

**Mapping Perceptions of Factors Related to Acceptance of Smallpox Vaccination  
under Varying Levels of Threat among Hospital Emergency Room Personnel**

**Abstract:**

Emergency department personnel would be first responders in the event of a bioterror smallpox outbreak, yet few were willing to be vaccinated during the 2002 federal campaign. To better understand vaccination concerns, perceptual mapping methods were used to create multidimensional models of how emergency department personnel (n=73) in the Philadelphia area perceive the risks and benefits of smallpox vaccination under four levels of threat: (1) Today; (2) If another terrorist attack happened anywhere in the US; (3) If a smallpox attack happened somewhere in the US; (4) If a smallpox attack happened locally. The perceptual maps show significant shifts in factors important for motivating respondents to accept vaccination under increasingly higher levels of threat. In the "today" scenario, endorsement of vaccination from a credible source, such as a major hospital in the area, was a very important factor (mean=7.10 on a 0-10 scale). However, endorsement was not as important under the two higher levels of threat. Under these conditions, respondents' sense of wanting to help in a disaster emerged as an important element the closer the hypothetical attack was to the respondent, ranging in importance from 3.87 under the least threat to 7.35 under the greatest threat scenario. The perceptual maps yield information that would assist planners in designing more effective risk communication strategies tailored to particular audiences and levels of threat. Such communications are important to prepare for a smallpox event or other uncertain outbreak, where it is essential to rapidly vaccinate a critical mass of health care workers.

## Introduction

Background: Smallpox, eradicated worldwide in the 1970's, has re-emerged as a possible bioterror threat (1). Following the events of 9/11/01 and subsequent anthrax poisonings, experts' concerns heightened over the use of smallpox as a bioterror agent because it is transmitted easily from person to person. As the last U.S. civilians were vaccinated over three decades ago, the population is immunologically susceptible, with less than 20% of the population of persons vaccinated before 1972 estimated to have retained protection [2]. In addition, most healthcare workers have never seen a smallpox case and emergency department personnel, who would be critically needed to contain an epidemic, are particularly vulnerable to exposure. As a result, a smallpox outbreak could overwhelm public health and healthcare systems and result in public panic [3].

In December 2002, the federal government initiated the National Smallpox Vaccination Program (NSVP), with plans to voluntarily vaccinate 500,000 healthcare workers in its first phase, up to 10 million first responders in the second phase and, in the final two phases, the entire civilian population [4]. The Phase I plan recommended that every US hospital vaccinate 50 to 100 health care workers to form a Smallpox Health Care Team [2] that included physicians, nurses, mid-level practitioners and ancillary staff [5]. While expecting Phase I to be implemented rapidly (over 30 days), in fact, only 39,579 individuals were vaccinated nationally, with states reaching varying levels of compliance (6). Nationwide, less than 17% of the available vaccine doses were used [6,7,8]. The success of the program was impeded by many factors. Logistical and economic issues hampered vaccination in some states. In others, the lengthy training sessions required for all potential vaccines and/or prohibitive health inclusion criteria reduced vaccination rates. The General Accounting Office [9], in a report on the progress of the campaign, noted that states reported that they lacked guidance about what "smallpox preparedness" meant and about how to assess if they were sufficiently prepared. Overall, healthcare worker acceptance and adoption of vaccination was very low. Studies of attitudes of health care workers toward the program revealed that most were

unconvinced that the benefits of vaccination outweighed the risks [10, 11, 12, 13, 14, 15]. Yih et al. [15] found that only 32% of 1165 emergency room or ICU health care workers studied said they would report to work after a patient with smallpox was admitted to their facility, unless they had been vaccinated recently. Only 61%, however, reported being willing to be vaccinated at the time of the survey. While other investigators found similar rates of intended vaccination, actual vaccination rates are much lower. Benin et al. [10] found that only two of 141 surveyed physicians actually received vaccination when asked to do so by their health care institution. This is an important distinction as intention is not necessarily an accurate predictor of behavior and is a limitation of these and other studies.

