and competence significantly more than those in receiving the values condition ($F=5.201$, $df =40$, $p< .05$).

Experimental Study

From July 22, 2011 through August 5, 2011 panel members were randomly drawn from a nationally representative sample of U.S. adults age 18 and older, participating in Knowledge Networks' KnowledgePanel. To recruit panel members, KN uses a combination of random-digit dial and address-based probability sampling methods. KN provides low-income panelists with access to the internet and hardware, if necessary, to ensure representative sample. Panelists participate in online research studies in return for internet access and hardware or for points redeemable for cash. KN sends emails and telephone reminders to panelists to maximize participation. More information on the KN research panel is available from their website

(http://www.knowledgenetworks.com). Members of this online research panel were recruited to participate in a post-test only randomized experiment to explore the role of trust and confidence in the public's response to a smallpox outbreak.

Survey Design

The survey instrument was administered in both English and Spanish. Respondents began by reading a short preface statement describing the threat of a smallpox outbreak from a bioterrorist attack and a brief introduction to a fictional smallpox outbreak scenario. Following the preface statement, participants responded to a single item measuring their current knowledge of the Department of Homeland Security. Next, respondents were randomly assigned to one of two experimental conditions – a trust message condition and a confidence message condition.

Study participants then read short messages describing a smallpox outbreak scenario, the role of DHS in such an event, and vaccine information and recommendations for members of a community believed to have been exposed to the virus. Message content was structured to contain information that enhances one of two pathways to cooperation as described by the TCC Model. The trust message condition was structured to enhance trust by highlighting the values dimension of trust with statements about shared and similar values, such as "The Department of Homeland Security is committed to an open and honest process of decision making that guarantees timely, consistent, and accurate information during a biological terrorist attack" (see Appendix for full message). The confidence message condition contained statements to strengthen confidence in DHS by highlighting their expertise and past performance during recent public health crises, such as "As one of several government entities responsible for detecting and

managing a bioterrorist attack, the Department of Homeland Security's (DHS) response to the current smallpox outbreak builds on concepts and approaches that were successfully employed 30 to 40 years ago to control smallpox outbreaks". After reading one of two messages, participants completed surveys designed to measure seven constructs relating to the dual-model of trust and confidence, as well as measures of knowledge and risk perception.

Measures

Shared values with DHS and their handling of the response to a smallpox outbreak were measured by a scale comprised of six items based on the components of trust identified by previous research. Rather than using scales predetermined by the researcher, Meredith et al. (2007) conducted qualitative research and an inductive analysis strategy to assess the role trust played in participant's reaction to escalating stages of a bioterrorism scenario and identified key components of trust. Applying these dimensions in the context of the H1N1 outbreak, Quinn et al. (2009) developed questions that asked for the level of trust respondents feel regarding the government's openness, honesty, commitment, caring and concern, and competence in addressing H1N1; the extent to which they believe they government's actions in response to H1N1 are in their personal best interest; and how much they believe the government will protect them from H1N1. These items were found to be highly correlated and an exploratory factor analysis indicated that all items loaded on one factor (Chronbach's alpha=0.91). These seven items were used in the current study to measure levels of shared values with DHS as they respond to and manage a smallpox outbreak.

Value similarity was assessed using a measurement scale similar to one used by Earle and Cvetovich (1997, 1999) and adapted to a smallpox context. Respondents were asked: With respect to managing a smallpox outbreak, I feel DHS: (a) shares similar values as me, (b) shares similar opinions as me, (c) thinks in a similar way as me, (d) takes similar actions as I would, and (e) shares similar goals as me. Competency in DHS was measured by a 3-item scale measuring institutional confidence as judgments of competence and expertise. Past performance was measured by a 3-item scale measuring judgments of how DHS performed during public health crises in the past. Risk perception measures were adapted from previous research on influenza vaccination and risk perceptions (Weinstein et al., 2007) and included measures of risk magnitude, perceived severity, and concern. Items measuring general trust and general confidence were selected from the literature with acceptable internal consistencies, 0.67 and 0.54 respectively (Siegrist, Gutscher, & Earle, 2005). Finally, a measure of participant's general knowledge of DHS was administered before exposure to message conditions.

A pre-test of the survey was administered to KN members between July 22nd and July 23rd, 2011 and yielded 78 completions. Feedback collected during this pre-test indicated many respondents were responding "no" to the item "If you had to make a decision now, would you get the recommended smallpox vaccine?" because they had received the smallpox vaccine as a child. In response to this finding, the following statement describing the length of protection provided by vaccine was included in both message conditions, "If you had a smallpox vaccine as a child it will not protect you now, as the vaccine only provides high protection for about 5 years". In addition, a follow-up item "What is the main reason you would *not* get the smallpox vaccine?" was added for those responding "no" to the first vaccine question.

