International Journal of Mass Emergencies and Disasters
November 2001, Vol. 19, No. 3, pp. XXX–XXX

Mass Terrorism and the Distribution of Gas Masks in Israel: A Longitudinal Cohort Analysis*

Alan Kirschenbaum
Faculty of Industrial Engineering and Management
Technion–Israel Institute of Technology
Haifa 32000
ISRAEL
Avik@tx.technion.ac.il

This paper describes and analyzes the distribution of gas masks in Israel. It is based on a longitudinal cohort analysis to assess the effectiveness of the program and those factors explaining skill level in mask use. A matched cohort sample ten years after the original distribution in 1991 are compared along with pre and post Gulf War mask recipients. The results suggest that the original distribution program to have been extremely effective in maintaining skill level in use, providing client satisfaction and increasing protective confidence. A matched cohort 10 years later showed a continuation of these high levels of preparedness and of skills required to effectively use gas masks. Contrasting pre-post Gulf War mask recipients revealed those who experienced the war had significantly higher mask-use skill levels. Marital status, and risk perceptions of an imminent war accounted for these differences.

Not since the use of chemical warfare in WWI have governments had to face the reality of preparing the civilian population for mass terrorism by biological and/or chemical agents (Henderson 1999). It is estimated that 26 nations may possess chemical agents weapons with another twelve in the developing stages, and with at least ten countries possessing or conducting research on biological agents for use in weapons (Central Intelligence Agency 1999; U.S. Department of Defense 2000). Today, such forms of terrorism have cast a shadow on other types of disaster scenarios (Bradford 1993) for which organizations and disaster managers must plan. The threat is not only against civilian populations but has wide spread environmental (Reutter 1999) and health consequences (Macintyre et al. 2000). Most governments have taken a two-edged sword approach to deal with biochemical terrorism by focusing on prevention and containment (Franz and Zajtchuck 2000; Centers for Disease Control 2000; Pavlin 2000). As a result, most of the research in this area has been technical in nature and sponsored by the military (Linkie 2000). The focus is on how will a certain virus, bacteria or chemical composition affect individuals and aggregate populations (Henderson 1999; Gao, Miller, and Daniels 2000)). These scenarios have sensitized public officials to such an extent that whenever a suspected biochemical terrorist act may have occurred, they set in motion a broad range of agencies to

* I wish to express my gratitude for the support given this project by the Israel Defense Forces Home Front, and the cooperation of numerous departments and officers involved in protecting Israel's citizens from mass terrorism. I also thank Efrat Gati, Yael Koresh and Tali Gants for their help in processing the survey data. This paper was presented at the 96th Annual Meetings of the American Sociological Association in Anaheim, California, 2001.

contain the threat (MMWR 2000). Yet, in terms of strategic societal survival, this type of terrorism (both domestic and international) is aimed at the civilian population, as a means of destabilizing governments (Fidler 1999) and putting into jeopardy the psychological and medical state of the civilian population (Centers for Disease Control 2000; Franz and Zajtchuk 2000; Hayes and Marrese 1991). Maximizing the protective behavior of this population from biochemical terrorism is therefore a key factor that can be employed to measure how well governments can prevent and contain such terrorist activity. One solution has been the distribution of gas masks and other protective means to populations at risk.

This solution, used during World War I, remains the basic format for population wide protection and was employed again when Iraq attacked Israel during the Gulf War in 1991. The 18 attacks by 39 long-range ballistic missiles capable of being outfitted with biological and chemical warheads justified the Israeli government's prior decision to distribute gas masks to its entire Jewish and Arab populations. The decision was based on the assessment that Arab countries—which had already fought and lost four wars against Israel—would resort to these weapons of mass destruction. In addition, there was an extreme sensitivity to such chemical agents related to the mass murder of Jews in gas chambers by the German Reich during World War II. For this reason, Israel manufactured and stockpiled gas masks for its population. The first hint that Arab countries would use these non-conventional weapons of mass destruction came during the Yom Kippur War (1973) when Syria used short-range Scud missiles against both military and Israel civilian populations. In addition, Egyptian soldiers attacking Israel had gas masks as part of their standard equipment. The fears of a biochemical attack increased as Iraq obtained the use of medium range ballistic missiles and started to create biochemical warheads. By 1990, a precedent already existed for their use when chemical and biological warfare was reintroduced by Iraq against the Kurdish population of Iraq which led to 7,000 deaths from mustard gas and nerve agents. It was also used in Yemen. By the time Iraq had invaded Kuwait and sparked the Gulf War, Israel had already distributed gas masks to its population. The defeat of Saddam Hussein of Iraq in the Gulf War did little to reduce the threat on Israel as in (Feburary) 1998; he again threatened to use biological weapons against Israel. This same threat hangs over Israel with the present US lead coalitions' "war on terrorism."