Health care workers were not convinced that the benefits of vaccination outweighed the risks. Because prior to eradication smallpox had a 30-50% case fatality rate, the risk-benefit ratio for vaccination then was clear. Today, when facing only a hypothetical outbreak, the risk-benefit ratio is less clear. Adverse outcomes from smallpox vaccination in a 1968 study included a case-fatality rate of one per one million primary vaccinations. More common complications included skin eruptions (eczema, progressive vaccinia and generalized vaccinia) and post-vaccinial encephalitis or inflammation of the brain. Based on historical vaccination data, the Centers for Disease Control and Prevention estimate that for every million persons vaccinated, 1000 would experience severe adverse events including 14-52 life-threatening reactions and one or two deaths [16]. While the actual number of adverse reactions in healthcare workers that were vaccinated under the NSVP was small (16), it was difficult to overcome the belief that the risks of vaccination were substantial. Little is known about efforts to develop risk communication messages that addressed such beliefs or what elements of messages were or might be effective.

To understand healthcare workers' attitudes about smallpox vaccination and the factors most important to them in making a decision to be vaccinated or not, we conducted a cross-sectional survey of emergency room personnel (primarily physicians, physician assistants, and nurses) (n=73) from seven hospitals in the Philadelphia area between September 2005 and April 2006. The self-administered survey asked

respondents to report their attitudes about smallpox vaccination under four increasingly serious levels of threat: 1) Today, with no smallpox cases; 2) If another terror attack of any kind occurred in the US; 3) If a smallpox outbreak occurred anywhere in the United States; and, 4) If a smallpox outbreak occurred locally. For each of the four levels of threat, we did perceptual mapping analyses that included multidimensional scaling (MDS) to assess which factors most influenced respondents' decisions to be vaccinated. These techniques allowed us to produce dynamic three-dimensional models of complex cognitive and affective processes in order to understand the specific elements that would best be used in communication messages designed to achieve vaccination compliance.

Theoretical Foundation: This research is grounded in two theoretical frameworks: 1) *Illness Self-Regulation Theory* (17,18,19) and 2) *Information-Communication Theory* (20,21), both based upon the individual's conceptual map or model of health threatening situations. *Illness Self-Regulation Theory* contends that when individuals are confronted with a health crisis (disease or health threat), they form a mental representation of the condition, what caused it, what its effects might be, how long it might last, and how to control it. These conceptualizations are what Leventhal calls the individual's "common-sense model" of the illness (17,19). Based on this model, individuals then appraise various coping strategies. We posit that in the case of smallpox vaccination, under different levels of threat, the individual forms different "common-sense" models of the risks and benefits of vaccination—and on the basis of those models, makes decisions about whether or not to be vaccinated.

If we have a valid representation of how individuals, or groups of individuals, conceptualize the elements that constitute the most salient factors that are associated with their likelihood of making the decision to be vaccinated under specific levels of threat, we can more effectively develop risk or crisis communication strategies that address these, and move the individual toward the decision to vaccinate. To do so, *Information-Communication Theory* (20,22,23,24,25) provides methods for identifying optimum message strategies to address each perceptual map. This approach to studying vaccination decision-

making allows us to identify “mental models” of vaccination situations under different levels of threat. This in turn creates an empirical basis for identifying optimum message strategies designed to increase rates of vaccination under different conditions. It must be recognized that both the self-regulation and information-communication approaches are highly rational in orientation and may not account for “irrational,” emotional, or subconscious influences on decision-making. With time, refinements in the ability to measure these more subjective aspects of decision-making should lead to improvements in the theories. Until then, we can only recognize that these more subtle dimensions are not fully represented.

## Methods

*The Perceptual Mapping Approach:* Perceptual mapping uses multidimensional scaling (MDS) to yield a graphic display of how respondents perceive the relationships among a set of elements (e.g. risks & benefits). The resulting map reflects how the elements are conceptualized relative to each other and relative to “Self.” The “Self” can be positioned in the model as an individual (if data from only one person is mapped), or as a group/sample average “Self.” Thus, for targeting and tailoring purposes, samples can be segmented into representative sub-groups and each group can be mapped separately.

Using paper-pencil measures, respondents rate the extent to which they associate elements with each other (based on similarities and differences), and rate where in the mix they place themselves. In this study, emergency department health care professionals (primarily doctors and nurses) rated the risks and benefits of smallpox vaccination under different risk scenarios. Judgments were made on a 0-10 scale.