Statistical Analyses

Post-stratification weights were used to adjust for non-coverage and non-response biases. These adjustments were made by a applying the most recent data from the Current Population Survey so that the weighted data represent the present U.S. population. Post-stratification weighting included gender, age, race/ethnicity, education, census region, urbanicity, and Internet access. SPSS 19.0 (SPSS Inc, Chicago, IL) was used for analyses. Descriptive analyses, expressed as unweighted frequencies and weighted percentages, were performed. Independent samples t-tests were conducted to assess differences in trust component scale scores between experimental groups. Differences in cooperation with vaccine recommendations between experimental groups were assessed with a chi-square test. A binary logistic regression analysis was conducted to assess the determinants of cooperation with vaccine recommendations. Significant independent predictors of cooperation with vaccine recommendations were assessed at $p<.05$ levels. A Pearson correlation coefficient was calculated to determine the observed relationship between trust in DHS and smallpox risk perception scores, as well as the relationship between risk perceptions and general trust and general confidence. Finally, the influence of smallpox knowledge on the relationship between trust in DHS and smallpox risk perception was assessed by calculating a Pearson correlation coefficient separately for those with lower and higher knowledge scores.

Hypotheses & Research Questions:

1) Hypothesis 1: Exposure to each message condition will result in higher scores on respective trust dimensions.
2) Hypothesis 2: Significant differences in cooperation with smallpox vaccine recommendations will be observed based on experimental groups.

3) Research Question 1: What are the significant determinants of cooperation with vaccine recommendations?
4) Research Question 2: What is the relationship between trust in DHS and smallpox risk perceptions?
5) Research Question 3: What is the relationship between general trust (and general confidence) and smallpox risk perceptions?
6) Research Question 4: Does knowledge of smallpox influence the relationship between trust in DHS and smallpox risk perceptions?

CHAPTER 4

RESULTS

Subjects

The final survey was fielded from July 25 to August 5, 2011 and completed by 521 respondents. Overall, the pre-test and final survey was fielded to 1106 panelists and completed by a total of 599 respondents for an overall completion rate of 54%. The overall completion rate for this study was slightly lower than the 70% average completion rate for Knowledge Networks web surveys (Schonlau, Fricker, Elliott, 2002). Sample characteristics are shown in Table 1, with both the unweighted frequencies and the post-stratification weighted percent for gender, age, race/ethnicity, education, and residential area. As shown in Table 1, the post-stratification weighting resulted in a sample predominantly White (67.6%) and female (51.4%). Age was well distributed across categories, with the 45-59 year old category having the highest percent (27.7%). Over 86% of respondents had at least a high school education and over 55% had at least some college education. Almost 84% of respondents lived in a metro residential area.

Table 1: Sample Characteristics

Characteristics	Unweighted N	Weighted %
Total	521	
Gender		
Male	272	48.6
Female	249	51.4
Age, years		
18-29	86	21.9
30-44	129	25.7
45-59	159	27.7

≥60+	147	24.7
Race/Ethnicity		
White, Non-Hispanic	374	67.6
Black, Non-Hispanic	52	11.7
Other, Non-Hispanic	23	4.2
Hispanic	58	14.0
2+ Races, Non-Hispanic	14	2.5
Education		
<High School	49	13.5
High School	167	30.7
Some College	151	28.1
Bachelor's degree or higher	154	27.7
Residential area		
Metro	444	83.9
Non-metro	77	16.1

Internal Consistencies

The internal consistencies achieved on the seven scales were excellent: Similar Values scale ($\alpha = 0.947$), Shared Values ($\alpha = 0.895$), Past Performance scale ($\alpha = 0.877$), Competency scale ($\alpha = 0.896$) and Risk Perception scale ($\alpha = .846$). Finally, the reliabilities of the general trust and general confidence scales were acceptable, $\alpha = .749$, $\alpha = .735$, respectively. Table 2 shows the 26 variables used for measuring the latent variables and the factor loadings for each. (For the complete survey see Appendix)

An exploratory factor analysis was conducted with the trust items (similar values and shared values), and confidence items (past performance and competency), to assess whether these four variables could be reduced to one trust and one confidence factor. Similar values and shared values were significantly correlated ($r = .639$, $p < .01$), as were past performance and competency

(r=.674, p<.01). The Kaiser-Mayer-Olkin (KMO) measure of sampling adequacy was calculated for trust items and confidence items. A KMO value above the suggested criteria of 0.60 was used to determine if there was a large enough sample relative to the number of items to warrant factor analysis. Similarly, the Bartlett's Test of Sphericity was calculated to determine if there were adequate relationships between variables to warrant factor analysis. The KMO values were more than adequate to warrant further analysis (0.923 for the trust items, and 0.857 for the confidence items). The Bartlett's Test of Sphericity were highly significant for trust and confidence items, χ^2=4313, df =55 p< .01 and χ^2=2001, df = 15, p< .01 respectively. Results from the exploratory factor analysis reveal more than one factor for both the trust and confidence items. For similar values and shared values items, 59.75% of the variance was explained by one factor (Eigenvalue=6.572) and 73.0% of the variance was explained by a two factor solution (Eigenvalue=1.457). For the past performance and competency items, 68.12% of the variance was explained by one factor (Eigenvalue=4.087) and 81.89% of the variance was explained by a two factor solution (Eigenvalue=0.826). Thus, the measurement model of two distinct latent variables for both the trust and confidence dimensions was retained.