The actual distribution of gas masks reflected a complex organizational enterprise that the Israel Defense Forces (IDF) Home Front directed. It was primarily viewed as a logistic problem, leading its designers to create an organizational structure closely mimicking proven military concepts. Part of the logistic problems included both the distribution and basic training in the use of gas masks (including the specialized auxiliary equipment for elderly, children, babies, etc.), the constraints in their use (effectiveness of the filters, when to use atropine self injectors) and storage instructions. Along with the technical knowledge about the masks themselves, the IDF Home Front provided basic information about the "protected sealed room" which would be (and was) used during Scud attacks, and a series of recommended behaviors during various attack scenarios. Local and national information centers were set up to answer questions and use was made of mass media to deliver and reinforce basic information provided during the distribution process.

The distribution process was designed to be dependent on local community distribution centers, whose location and number were relative to the community's population size. Local schools were most frequently used, mainly after school hours. Individuals received a mailed postcard instructing him or her when and where to obtain their gas masks. The distribution center itself was structured along the lines of an industrial assembly line where individuals or families

would enter, pass through several stages (registration, small group information demonstrations, fittings, etc.) and finally obtain the pre-packed gas mask in a sealed box. At each stage, trained military personnel provided frontal lectures to groups or individuals with teams of personnel assigned to different shifts.

The Israeli governments' efforts to prepare and contain these mass terrorism attacks form the basis for this paper. Studies before and ten years after the Gulf War provided raw data to not only evaluate the effectiveness of the gas mask distribution process but also discern what factors explain the use, skill level and maintenance of the gas masks given to the civilian population.

Behavioral Uncertainties

The attack on Israel by long-range Scud missiles from Iraq provided researchers with a rare opportunity to investigate disaster related behavior associated with non-conventional warfare on civilian populations. However as the literature associated with non-conventional warfare is scant, a firm theoretical basis was wanting. Those few articles that are available (not censored or secret) are mainly hypothetical (Fisher 2000), or practical preparedness/protection guides (Chester and Zimmerman 1985; Betts-Symonds 1995; FEMA 1993). A large number, found in the popular press, discuss alternative scenarios, specific terrorist methods, symptoms we can expect from a biochemical attack (Wilson 1987), probable medical outcomes (AAP 2000) and how governments and individuals can create preventive measures (Macintyre et al. 2000). Some literature deals directly with the effectiveness of masks as a protective unit product (Howard 1995). Unfortunately there are only a handful of empirical studies available that have investigated actual biochemical terror incidents (Okudera et al. 1997). These studies, mainly by Israeli researchers, cover a wide range of topics relevant to post Gulf War behaviors. These range from the impact that life threatening stressors (missiles) had on mortality rates during the war (Kark, Goldman, and Epstein 1995), the medical and psychological consequences of using gas masks (Golan et al. 1992; Ritchie 1992), the effects of being in a sealed room (Borkman et al. 1993; Goldsmith 1992-93), the probability of anxiety related somatic reactions (Carmeli, Lieberman, and Mevorach 1991), the consequences of misuse of gas masks (Hiss and Arensburg 1992) and how social networks affected coping (Shavit, Fischer, and Koresh 1994). There were also a number of reports prepared for the IDF Home Front based either on case study or policy analysis methods.