*The Mapping Program:* A metric MDS program, *Galileo* (20), was used to create the perceptual maps. This program converts the scaled judgments (through a scalar-products procedure) into distances used in the mapping. As Borg and Groenen note (26), “*Scalar products are functions that are closely related to Euclidean distances. They are often used as an index for the similarity of a pair of vectors. A particularly well-known variant is the product-moment correlation for (deviation) scores. (p.301)*”

Input associations among the risks/benefits were derived from the inter-item correlations of all elements, where the absolute values of the Pearson product-moment correlations were converted to a 0-10 scale base. Thus, all distance matrix input data were on the same 0-10 scale. Input values were also "reflected" so that more important elements appear closer to the "self," while those judged less important are farther away (see Table 3). In the last step, the *Galileo* software performs a metric multidimensional scaling analysis and produces graphic arrays of the distances among the elements. The graphic plots can be displayed in two- or three-dimensions for visual inspection and interpretation. The percentage of variance accounted for by the analysis is provided as an assessment of the explanatory value of each map. The resulting maps display the risk/benefit elements relative to each other, and to "Self." Essentially, the maps provide a snapshot of the respondents' conceptualization of the situation, and reveal the relative importance of different elements. Maps of the four risk scenarios studied are presented below.

This analytic procedure has been used successfully in marketing research (27) and political campaigns to identify points where behaviors could actually be influenced, although much of this is unpublished because of propriety. One published example used this procedure to identify campaign issues that if addressed, would shorten the distance between the "Self" and a political candidate, moving the self closer to the targeted behavior of voting for that candidate (28). The procedure has rarely been used in public health or health care, but a recent presentation showed similar analyses in the area of family planning and reproduction (29).

In sum, perceptual mapping provides a methodology for assessing perceptions, modeling conceptual frames, developing message or intervention strategies, and tracking perceptual/conceptual changes over time. Looking at a perceptual map is like looking into the mind of the individual or group, to observe how they see their world and where they position themselves in relation to a specific decision or action -- in our case, the decision about whether to be vaccinated for smallpox.

*Risk Scenarios:* To assess how emergency personnel view the risks and benefits of smallpox vaccination we surveyed emergency department healthcare professionals about their concerns and how they would respond to calls for smallpox vaccination under four different levels of threat, using the following scenarios: 1) Today, with no cases of smallpox; 2) If another terrorist attack of any kind occurred in the USA; 3) If a smallpox terrorist attack occurred somewhere in the USA, and; 4) If a smallpox case occurred locally.

*Instrumentation:* To develop the instrument we conducted semi-structured interviews with infectious disease experts and focus groups with a total of 14 Emergency Department staff in four hospitals in the Philadelphia metropolitan area. These qualitative data allowed us to identify the core concepts related to decision-making about smallpox vaccination and personal perceptions of smallpox vaccination to develop the perceptual mapping questionnaire. The survey instrument was designed for respondents to answer each question on a 0 to 10 scale in each of the four scenarios. Thus respondents were asked their intention of being vaccinated for smallpox and were also asked to respond to questions about concerns they thought they would have about being vaccinated under each scenario. For example, they were asked about how concerned they would be about legal or liability issues, contra-indications related to the vaccine, losing time from work, or if they thought that getting vaccinated would increase their responsibility in the workplace should an outbreak occur. The survey also asked whether they felt they needed a strong recommendation from a credible health care leader before they would be vaccinated, and if they felt it was their duty to be vaccinated. Table 1 lists the key survey questions.

*Sample and Data Collection:* After developing the mapping instrument we surveyed 73 hospital emergency department health care professionals (who had not been interviewed or participated in the focus groups) in two large urban teaching hospitals and five smaller suburban hospitals in the Philadelphia area. Surveys and informed consent documents were distributed through the heads of the emergency departments between September 2005 and April 2006. Each department head asked staff to fill out the



surveys and return them to him/her along with informed consent documents. To ensure anonymity, informed consent documents and surveys were separated before department heads delivered them to the project staff. Because this was a convenience sample and we did not enroll participants from a sampling frame there is not a "refusal rate" to report. The Temple University Institutional Review Board approved the protocol.

*Data Analysis:* Survey data for each of the scenarios were rendered in distance matrix form for input into the *Galileo* multidimensional scaling program. The program produces the maps or models as n-dimensional rigid structures. To produce a coordinate frame around the structure for referencing purposes, the program uses a simple component factor analysis. Thus, the model can be seen to exist in an X-Y-Z coordinate space, making it easy to refer to the location of any given point (concept), including the 'Self.' The factoring process also produces eigen values for each factor, which provide a "variance explained" value. Thus, the total variance explained by a particular two- or three-dimensional model can be determined.