Table 2: Factor Loading Estimates for Indicator Variables (weighted)

Factor/Variables	**Factor Loading**
Value Similarity: With respect to managing a smallpox outbreak, I feel DHS:	
V1: Shares similar values as me	.788
V2: Shares similar opinions as me	.860
V3: Thinks in a similar way as me	.849
V4: Takes similar actions as I would	.820
V5: Shares similar goals as me	.815
Social Trust:	
V6: How committed do you think DHS is with information regarding smallpox?	.532
V7: How much caring and concern do you think DHS has shown about people who	

might be affected by smallpox?	.646
V8: How open do you think DHS is with information regarding smallpox?	.674
V9: How honest do you think DHS is with information regarding smallpox?	.714
V10: How much do you believe DHS's actions in response to smallpox are in your personal best interest?	.659
V11: How much do you believe DHS will protect you from smallpox?	.583
Past Performance: DHS has done a good job in the past…	
V12: Protecting the public from smallpox	.731
V13: Protecting the public from recent public health crises such as anthrax	.858
V14: Protecting the public from recent public health crises such as SARS	.825
Confidence:	
V15: DHS is competent enough to deal with smallpox	.818
V16: DHS has the necessary skilled people to carry out its job with regard to smallpox	.848
V17: DHS has the expertise needed to deal with smallpox	.820
Risk Perception: Without a smallpox vaccine…	
V18: How likely are you to become ill with smallpox?	.764
V19: How severe do you think the consequences might be?	.762
V20: How concerned would you be about getting smallpox?	.836
General Trust:	
V21: If given a chance, most people would try to take advantage of you	.513
V22: Most people are too busy looking out for themselves to be helpful	.746
V23: You can't trust strangers anymore	.671
General Confidence:	
V24: There will be more accidents and catastrophes in the future than we had in the past	.728
V25: Nowadays, things seem to be getting more and more out of control	.742
V26: A person can never have too much insurance to protect against the inevitable disasters in life	.506

An independent samples t-test was conducted to compare the two experimental conditions on the summed scores of four variables from the TCC model. There was not a significant difference observed ($t=0.644$, $df=519$, $p = 0.520$) in the shared values scores for the trust experimental condition ($M_{avg}=14.67$, $SD=4.17$) and confidence experimental condition ($M_{avg}=14.43$, $SD=4.39$). Similarly, there were no significant differences observed between conditions on

similar values (t=1.016, df = 497, p=0.310), confidence (t=-0.710, df = 507, p=0.478), or past performance (t=0.242, df = 491, p=0.809).

Table 3: Trust and Confident factors by Experimental Condition

	Trust Condition (n=262)	**Confidence Condition (n=259)**	**Independent samples t-test**
Trust (Similar Values)	14.62 (SD= 3.44)	14.31 (SD=3.32)	(t=1.016, df= 497) p=.310
Trust (Shared Values)	14.67 (SD=4.18)	14.43 (SD=4.39)	(t=.644, df=519) p=.520
Confidence (Past Performance)	9.27 (SD=1.96)	9.23 (SD=1.97)	(t=.242, df=491) p=.809
Confidence (Competency)	8.88 (SD=1.93)	9.00 (SD=1.84)	(t=-.710, df=507) p=.478

Independent Samples t-test, Sig (2-tailed)

Differences in cooperation with vaccine recommendations between experimental groups were assessed with a chi-square test. The assumptions of a random sample, randomly assigned to treatment groups, and independent observations were met. In addition, the assumption that the expected value for each cell be five or higher was met. Cooperation with smallpox vaccine recommendations did not significantly differ between the trust message condition and confidence message condition χ^2 (1, N=520) = 0.044, p=0.835.

Determinants of Cooperation with Vaccine Recommendations

Results from binary logistic regression analyses of the association between sociodemographic factors and cooperation with vaccine recommendations are presented as model 1 in Table 4. In

addition to sociodemographic factors, model 2 includes trust factors, risk perceptions, and knowledge of smallpox and DHS as predictors of cooperation with official smallpox vaccine recommendations. In regression model 1, race and education appear as moderately significant predictors. Those with a bachelor's degree or higher were significantly more likely to cooperate with vaccine recommendations than those with less than high school education (OR=3.191, p=.013). Respondents in the 2+ races, Non-Hispanic race/ethnicity category were significantly less likely to cooperate compared to Whites (OR=0.268, p=.028).

In the complete regression model that includes sociodemographic factors as well as trust factors, risk perceptions, and knowledge measures, additional sociodemographic variables appear as significant predictors of cooperation with official smallpox vaccine recommendations. Females are less likely to cooperate than males (OR=0.346, p=.008). Hispanics were significantly more likely to cooperate compared to Whites (OR=5.435, p=.019), whereas those in the 2+ races, Non-Hispanic race/ethnicity category were significantly less likely compared to Whites to cooperate with recommendations (OR=0.069, p=.008). All three education categories were significantly more likely to cooperate compared to those with less than high school educations. When controlling for sociodemographic factors, general trust (OR=1.455, p=.001) and similar values (OR=1.20, p=.035) were the only trust factors to appear as significant predictors. In addition, risk perceptions significantly predicted cooperation (OR=1.376, p<.001). Knowledge of DHS also appears as a marginally significant negative predictor of cooperation (OR=0.325, p=.041). Finally, the percent of variance explained by model 2 (Nagelkerke R^2=.577) is a major improvement over that of model 1 (Nagelkerke R^2=.090).