An additional flurry of studies came about with the 1998 threat by Saddam Hussein to repeat his Scud missile attack on Israel. One of interest measured this threats' impact on increased frequency of visits to health clinics (Zalewski et al. 2000). In addition, popular press releases in Israel and abroad about hoarding, fears of a real biochemical missile attack, problems involved in the gas mask distribution and filter renewal process were prevalent (*Wall Street Journal* 1998; Inter Press Service 1998; *The Economist* 1998). Thus, the initial Gulf War attack on Israel along with continued terrorist attacks on Israelis and another threat by Iraq to use biochemical weapons of mass destruction created a social climate that mass terrorism using biochemical weapons was a real possibility.

The Black Box Effect

One of issues involved in the effectiveness of distributing gas masks has to do with the uncertain reactions of potential users. Suddenly, individuals and families are faced with the

reality that they may be targets for what they perceive as a hideous threat. This threat is made more potent by a combination of factors; a lack of knowledge of the threat, inaccurate myths, inability to avoid it, feelings of powerlessness, and the almost certain outcome of suffering and death. Agreeing to accept a gas mask acknowledges the threat and risk. Yet, its correct use and maintenance is crucial in reducing the risks of injury and death.

This type of protective behavior has been found to be dependent on several sets of intertwining factors. For example, there is the indirect impact of disaster warnings. The literature repeatedly acknowledges that warnings have a variable impact on actual avoidance and protective behavior (Kirschenbaum 1992; Ikeda 1982). Therefore, the interpretation of the warning as a risk, its source and perceived level of threat would likely affect accepting a gas mask and its effective use and care (Covella 1983). In addition, the longer the threat remains in place, as in our case over a ten-year period (1990-2000), the less its impact may have on disaster avoidance (Turner, Nigg, and Paz 1986; Hirose and Ishizuka 1983). These factors are also related to the socio-demographic characteristics of the potential victims. Here, age, gender, educational level and family status, among others, affect how the threat is perceived (level of risk) and acted upon (Cutter 1994). In addition, these perceptions of risk may also be affected by previous experiences with various types of disaster (Rogers 1997; Covello 1983). From the point of view of the government agency issuing the warning and providing the means for protection (i.e., gas masks), there always remains the possibility that the message may create unexpected and dysfunctional behavioral patterns for disaster managers (Mileti and Sorensen 1990). This is particularly pertinent in cases of biochemical threats when evacuating an area may not be desirous and actually be detrimental (Rogers 1990).

Thus, the decision to distribute gas masks in the face of a potential threat faces a host of problems for both the distributing agency and the receiving public. There remains the possibility that the warnings will not be heeded, that is, people will refuse to accept or maintain masks. The distribution itself may exacerbate individual psychological problems, social tensions, lower societal moral and even create a gray market in biochemical equipment. It may become extremely costly if gas masks are not used, neglected or used for other purposes. Thus, the basic decision made by governments to distribute gas masks as a protective measure against mass biochemical terrorism, are fraught with uncertainties.

Measures of Effectiveness

The distribution of gas masks in Israel provided an opportunity to understand the effectiveness of the distribution process and its long-term impact on the maintenance of skill levels to assure maximum protection. With no direct empirical evidence available, theoretical links to explanatory factors measuring the effectiveness of the distribution process were sought in related protective and preparedness research. The general concept of preparedness has been viewed in terms of the individuals' acknowledgement, choice, implementation and evaluation of alternative behaviors (Lindell and Perry 1992; Mileti 1980; Perry, Lindell, and Greene 1981). These behaviors can be related to the distribution process in terms of gas mask acceptance, use and skill level for optimal protection against biochemical terrorism.