The survey data were then entered into SPSS version 9 to generate inter-item correlation coefficients. The correlations, based on the total sample, were then converted to a 0-10 scale for processing through the *Galileo* multidimensional scaling perceptual mapping software. The resulting 3-dimensional maps for each risk scenario are presented in Figures 1 – 4. Figure 5 shows how the "Self" is re-positioned in relation to each concept as the threat-risk changes across the four scenarios. In other words, this figure shows how the individuals in the sample changed their thinking about which concepts were or would be important to them when making a decision about being vaccinated for smallpox as the scenarios changed.

## Results

*Demographics:* The respondents represented a cross-section of health professionals working in urban and suburban emergency rooms. Almost 80% were ER physicians, nurses or nurse practitioners. The

other 20% were social workers, psychologists or surgeons who regularly consulted in the ER. Nurses were the predominant respondents, representing 50.7% of the sample. In addition, 20.5% were attending physicians, 8.2% were resident or fellow physicians, 5.5% were nurse practitioners and 13.7% were "other", which included those professionals working in the ER who did not fit the above categories. Overall, 38.4% of the respondents worked in smaller, private urban hospitals, 23.2% worked in suburban hospitals, and 28% worked in large, urban teaching hospitals. Demographically, the majority of respondents (69.8%) were between the ages of 30 and 49, while 21.9% were between the ages of 50 and 59, 2.7% were over the age of 60 and 5.5% were 29 years of age or younger. The majority of respondents (69.9%) were female.

Perceptual Mapping by Scenario: For the models presented, the percentage of variance accounted for by the three dimensional solutions to the scenarios ranged from 64.0% to 67.7%. Thus, a substantial amount of the variance is accounted for in the three-dimensional solutions. Table 2 presents the variance accounted for by each dimension for each scenario.

Interpretation of 3-Dimensional MDS plots: Clear delineations in the perceptual maps were found when comparing the four study scenarios, especially when comparing the first two scenarios (*Today* and *If a Terror Event Occurs in the US*, Figures 1 and 2) to the last two scenarios (*If a Smallpox Case Occurs in US* and *If a Smallpox Case Occurs Locally*, Figures 3 and 4).

Examination of the perceptual maps from the first two scenarios (see Figures 1 and 2) reveals that the distance between the *Self* and *Likely to Vaccinate* is considerable. In Figure 1, the input distance between *Self* and *Likely to Vaccinate* was 8.67 on the 0-10 scale (see Table 3 for distances). These data show that there is little interest in being vaccinated with things as they are today. In the second scenario (Fig. 2: *Terror Attack in US*), the distance between *Self* and *Likely to Vaccinate* is 7.08. Thus, overall, the mapping graphically captures the relationship of *Self to Likely to Vaccinate* in both of these perceptual maps.

The fact that the negative elements involving *Contra-indications*, *Negative side-effects*, *Loss of work-time*, and *Infecting others* are positioned near each other in the space shows that they are strongly linked in the respondent's mind. A smaller subset of elements that also group together involves *Feeling it is my duty to get vaccinated*, and *Wanting to help* in time of need, reflecting their altruistic similarity. From the positioning of *Feeling the need for more information* before deciding and *Needing a strong recommendation* from a trusted health care leader, it is clear that these elements are associated in the respondents mind and are located close to *Self*, reflecting their importance. The fact that *Liability concerns* are positioned in the map between *Concern about an epidemic*, the *sense of Duty & Wanting to help*, and *Likelihood of getting vaccinated*, reflects the tension among these competing aspects of getting vaccinated under *Today's* scenario, where the threat of smallpox is either minimal or ambiguous. Overall, the conceptual structure reflected by the positioning of issues relative to each other in Figures 1 and 2 shows little variation. In other words, respondents do not believe that another terrorist attack (non-smallpox) somewhere in the USA would lead them to significantly rethink their position about *not* getting vaccinated compared to how they feel about smallpox vaccination currently.