Table 4: Logistic Regression stressing association between sociodemographic factors and cooperation with vaccine recommendations (model 1); and between sociodemographic factors, trust factors, risk perceptions, knowledge and cooperation with vaccine recommendations (model 2).

Variable	Weighted (%)	Model 1: sociodemographic factors		Model 2: sociodemographic factors, trust factors, risk perceptions, and knowledge	
		OR (95% CI)	p value	OR (95% CI)	p value
Gender					
Male	48.6	1 (reference)		1 (reference)	
Female	51.4	0.638 (0.382-1.066)	.086	0.346 (0.158-0.758)	.008
Age					
18-29	21.9	1 (reference)		1 (reference)	
30-44	25.7	0.754(0.357-1.591)	.458	1.216 (0.400-3.698)	.731
45-59	27.7	0.954 (0.455-2.00)	.901	0.615 (.198-1.905)	.399
60 years and more	24.7	1.055 (0.497-2.241)	.888	2.485 (0.843-7.326)	.099
Race/Ethnicity					
White	67.6	1 (reference)		1 (reference)	
Black	11.7	1.129 (0.517-2.465)	.761	1.768 (.555-5.634)	.335
Hispanic	4.2	2.269 (.918-5.607)	.076	5.435 (1.32-22.362)	.019
Other – Non-Hispanic	14.0	1.076 (0.303-3.814)	.910	1.188 (0.231-6.124)	.837
2+ races, Non-Hispanic	2.5	0.268 (0.083-0.866)	.028	0.069 (0.009-0.498)	.008
Education					
Less than High School	13.5	1 (reference)		1 (reference)	
High School	30.7	0.839 (0.395-1.785)	.649	3.095 (1.037-.9.233)	.043
Some college	28.1	1.735 (0.746-4.033)	.201	4.558(1.33-15.585)	.016
Bachelor's or higher	27.7	3.191 (1.278-7.965)	.013	6.991 (1.70-28.748)	.007
Residential area					
Metro	83.9	1 (reference)		1 (reference)	
Non-metro	16.1	0.639 (0.306-1.377)	.235	1.060 (.371-3.027)	.913
Shared Values				1.068 (.921-1.238)	.386
Similar Values				1.200 (1.013-1.420)	.035
Past Performance				0.871 (.659-1.152)	.332
Confidence				1.168 (.883-1.545)	.277
General Trust				1.455 (1.164-1.818)	.001
General Confidence				0.956 (.763-1.197)	.694
Risk Perception				1.376 (1.268-1.493)	.000
Knowledge of Smallpox				1.442 (.405-5.139)	.572
Knowledge of DHS				0.325 (.111-.953)	.041
Nagelkerke R-square		.090		.577	

As general trust was found to be a significant positive predictor of cooperation, further examination of its role in cooperation was undertaken. Higher and lower general trust groups

were created by selecting those with general trust scores with one standard deviation (SD=2.27) above and below the median score (9.0). The higher general trust group consisted of 86 respondents, and the lower general trust group created consisted of 97 respondents. A logistic binary regression to predict cooperation was then performed separately for the two groups. No predictors were found significant when examining high and low general trust groups separately.

The strength of the linear relationship between trust in DHS and smallpox risk perceptions was assessed by the Pearson correlation coefficient. Scatterplots of trust variables and risk perception were examined and no influential points were observed. The summed values of the shared values scale and risk perception scale had a significant positive relationship (r=0.330) at the 0.01 level, two-tailed. Similarly, similar values and risk perceptions showed a significant positive relationship (r=0.232) at the 0.01 level, two-tailed. Additionally, the strength of the linear relationships between smallpox risk perceptions and general trust and general confidence were assessed by the Pearson correlation coefficient. The summed values of the general trust scale and risk perception scale had negative relationship (r= - 0.026) but was not significant. However, general confidence and risk perceptions showed a significant negative relationship (r= - 0.104) at the 0.05 level, two-tailed.

Finally, the influence of smallpox knowledge on the relationship between trust in DHS and smallpox risk perception was assessed by calculating a Pearson correlation coefficient separately for those with lower and higher knowledge scores and shown in Table 5. Those responding "knowledgeable" and "very knowledgeable" to the question "How knowledgeable are you about smallpox" were combined into the higher knowledge group. Those responding "somewhat

knowledgeable" and "not knowledgeable at all" were combined for the lower knowledge group. The Pearson correlation between shared values and risk perception for those with lower knowledge levels of smallpox was (r=0.268), and (r=0.265) for those with higher knowledge. The Pearson correlation between similar values and risk perception for those with lower knowledge levels of smallpox was (r=0.218), and (r=0.259) for those with higher knowledge.