The research literature stresses four basic core concepts that have been linked to general preparedness. The first, *socio-demographic* characteristics of the population have focused on such variables as gender, age, education, family status and size and socio-economic level (Dooley et al. 1992; Perry and Lindell 1997; Ruestemli and Karanci 1999; Sims and Baumann

1983; Turner et al. 1986; Morrow and Enarson 1994; Russell, Goltz, and Bourque 1995). These characteristics act to filter risk perceptions and consequential behavior through their normative and cultural links to society (Slovic 1991). For example, family unit behavior in the face of a disaster differs from that of single households; women relate to disasters differently from men, etc. A second set of theoretical variables relates to the impact of *social networks*. These variables stress that social interrelationship contributes toward initiating and sustaining levels of preparedness and coping (Shavit et al. 1994). These have included family and friendship networks (Smith 1983; Clifford 1956; Lavee and Ben-David 1993; Weinstein 1987) as well as social commitments toward neighbors and neighborhood (Turner et al. 1986). A third conceptual factor relates to *past experiences*. The assumption here is that people learn from experience and this can affect their level of preparedness. Thus, past experiences were found to positively affect preparedness in some cases (Norris, Smith, and Kaniasty 1999; Blanchard-Boehm 1995) but not in others (Faupel and Styles 1993). A final set of variables relates to *risk assessment* of the disaster threat. The literature here argues that perceptions of a disaster threat lead persons to grade the risks involved (Kirschenbaum 1996; Palm and Hodgson 1991; Covello 1983), which then has an impact on the degree to which they will prepare for the actual event.

Methodology

Design Strategy

To evaluate the effectiveness of the gas mask distributions process in Israel required the availability of a pre and post-distribution data set for comparative analysis. In addition, a measure of effectiveness was necessary. To this end, advantage was taken of a data set I collected in a field survey (1990) evaluating a pilot distribution project shortly before the mass distribution of gas masks in Israel. This survey provided a benchmark from which a national survey I conducted ten years later could be compared. The comparison was done on the basis of a matched cohort where the age, education and gender of those in the original 1990 survey were matched against the 2000 survey sample. In this way, one measure of effectiveness—skill level in the use of gas masks—could be gauged for the same type of individuals who originally were gas mask recipients. In addition, by comparing the matched cohort against those who did not participate in the mass distribution of gas masks in 1990, clues could be found as to why some categories of persons retained their skills and other did not.

Data Source

Pre-Distribution Survey. Just prior to the mass distribution of gas masks in Israel, a random sample of adults who entered three of the six pilot gas mask distribution centers were asked to complete both an entrance and exit questionnaire. Of the 132 adults who completed the entrance questionnaire, 113 also agreed to fill in the exit questionnaire. In addition, self-report questionnaires were also distributed to providers (trained military personnel) so as to obtain a picture of bottlenecks, waiting periods and provider burnout. Also, trained observers were posted at key points in the distribution system to record specific organizational changes that occurred; for example, the number of requests to see "managers" to find solutions to specific problems. The flow of receipients, their numbers and timing through the distribution centers, was also recorded. Entrance questionnaires focused on the recipient's specific evaluation of the

distribution process and included "awareness," "attitudinal-affective," "administrative," "ecological," and "socio-demographic" variables. Exit questionnaires asked about "client satisfaction," "emotional outcomes," and "waiting time" variables.

Post-Distribution Survey. Nearly ten years later after the actual distribution of gas masks, a national representative household sample of Israels adult urban population (both Jews and Arabs) was conducted to assess the populations "preparedness" for potential future hostilities based on non-conventional weapons. The survey was based on randomally generated telephone numbers followed by a telephone interview which lasted about 20-25 minutes. Over 800 households were surveyed. Given the subject matter and sponsor (IDF), refusals were rare. Included in this survey were questions concerning the skill level in the use of gas masks and auxilliary equipment which had originally been distributed (or received during the interim period).

Cohort Matching

The pre-distribution questionnaire in 1990, before the outbreak of the Gulf War, asked the respondents to indicate their age, gender and educational level. These three key socio-demographic variables were also included in the questionnaire of the representative national sample ten years later in 2000. Along with these key variables were retrospective measures of the use of gas masks during the Gulf War, consequent maintenance and filter renewal and present knowledge and skill in their use. These retrospective data dependent on memory was matched against the results of surveys taken during the Gulf War and found to be extremely similar. By employing a cohort matching technique, it was possible to select a sub-sample of the national sample whose characteristics would match those in the original pre-distribution process. Thus, each individual on the basis of their combined age, education and gender in the original pre-distribution sample were matched against individuals with *exactly* the same characteristics in the national sample ten years later. While the cohort sample was not a true longitudinal trace of the original recipients of gas masks in 1990, it did allow for a match of the primary socio-economic cohort characteristics of the original recipients.