### Figure 1. Perceptual Map Using Scenario "Today"

### Figure 2. Perceptual Map Using Scenario "After Another Terror Attack in US"

When comparing the third and fourth scenario perceptual maps, which both involve the appearance of smallpox in the United States, significant shifts in decision-making about *Likely to vaccinate* and the location of *Self* become apparent. As seen in Figures 3 and 4, although the basic conceptual structure remains quite similar to the previous scenarios, there are five important shifts. First, the *Self* location has moved substantially closer to *Likely to vaccinate*, reflecting a greater intention to be vaccinated. The input mean distance in Fig. 3 is 2.72 and in Figure 4 moves to 1.87 on the 0-10 scale.

Second, *Concern about an epidemic* and *Self* are closer together. Third, *Wanting to help*, and *Feel it is my duty* have reversed positions such that wanting to help is closer to *Concern about an epidemic*. Fourth, *Self* and *Need a strong recommendation* are farther apart, reflecting the fact that the situation is more likely to be driving the decision to vaccinate than the need for a strong recommendation. Fifth, *Liability concerns* have moved away from the *Want to help and Feel it is my duty* cluster, probably reflecting a realization that the need to address a potential epidemic would outweigh the inhibitory influences of liability issues. In addition, in Figure 4, *Self* and *Need for a strong recommendation* are now more separated reflecting the fact that the immediate threat negates the need for a recommendation before taking action to vaccinate.

**Figure 3. Perceptual Map Using Scenario “If Smallpox Attack in the US”**

**Figure 4. Perceptual Map using Scenario “If Smallpox Attack Occurred Locally”**

Finally, Figure 5 illustrates how the *Self* changes in relation to the vaccination concepts in the survey in each scenario. In other words, this shows how respondents changed their views of what was most important to them when deciding whether or not to be vaccinated for smallpox under the varying conditions. From Figure 5, using the first map as the baseline context, it can be seen that there is a clear progression of *Self* movements across the different scenarios. In sum, the location of *Self* to *Likely to vaccinate* shifts quite dramatically as the scenarios change – from a distance of 8.69 in Scenario 1 (*Today*), to 1.87 in Scenario 4 (*Case of smallpox locally*). Table 3 summarizes the *Self* distances from the key elements across all 4 scenarios.

**Figure 5. Perceptual Map Illustrating Repositioned Self under Four Study Scenarios**

## **Discussion**

These results demonstrate that the decision to vaccinate among health care workers is complicated and involves the weighing of several important factors. Importantly, the results show that the weights of these factors are likely to vary as the risk of actual infection increases. Finally, comparing the results

across the four scenarios shows how attributes that contribute to decisions may differ under various levels of uncertainty, indicating the need for differences in messages and strategy to reach a particular population under different conditions. In this case, it is clear that emergency room health care workers, who in the case of smallpox would be clearly affected and asked to respond, still have many reservations when thinking about whether they would be vaccinated under current conditions or even another terrorist event unless it were related specifically to smallpox. The negative attributes, such as liability issues, possible negative side effects and the fear of infecting others strongly contrasts to the positive attributes, such as wanting to help or feeling it is a duty to respond. These opposite forces pull against each other but it is obvious in Figures 1 and 2 that the negative attributes, along with the need for more information and a strong recommendation, are more influential in shaping decision-making about whether or not to be vaccinated when the threat remains hypothetical.

In contrast, those negative attributes are less influential as the threat of smallpox becomes more certain. As Figures 3 and 4 illustrate, while the negative attributes of liability and negative side effects are still substantial, the positive influences of wanting to help and feeling it is a healthcare worker's duty to respond are repositioned. Under these conditions, these forces are stronger and more likely to counteract the negative influences. Thus we see a shift in how the self is positioned relative to the vaccination decision as we move from maximum uncertainty about the threat to greatest certainty. In addition, the need for more information or a clear recommendation from a trusted source becomes far less important when a possible epidemic looms. Thus these attributes, which are clearly part of the decision process in the first two scenarios, become moot in the last two scenarios when the certainty of the threat increases. As these attributes fall out of the decision process, being concerned about an epidemic moves into a position of importance whereas in the first two scenarios, it had no influence because it was not seen as a certain threat. The influence of these shifts is clearly seen in Figure 5, which illustrates how the *Self* has moved toward probable vaccination through the four scenarios. This shows that as the scenarios shift, the

decision making process for respondents change with different attributes becoming more influential in the context of the situation.