Table 5: Trust and Risk Perception Correlation by Smallpox Knowledge Level

Lower Smallpox Knowledge		**Risk Perception**
Shared Values	Pearson Correlation	0.268**
	Sig. (2-tailed)	.000
	N	421
Similar Values	Pearson Correlation	0.218**
	Sig. (2-tailed)	.000
	N	409
Higher Smallpox Knowledge		**Risk Perception**
Shared Values	Pearson Correlation	0.265**
	Sig. (2-tailed)	.010
	N	94
Similar Values	Pearson Correlation	0.259*
	Sig. (2-tailed)	.015
	N	89

**Correlation is significant at the 0.01 level (2-tailed).

CHAPTER 5

DISCUSSION

This study employs a post-test only experimental design to measure trust and confidence in the Department of Homeland Security to manage a smallpox outbreak, and examines these measures, along with measures of perceived risks and knowledge, as determinants of cooperation with smallpox vaccine recommendations. Results do not show significant differences in cooperation with smallpox vaccine recommendations based on exposure to experimental message conditions. Respondents in both groups reported very similar willingness to accept smallpox vaccine recommendations. It is unclear whether message conditions were unable to produce a sufficiently strong enough boost in their relative trust dimension, or if each trust dimension is equally important in influencing decisions about cooperation with official recommendations. Perhaps individual's trust and confidence assessments of DHS are static and resistant to change through messaging.

Two of the six constructs outlined by Trust, Confidence and Cooperation model were found to be significant positive predictors of cooperation with official smallpox vaccine recommendations. General trust, a personality trait rather than a measure of trust in a specific entity, was found to be an important predictor of cooperation. Similar values were found to be a significant predictor of cooperation as well, whereas shared values were not. However, the confidence intervals for the odds ratios of shared values (0.921-1.238) and similar values (1.013-1.420) overlap and therefore these findings remain tentative. That general trust and similar values, and not shared values (tentatively), predict cooperation is an interesting finding. The results from an exploratory

factor analysis suggest that similar values and shared values are indeed distinct from one another. As outlined by the TCC model, the trust dimension is best explained by a two factor solution for the trust dimension, with 73% of the variance explained compared to 59% when items were loaded onto one factor. Similarly, consistent with the TCC model, a two factor solution was confirmed for the two factors of the confidence dimension (81% of variance explained) versus 68% variance explained by one factor.

Past performance and confidence factors did not appear as significant predictors in this study. It may be that respondents have insufficient experience or knowledge of how DHS has managed past crises for these constructs to influence their willingness to cooperate. Consistent with the literature, risk perceptions were strongly predictive of cooperation with protective measures. Risk perception is a central construct in many theories of health behavior that suggest the risk a person perceives from a health threat will be associated with their willingness to engage in behaviors to protect them from that threat. In the case of vaccine acceptance, it would be interesting to examine the influence of risk perceptions of the vaccine, in addition to those associated with the disease. Future studies on trust and vaccine behavior should measure risk perceptions of both the hazard and vaccine to assess the influence of vaccine risk perceptions on cooperation, independent of risk perceptions related to the hazard.

In a disease outbreak scenario, those individuals' that are generally distrustful are likely to be the hardest to convince to take recommended action. A closer look into the role that general trust plays in cooperation was undertaken in the hopes of identifying specific factors uniquely important to those with low general trust levels. Communication strategies and message

ingredients could then be developed around those specific factors most likely to influence those individuals. However, none of the factors examined in this study were significant predictors of cooperation when examining individuals with low general trust levels.

Results show both shared values and similar values with the Department of Homeland Security to be significantly related to smallpox risk perceptions. The positive correlation between these trust factors and risk perceptions observed in this study is in contradiction to a general consensus among risk researchers that trust in risk management institutions is negatively associated with risks perceived from potential hazards. The hazards for which risk perceptions are measured in many of these studies have been technological and environmental threats such as nuclear waste and pesticides. Perhaps the nature of the hazard in this case, smallpox, is quite different than these other hazards, and therefore the risks associated with smallpox are less influenced by trust in a particular risk management institution.

One possibility is that the public may be more knowledgeable about smallpox, than say gene technology or nuclear waste, and therefore rely less on their trust of those responsible for managing those hazards when assessing risk. Therefore, influence of smallpox knowledge on the relationship between trust factors and risk perception was also examined. The correlation between trust and risk perception for those reporting lower knowledge of smallpox was very similar to those reporting higher knowledge of smallpox. Thus, the results of this study suggest that those with high trust in DHS are more likely to perceive higher risks from smallpox, and that their level of knowledge of smallpox has little influence on this relationship. Future studies should further explore the relationship between trust and risk perceptions for public health

threats like communicable disease and pandemics. As this study suggests, the influence of trust on the public's risk perceptions of such hazards function quite different than for those hazards previously examined in the risk management literature. It may be that risk perceptions at the community level rather than the individual level capture a unique risk assessment of such hazards, one that may conform to the negative correlation between trust and risk found in other studies. As researchers in risk management strive to integrate the role of risk perceptions into the broader Trust, Confidence and Cooperation framework, the literature shows the relation between trust and risk perception is conditioned by certain critical contextual factors. In addition to factors identified in previous work, such as the level of knowledge or familiarity with the hazard, the results of this study suggest the relation between trust and risk perception varies with different hazard types (technological vs. infectious disease).

Although trust in a specific risk management entity did not appear to negatively influence smallpox risk perceptions, general trust and general confidence were negatively associated with risk perceptions. Although this relationship was not significant for general trust, the relationship between risk perceptions and general confidence was statistically significant. These results suggest that positive expectations in general (i.e., general confidence) are significant predictors of risks perceived when it comes to smallpox. Perhaps individuals with a tendency to express conviction that everything is under control, and uncertainty is low, are less likely to feel at-risk during a bioterrorist event such as a smallpox outbreak. Such findings are consistent with evidence reported in the literature that general confidence influence risk perceptions of new technologies. Further study is needed to explore whether general trust and general confidence

influence risk perceptions of other health hazards as they as demonstrated in other domains such as new technologies.