The cohort matching technique can be visualized as a system of selective filters screened by specific profiles of individuals in the pre-Gulf War sample. Thus, the profiles of individual records from the pre-Gulf War sample were singly iterated so as to locate and tag an exact match among the individual records in the national sample. For example, if a male aged 56 with 3 years of college found in the pre-Gulf War sample was sought in the national sample, the program first screened out all males, then those 56 years of age among the men first selected, followed by a further screening of only 56 years old men with 3 years of college. When an exact match was made providing an identical profile, that individual was transferred into a separate data file designated as the cohort sample.

In creating the cohort sample, we took into account that it had to be ten years older than the original 1990 survey. Also, only those who were in Israel during the Gulf War were chosen from the national sample to assure a history of common experiences related to both the gas mask distribution and subsequent related events. Thus, the pre-distribution "entrance-exit" questionnaires were primarily designed as a vehicle to describe the in and outflow of population, basic evaluation of the distribution process and client satisfaction. The matched sub-cohort sample, which included various measures of use and skill level of gas masks, was utilized to assess how effective the distribution process was in its goals of preparing the civilian population for biochemical terrorist warfare. In additional to examining the matched cohort, it was also

possible to compare those who experienced the original distribution process just before the Gulf War with those who did not.

Variables

The basic *dependent variable*, "gas mask skills," was based on the question: "To what degree do you feel you know how to put on a gas mask on yourself. The responses were based on a Likert type scale of 1= know extremely well, 2= have a basic idea, 3= don't know at all.

The *independent* explanatory variables were based on both theoretical models and empirical studies which have focused on preparedness and on the long term effects of disasters. Unfortunately, little is known about the determinants of gas mask use and maintenance. However, related theoretical and empirical literature provides four basic sets of conceptual variables which should theoretically affect this type of preparedness. This assumes that gas masks are a form of preparedness/protective behavior.

The first conceptual set encompasses *socio-demographic* variables such as age, gender, education, occupation, marital status, family size and ethnic/religious group. These were measured either as interval or dichotomous variables. A second set of theoretical measures was employed which dealt with how *social networking* influenced preparedness. The basic measures relate to both neighborly and family social networks. Employing mainly dichotomous variables, respondents were asked the strength, closeness and number of such networks. Thus, respondents were asked if they knew most of their immediate neighbors and whether or not their neighbors would be willing to help in case of need" Another set asked about family, to gauge the number of relatives nearby and the strength of the ties. A third group of variables are related to *risk perceptions*. In our case, several measures were employed. Likert scale measures 1=high risk to 3=no risk) first focused on the level of risk that "yourself or a close family member would be injured in a conventional, chemical, or biological weapons attack". A second set of measures asked about actual decision to prepare for a war (sealed room or renew gas mask filter) based on the sources upon which a risk assessment was made. Here, the sources ranged from (a) the media (CNN, Israel TV), (b) mainly friends and to some degree media but not government orders and finally (c) upon direct government directives. A dichotomous response was recorded (1=yes, 2=no). "The final set, *past experience*, particularly those experiences related to the Gulf War. Here, the matched cohort was asked specifically if his/her past experiences in an emergency situation contributed to preparation for future emergencies (Likert scale 1=much so to 4 not at all). In addition, a cumulative score was derived from past experiences in a variety of "emergency situations" (e.g., from car accidents, fires, terror events, artillery/Katusha attacks, war, evacuation).

Results

Pre-Distribution Pilot Survey

The data in Table 1 and 2, which reflect responses from the pre-distribution sample survey, reveal that the majority of those who came to physically obtain their gas mask were men (65 percent), those aged 35-54 (63 percent) and had at least a high school education (67 percent). The majority arrived by car (52 percent) or by foot (44 percent) with equal proportions arriving at the center by themselves or with their entire family (50 percent). The *entrance questionnaire*

gave a clear indication that nearly all received an official notice to pick up their gas masks (94 percent), that the information about themselves on these summons was correct (92 percent) and instructions of how to go about getting a mask clear (98 percent). When asked if they knew of any others who did not get a notification, only a handful affirmed they knew of someone (12 percent). Only a very small proportion of those waiting to enter the distribution center indicated they were nervous waiting (7 percent) or that the recent mass media about Iraq's threats had made them unusually stressful (10 percent). Questioned about waiting in line, only very few respondents complained of the long wait (9 percent) while an even small number saw it as disorderly (3 percent).