This study also demonstrates how perceptual mapping is a useful tool to understand behavioral intentions, in this case, how emergency health care professionals conceptualize decision making about being vaccinated for smallpox. Furthermore, the results indicate which elements should play a prominent role in communications from emergency management policy makers to health care workers under different conditions of uncertainty. Different messages are clearly required for campaigns that seek to foster preventive measures for less certain threats than imminent ones. These data show that to effectively engage healthcare workers in preparedness prior to an outbreak, communications that focus on prophylactic vaccination when the threat of an epidemic is uncertain, require clear and strong endorsement from credible leaders. In contrast, in the response phase, in the face of a more certain threat, appeals to professional responsibilities might be effective. Understanding how perceptions under different levels of uncertainty are related to willingness to undertake preventive action is useful for developing a systematic means of tailoring risk communication more strategically to achieve desired levels of preparedness.

Limitations: This study was conducted with a small, non-representative sample of healthcare workers following a failed public health campaign to vaccinate healthcare workers for smallpox. It took place during a period in which the goals of the campaign were contested and states differed in their efforts to implement CDC recommendations for achieving specified levels of preparedness (6). Because of considerable debate over the advisability of smallpox vaccination in the region in which the sample was recruited, including the refusal of opinion leaders to endorse the campaign, healthcare workers' perceptions may have been more strongly affected by the opinions of leaders than they might be under different conditions. In addition, despite the use of formative evaluation methods to delineate core study concepts, it is likely that there are unmeasured factors that shape individuals' or sub-groups' perceptual maps that could not be examined in this study. For example, in a larger study with a probability sample, it would be

desirable to assess whether perceptual maps and vaccination intentions were associated with factors such as prior history of smallpox vaccination (as a child, in the military or during the federal campaign) Finally, another limitation is that one of the scenarios (today – no smallpox cases) was factual whereas the others were hypothetical, How people expect they would respond in a hypothetical situation is not likely as accurate as self-reporting current or recent experience. It would be useful to replicate this study with a probability sample in a state that reached CDC recommended levels of vaccination.

### **Conclusion**

This research demonstrates that the perceptual mapping method is appropriate for studying how, under different levels of uncertainty about a threat, subjects re-conceptualize the relative importance of each of the factors that are involved in making a decision to vaccinate for smallpox. Looking across the four scenarios, we are able to view the simultaneous mix of elements in relation to each other that provides a more comprehensive assessment of change than looking at individual scaled items. Understanding which elements move people toward the decision to vaccinate under different conditions provides the critical empirical basis needed for designing optimal risk communication messages and decision aids that are specific to the contexts in which they will be used.

We believe that this method hold promise for studying other vaccination and rapid treatment campaigns to manage epidemics of conditions such as influenza that have both predictable patterns of strains that exhibit seasonal variation and more virulent strains that produce unpredictable pandemics. Similarly, perceptual mapping research could strengthen our capacity to develop and implement effective health communications to manage highly unpredictable outbreaks such as SARS, nuclear incidents and bioterrorist weaponization of life-threatening communicable diseases.

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Table 1. Questions on Smallpox Vaccination Decision-Making Under Four Levels of Threat

Survey Questions (each answered on a 0 to 10 point scale for four scenarios):
<i>If a smallpox vaccine were made available to you as a professional...</i>
1. How likely would you be to get vaccinated under the four scenarios? (0=not likely at all; 10=very likely)
<i>If the smallpox vaccine were made available to you as a professional, for each scenario rate how concerned you would be about each of these items: (0=not concerned at all; 10=very concerned)</i>
2. ...legal or liability issues?
3. ...that a smallpox epidemic might happen?
4. ...about the negative side-effects of the vaccination?
5. ...about the possibility of infecting others around, i.e family and friends?
6. ...about contra-indications related to your own health conditions?
7. ...about losing time from work while the vaccine incubates?
8. ...that you would be expected to carry more responsibility?
9. ...that you need more information to decide about vaccination?
<i>Rate how you would feel about the following statements, under each scenario: (0=Do not agree at all; 10=agree very much)</i>
10. I would need a strong recommendation by a credible health care leader before I would get vaccinated for smallpox.
11. I feel it is my duty to get vaccinated.
12. I worry that if I get vaccinated, I would become a front-line worker.
13. I would want to get vaccinated so I could help out.