Limitations

The findings from this study are limited by several factors. First, this study has individuals consider a hypothetical bioterrorist attack. Responses regarding behavior intention, trust and confidence in DHS, and risk perceptions surrounding a fictional smallpox outbreak are likely to differ from those during a real outbreak. Another limitation is that this study evaluated intentions. A body of research has demonstrated that intentions are moderately good predictors of future behavior (Ajzen & Fishbein, 1980; Albarracin & Wyers, 2000). However, it would be highly beneficial to the field to examine the role of intentions in behavior through longitudinal analysis of vaccine uptake during an actual outbreak. Such work would offer additional insight on the trust factors that are truly motivating to cooperation with vaccine recommendations during an outbreak scenario and how stable trust factors and intentions are over time. The sample size presents another limitation, such that statistical power to detect all relationships may have been lacking, particularly those associated with smaller effect sizes.

Another possible limitation of this study involves the extent to which the public perceives the Department of Homeland Security as a major player in the government's response to a bioterrorist event such as a smallpox outbreak. Results from a treatment validity study with college students show that DHS was ranked third as the government agency most involved in such an event, behind CDC and HHS. However, no data were collected to assess such rankings

with the sample in the experimental study. In real bioterrorist event, DHS along with CDC, would coordinate the government's response.

Conclusion

This study builds on the burgeoning interest and research into the role that trust plays in cooperative behavior. General trust and risk perceptions arise as significant predictors of cooperation with official government recommendations for vaccine during a bioterrorist smallpox attack. When the time comes to develop messages to encourage the public to take action during a public health crisis, communicators should focus on these factors to maximize cooperation. As public health professionals and risk communicators prepare for future events such as bioterrorism and pandemic outbreaks, it is prudent to expect a large segment of the population to be generally distrustful and reluctant to cooperate with government recommendations. In today's media environment, many channels exist for rapid communication where the quality and accuracy of the information disseminated is questionable at best. However one thing is for certain. In the event of a disease outbreak demanding the rapid mobilization of the U.S. citizenry, public health messaging will have to compete with other prominent information sources, through an ever increasing and evolving universe of communication channels, to convince an increasingly distrustful public to take recommended action. The ability of the government to respond to and recover from health emergencies, such as bioterrorism or future pandemics, depends heavily on the trust of its people. As President Obama has said, "If the people cannot trust their government to do the job for which it exists - to protect them and to promote their common welfare - all else is lost".

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APPENDIX

Smallpox Vaccine Recommendations: Is Trust a Shot in the Arm?
July, 2011
- Questionnaire -

TESS Project Description: Final Instrument

Project Title: Smallpox Vaccine Recommendations: Is Trust a Shot in the Arm?

Contact Information:
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Design:
The proposed research study is a post-test only randomized experiment to explore the role of trust and confidence in influencing the public's response to a smallpox outbreak. Participants will begin by reading a short preface statement describing the threat of a smallpox outbreak from a bioterrorist attack and an introduction to a fictional smallpox outbreak scenario that will follow. Following the preface statement, and prior to exposure to experimental conditions, participants will respond to a single item measuring their current knowledge of the Department of Homeland Security (DHS).

Study participants will then be randomized into one of two groups and read short messages describing a smallpox outbreak scenario, the role of DHS in such an event, and vaccine information and recommendations for members of a community believed to have been exposed to the virus. Message content will be structured to contain information that enhances one of the two pathways to cooperation as described by the Trust, Confidence, and Cooperation (TCC) Model. One message condition will aim to enhance trust by highlighting the shared values dimension of trust. A second message condition will aim to enhance confidence in the DHS to effectively manage the smallpox outbreak by highlighting past performance during recent public health crises (i.e. anthrax and SARS) as well as approaches that were successfully employed in the past to control smallpox outbreaks. After reading one of two messages, all participants will then complete surveys measuring shared values with DHS, past performance of DHS, confidence in DHS to manage smallpox, smallpox risk perceptions, knowledge of smallpox, and behavioral intention to cooperate with government vaccine recommendations. Covariates will include general confidence, general trust, and demographics. If 250 respondents are randomized to each condition, this will provide at least 86% power at the two-sided alpha=0.05 significance level to detect a difference of 0.14 between the proportions cooperating with

smallpox vaccine recommendations (e.g., 57% versus 43%). With 200 respondents per group, the power is 87% to detect a difference of 0.16 between cooperation proportions.

Sample:
N = 500 general population subjects
K = 29 items
[N X k] = 14,500 respondent-items

Recommended Online Consent Form

[DISPLAY]

My name is John Parmer (parmer@uga.edu) and I am a graduate student under the direction of Dr. Marsha Davis (davism@uga.edu) in the Department of Health Promotion and Behavior at the University of Georgia. I invite you to participate in a research study entitled "Smallpox Vaccine Recommendations: Is Trust a Shot in the Arm"? In this study, you will be asked to consider a fictional smallpox outbreak scenario and answer questions about your levels of trust and confidence in the government to respond to and manage such a crisis. This survey will take approximately 15-20 minutes of your time.