Table 1 About Here

The *exit questionnaire* given to the original sample as it exited the distribution center provided a measure of how the process and actual receipt of the gas mask affected the samples' emotional state. Nearly all felt that the process (from registration, basic training in its use and receipt) was clearly explained to them at each stage (97 percent) and their questions candidly answered (97 percent). All felt the distribution process was extremely well organized and that the IDF Home Front personnel involved were kind and helpful. The overall evaluation of the "service" was high (75 percent) and resulted in feeling safer (92 percent). Only a small proportion felt more nervous afterward (13 percent). A view of the flow chart (Figure 1) of those asked to obtain their gas masks indicates that there was no "onslaught" when the centers were opened (14:00) with a stable flow period followed by increased numbers peaking two to three hours before closing.

Figure 1 About Here

In an effort to discover if group differences could explain pre-entry and exist variations in the respondent's reactions, responses were categorized by gender, age and education. The results in Table 2 reveal that only in the case of gender and education ($p<.01$), and only in the decision to come with/without all family members, was there a significant difference. Education, in addition, played a role in evaluating the level of service satisfaction ($p<.01$) as measured in the exit questionnaire. A further analysis also found significant differences by age in the mode of transportation ($p<.05$). These small number of group differences reflect the overall consensus of opinion among the sample. Overall, there appeared to be a nearly complete and highly positive consensus of opinion about the distribution process.

Table 2 About Here

Protective Behavior

Examining the matched cohort ten years after revealed that nearly all had gone through the Gulf War (97 percent), had created a sealed room in their home (87 percent), had used a gas mask from the start of the war until its cessation (92 percent) and also made sure that their family members had a mask (90 percent). When questioned about their *present* skill level in putting on a gas mask ten years after its original distribution, close to all (96 percent) felt that they could do so without any problem, an extremely small number stated they would have some problem (4

percent) and no one claimed they could not do it at all. Other types of protective behavior were also examined indicating that as more complicated activities were involved, the proportion with adequate skill levels dropped; primarily in the use of self-injector atropine (44 percent) and helping dependents (children, elderly) put on special gas masks (63 percent).

Due to the lack of variance in gas mask skill level, it became clear that a multivariate analysis could not be initiated to discover the factors explaining skill level differences. Instead, a series of non-parametric tests were used to test group differences. Utilizing the four theoretical explanatory concepts, namely socio-demographic, social networks, risk perceptions and past experience, an ANOVA test statistic was generated. The results revealed that only one group characteristic, marital status, was significant is discerning differences in reported skill levels in using gas masks ($p=0.01$). The sign of the relationship suggests that married persons are more likely to report better skills in using a gas mask than non-married heads of households.

Table 3 About Here

Pre- vs. Post-Gulf War Users

The national sample also allowed a comparison between the matched cohort samples (those who experienced the Gulf War and participated in the original distribution process) with those who did not. This included the mask training sessions and actual use during the war. Those who did not participate in this process (either due to immigration or were children) formed the second comparative group. An initial examination of the two groups in terms of their skill levels in use of gas masks shows a significant difference ($p= 0.04$). Over 70 percent of the matched cohort group reported having high skill levels in using gas masks in contrast to less than 30 percent among those who did not participate in the mask distribution process. Given this type of group comparisons, a Mann-Whitney Paired Ranking test was performed. This procedure allows a comparison of the two groups (pre and post War) on one variable (skill level) with all the cases ranked in order of increasing size with the U test statistic based on paired ranking differences. The results are presented in Table 4.