**Table 2: Percentage of Variance Explained by the Three-Dimensional MDS Solutions  
By Dimension and Scenario\***

<i>Dimension</i>				
<i>Scenario</i>	1	2	3	<i>Cumulative Variance Explained</i>
1. Today: No Cases	32.5	17.3	14.2	64.0
2. Terror Attack in US	37.3	18.8	11.5	67.6
3. Smallpox Case in US	33.4	18.4	15.9	67.7
4. Smallpox Case Locally	37.5	16.8	12.0	66.3

\*Dimensions are factors as in a traditional orthogonal factor analysis. The dimensions simply provide a framework for locating the points in space and as such, no attempt is made to name the dimensions.

**Table 3. Distances of 'Self' to Risks/Benefits and Likelihood of Getting Vaccinated for Smallpox (n=73)**


Scenarios				
	<i>Today: No Cases</i>	<i>Terror Attack Somewhere in US</i>	<i>Smallpox Case Somewhere in US</i>	<i>Smallpox Case Locally</i>
<b><i>Risks/Benefits</i></b>				
1. Likely to vaccinate	8.67* **	7.08	2.72	1.87
2. Legal issues/concerns	7.37	7.18	6.64	6.58
3. Concern about an epidemic	7.93	6.55	2.86	2.15
4. Side effects concerns	5.03	4.59	3.52	3.34
5. Might infect others	6.29	5.25	3.18	2.60
6. Contraindications concerns	6.86	5.95	5.27	5.05
7. Lost time concerns	6.92	6.09	5.49	5.66
8. Might get more responsibility	7.60	5.90	4.96	4.49
9. Need more information	5.82	4.63	3.56	3.44
10. Need recommendation	2.90	2.68	3.30	3.85
11. Feel it is my duty	8.19	7.62	4.51	4.42
12. Might be put on front-line	8.22	7.40	6.79	6.38
13. Want to help	7.35	6.25	4.51	3.87

\*Scale Base = 0-10









\*\* Smaller mean values are closer to "self"

Legend for Figures 1-5





<u>Shape</u>	<u>Map Label</u>	<u>Questionnaire Item</u>
--------------	------------------	---------------------------

- |  |                                   |   |
|--|-----------------------------------|---|
| 1.  | <b><i>Likely to Vaccinate</i></b> | How likely would you be to get vaccinated (under the four scenarios)? (0=not likely at all; 10=very likely) |
|--|-----------------------------------|---|

**Items 2-9 rated on a scale of: 0=not at all; 10=Very Much**

- |  |                                   |   |
|--|-----------------------------------|---|
| 2.    | <b><i>Liability</i></b>           | How concerned are you about legal or liability issues?  |
| 3.    | <b><i>Epidemic:</i></b>           | How concerned are you that a smallpox epidemic might happen?  |
| 4.    | <b><i>Neg Side-Effects:</i></b>   | How concerned are you about the negative side-effects of the vaccination?                             |
| 5.    | <b><i>Infect Others:</i></b>      | How concerned are you about the possibility of infecting others around you, i.e., family and friends? |
| 6.    | <b><i>Contra Indications:</i></b> | How concerned are you about contra-indications related to your own health conditions?                 |
| 7.  | <b><i>Lose Work Time:</i></b>     | How concerned are you about losing time from work while the vaccine incubates?                        |
| 8.  | <b><i>More Resp.:</i></b>         | How concerned are you that you would be expected to carry more responsibility?                        |
| 9.  | <b><i>Need More Info:</i></b>     | How concerned are you that you need more information to decide about vaccination?                     |

**Items 10-12 rated on a scale of: 0=Do not agree at all; 10=Agree very much**

- |   |   |  |
|---|---|--|
| 10.  | <b><i>Need Strong Recommendation:</i></b> | I would need a strong recommendation by a credible health care leader before I would get vaccinated. |
| 11.  | <b><i>Feel It's My Duty:</i></b>          | I feel it is my duty to get vaccinated.  |
| 12.  | <b><i>Be Frontline:</i></b>               | I worry that if I get vaccinated, I would become a front-line worker.                                |
| 13.  | <b><i>Want to Help:</i></b>               | I would want to get vaccinated so I could help out.  |