There are no foreseeable risks associated with this project, nor are there any direct benefits to you. There are, however, important benefits in understanding the decision-making of people like yourself in the event of a biological terrorist attack. Such understanding will help guide the government's communication to the public during a bioterrorism event and will offer practical guidance to risk communicators and public health professionals on how to maximize cooperation with government recommendations during a smallpox outbreak.

This is an entirely confidential survey, and Knowledge Networks will not release any personally identifiable information to the researcher. While there is a limit to the confidentiality that can be guaranteed due to the technology itself, Knowledge Networks will separate identifying and non-identifying data into different database systems, each of which has its own defined security roles. Your participation is voluntary. You will not be penalized for refusal to participate or withdrawal from the survey, and you can skip any question to which you do not want to respond. Your relationship with Knowledge Networks and benefits of membership with Knowledge Networks will not be affected by the decision to participate or not to participate in this research study.

If you have any questions about this research study please contact John Parmer at (404) 290-6504, parmer@uga.edu or Dr. Marsha Davis at davism@uga.edu. If you have questions about your rights as a participant in this survey, or have any other questions or problems as a research participant you may contact The Chairperson, Institutional Review Board, University of Georgia, 629 Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-3199; E-Mail Address *IRB@uga.edu*

Description of Study:

Instructions: All respondents will read the preface and then respond to one item measuring knowledge of The Department of Homeland Security.

[SHOW ALL]

Preface: Thanks to the success of vaccination, the last natural outbreak of smallpox in the U.S. occurred in 1949. In 1980, smallpox was said to be wiped out worldwide, and no cases of naturally occurring smallpox have happened since. Today, the smallpox virus is kept in two approved labs in the U.S. and Russia. However, credible concern exists that the virus was made into a weapon by some countries and that terrorists may have obtained it. A single case of smallpox is likely to represent a bioterrorism release and will require an immediate and coordinated public health, medical, and law enforcement response to control the outbreak and to protect the public from any additional release. The information below describes a fictional smallpox outbreak designed to mimic the events and public health decisions that might occur during an actual bioterrorist attack scenario.

[SP]

Q1. How knowledgeable are you about the Department of Homeland Security (DHS)? 1=Very knowledgeable
2=Knowledgeable
3=Somewhat knowledgeable
4=Not knowledgeable at all

*Instructions: Respondents are **randomized** into one of two groups. Group 1 will read receive "Condition 1" and Group 2 will receive "Condition 2".*

[SHOW IF XDHS=1]

Condition 1:

Several cases of smallpox were recently confirmed in your community. As one of several government entities responsible for detecting and managing a bioterrorist attack, the Department of Homeland Security (DHS) takes this responsibility very seriously and acts carefully and compassionately to protect the public in the event of a laboratory confirmed case of smallpox. Officials are investigating these cases as an act of terrorism and health officials are dedicated to quickly finding, vaccinating, and treating people who may have been exposed to the smallpox virus.

The Department of Homeland Security is committed to an open and honest process of decision making that guarantees timely, consistent, and accurate information during a biological terrorist attack. The smallpox vaccine is the best way to defend yourself if you are exposed to the smallpox virus. Vaccination within 3 days of exposure will prevent or significantly lessen the severity of smallpox symptoms in the vast majority of people. If you had a smallpox vaccine as a child it will not protect you now, as the vaccine only provides high protection for about 5 years. Anyone directly exposed to smallpox, regardless of health status, will be offered the smallpox vaccine because the risks associated with smallpox disease are far greater than those posed by the vaccine. The Department of Homeland Security is collaborating with the County Health Department to assign local health workers to your community who are responsible for getting

accurate information out to your neighborhood. These local health workers are recommending vaccinations as the best way to care for you and your neighbors.

[SHOW IF XDHS=2]
Condition 2:

Several cases of smallpox were recently confirmed in your community. Officials are investigating these cases as an act of terrorism and health officials are using their expertise to quickly find, vaccinate, and treat people who may have been exposed to the smallpox virus. Finding of people who have been exposed, vaccinating, and treating them and their contacts is a proven method for stopping the spread of smallpox. As one of several government entities responsible for detecting and managing a bioterrorist attack, the Department of Homeland Security's (DHS) response to the current smallpox outbreak builds on concepts and approaches that were successfully employed 30 to 40 years ago to control smallpox outbreaks. These overall concepts for outbreak containment contributed greatly to the eventual global eradication of smallpox. In addition, lessons learned from recent public health crises, such as the emergence of SARS in 2003 have been incorporated into the response to the current smallpox outbreak.

Overtime, the Department of Homeland Security has learned that the smallpox vaccine is the best protection you can get if you are exposed to the smallpox virus. Vaccination within 3 days of exposure will prevent or significantly lessen the severity of smallpox symptoms in the vast majority of people. If you had a smallpox vaccine as a child it will not protect you now, as the vaccine only provides high protection for about 5 years. Anyone directly exposed to smallpox, regardless of health status, will be offered the smallpox vaccine because the risks associated with smallpox disease are far greater than those posed by the vaccine. Based on past experiences with disease outbreaks, the Department of Homeland Security is collaborating with the County Health Department to assign local health workers to your community to direct the response to this threat in your neighborhood. These local health workers are recommending vaccinations as a proven method to protect you and your neighbors against smallpox.

Instructions: All respondents (Group 1 and Group 2) will receive the short paragraph below and complete the rest of the items that follow.

[SHOW ALL]
The smallpox outbreak scenario you just read is fictional. However, it is important that you consider what your *actual* responses and behavior would be in such a scenario. For the following items, please base your responses according to the scenario you just read.

[SP;PROMPT]
Q2. If you had to make a decision now, would you get the recommended smallpox vaccine?
a. Yes
b. No

[SHOW IF Q2=B; MEDIUM TEXT BOX; PROMPT]

Q2a

What is the main reason you would *not* get the smallpox vaccine?

[GRID; SP]

Q3. Without a smallpox vaccine, how likely are you to become ill with smallpox?

Not At All Likely									**Very Likely**
1	2	3	4	5	6	7	8	9	10

[GRID; SP]

Q4. Without a smallpox vaccine, how severe do you think the consequences might be?

Not At All Severe									**Very Severe**
1	2	3	4	5	6	7	8	9	10

[GRID; SP]

Q5. Without a smallpox vaccine, how concerned would you be about getting smallpox?

Not At All Concerned									**Very Concerned**
1	2	3	4	5	6	7	8	9	10

[SP]

Q6. How committed do you think the Department of Homeland Security is with information regarding smallpox?

1=Not at all committed
2=Somewhat committed
3=Committed
4=Very committed

[SP]
Q7. How much caring and concern do you think the Department of Homeland Security has shown about people who might be affected by smallpox?

1=Not at all caring
2=Somewhat caring
3=Caring
4=Very caring

[SP]
Q8. How open do you think the Department of Homeland Security is with information regarding smallpox?

1=Not at all open
2=Somewhat open
3=Open
4=Very open

[SP]
Q9. How honest do you think the Department of Homeland Security is with information regarding smallpox?

1=Not at all honest
2=Somewhat honest
3=Honest
4=Very honest

[SP]
Q10. How much do you believe the Department of Homeland Security's actions in response to smallpox are in your personal best interest?

1=Not at all
2=To some extent
3=In my best interest
4=Absolutely in my best interest

[SP]
Q11. How much do you believe the Department of Homeland Security will protect you from smallpox?

1=Not at all
2=Somewhat
3=Yes, will protect me
4=Absolutely will protect me

[GRID; SP]

With respect to managing a smallpox outbreak, I feel the Department of Homeland Security:

	1=Agree strongly	2=Agree mildly	3=Disagree	4=Disagree strongly
12. Shares similar values as me				
13. Shares similar opinions as me				
14. Thinks in a similar way as me				
15. Takes similar actions as I would				
16. Shares similar goals as me				

[SP]
Q17. The Department of Homeland Security is competent enough to deal with smallpox.
1=Agree strongly
2=Agree mildly
3=Disagree
4=Disagree strongly

[SP]
Q18. The Department of Homeland Security has the necessary skilled people to carry out its job with regard to smallpox.
1=Agree strongly
2=Agree mildly
3=Disagree
4=Disagree strongly

[SP]
Q19. The Department of Homeland Security has the expertise needed to deal with smallpox.
1=Agree strongly
2=Agree mildly
3=Disagree
4=Disagree strongly

[SP]
Q20.The Department of Homeland Security has done a good job in the past protecting the public from smallpox.
1=Agree strongly
2=Agree mildly

3=Disagree
4=Disagree strongly

[SP]
Q21. The Department of Homeland Security has done a good job in the past protecting the public from recent public health crises such as anthrax.
1=Agree strongly
2=Agree mildly
3=Disagree
4=Disagree strongly

[SP]

Q22. The Department of Homeland Security has done a good job in the past protecting the public from recent public health crises such as SARS.
1=Agree strongly
2=Agree mildly
3=Disagree
4=Disagree strongly

[SP]
Q23. How knowledgeable are you about smallpox?
1=Very knowledgeable
2=Knowledgeable
3=Somewhat knowledgeable
4=Not knowledgeable at all

[SP]
Q24. If given a chance, most people would try to take advantage of you.
1=Strongly disagree
2=Disagree
3=Neither agree nor disagree
4=Agree
5=Strongly agree

[SP]
Q25. Most people are too busy looking out for themselves to be helpful.
1=Strongly disagree
2=Disagree
3=Neither agree nor disagree
4=Agree
5=Strongly agree

[SP]
Q26. You can't trust strangers anymore.
1=Strongly disagree
2=Disagree,

3=Neither agree nor disagree
4=Agree
5=Strongly agree

[SP]
Q27. There will be more accidents and catastrophes in the future than we had in the past.
1=Strongly disagree
2=Disagree
3=Neither agree nor disagree
4=Agree
5=Strongly agree

[SP]
Q28. Nowadays, things seem to be getting more and more out of control.
1=Strongly disagree
2=Disagree
3=Neither agree nor disagree
4=Agree
5=Strongly agree

[SP]
Q29. A person can never have too much insurance to protect against the inevitable disasters in life.
1=Strongly disagree
2=Disagree
3=Neither agree nor disagree
4=Agree
5=Strongly agree