Table 4 About Here

The Table reveals clear significant differences between the pre and post war groups. Among the socio-demographic variables, age, educational level and size of family were found to be significantly differentiating the two groups. No significant differences were found in terms of any measure of the intensity of each groups' social networks. However, how friends evaluated the situational risk and official warnings by government spokespersons clearly affected group differences in their perception of the risks of death or injury due to an attack by biochemical non-conventional weapons. Finally, for those variables measuring the impact of past experience involving emergency/disaster situations, the cumulative effect of experiences relating to emergencies and disasters were found to be significant.

To focus more sharply on what differentiate those who participated in the gas mask distribution process and those that did not, and how this affected their present skill level in using a gas mask, explanatory variables were introduced to both groups by skill levels in using gas masks. Among the four sets of core explanatory variables, three of the 19 variables proved to be significant. The first is a socio-demographic characteristic of the recipient, namely marital status

(p=0.05). The two remaining variables are related to risk perceptions; namely how gas mask recipients evaluated the risk of an actual war taking place (p=0.03) and the degree to which they felt their friends evaluated the same risk (p=0.01).

Summary and Conclusions

The threat of non-conventional biochemical weapons on civilian populations, either by terrorists or nation states, is becoming more probable as technology makes such weapons more easily accessible. In reaction, governments and disaster management agencies have expended extraordinary efforts to prevent such catastrophic events from occurring as well as preventative measures to protect their civilian populations. One traditional means of protecting civilians from biochemical attacks has been the use of gas masks and other measures to minimize contact with the offending agent. Not until Iraq threatened Israel with the use of such biochemical weapons in 1991 and attacked her with Scud ballistic missiles, did the spectra of mass terrorism using such weapons become realized. In response to the threat, Israel distributed gas masks to its entire population as well as created collateral means of protection (e.g., the sealed room). The distribution process and its consequence ten years later on the level of one key aspect of preparedness, skill level in using gas masks, were examined in this paper.

The mass distribution process initiated throughout Israel was preceded by a series of pilot projects, characterized by its classic military structure and focusing on a highly rationalized distribution system. Such a pilot project in 1990 provided behavioral and attitudinal survey data of the process. It incorporated a data collection design based on an entrance-exit questionnaire of a random sample of those processed in a representative sample of gas mask distribution centers. These experimental pilot projects were nearly duplicated in both form and structure during the mass distribution which took place soon afterward. Ten years later, a national representative sample of urban households was conducted on Israel's "state of preparedness" for war related disasters. This survey allowed a cohort match on the basis of age, gender and educational level of those who were in the original 1990 sample. By utilizing this matched cohort, it was possible to evaluate how effective the distribution system was over this period in terms of the retention of skills needed to use gas masks.

Essentially, the pre-distribution sample, based on entrance-exit interviews, demonstrated that the pilot distribution process was highly effective. The system not only physically provided gas masks to individuals and families but also provided basic training skills in their use, aligned fears and nervousness about biochemical attacks and received high grades as a service provider. An analysis of these attitudes suggested that gender and educational level affected levels of satisfaction with the distribution. Taking this original sample, I then exactly matched their age (+10 years), gender and educational level with a similar number in the survey conducted 10 years later in 2000. This matched cohort sample—who for all purposes represented the same type of persons who originally received gas masks—provided an opportunity to evaluate the present state of preparedness and effectiveness of the distribution process. What become very clear from the analysis was that the distribution system and training (educational) program had been highly effective. Over 90 percent had an operative gas mask available, either a sealed room or material to construct one and nearly the entire cohort reported high skill levels for effectively using the gas masks in their possession. The skill levels among the matched cohort dropped somewhat when asked about auxiliary equipment such as self-injecting atropine or the use of specialized gas masks for dependents.

In trying to decipher what variables could explain the level of gas mask skills, the lack of variance (96 percent reported high levels) discouraged a multivariate approach but did suggest a strategy utilizing non-parametric analyses. Assuming that skill in using gas masks was a critical form of preparedness, four sets of core theoretical concepts associated with preparedness were suggested as possible explanators. These included measures of socio-demographic characteristics, social networks, risk perceptions and past experiences. An initial analysis revealed that only marital status, of the 19 measures, was significant in predicting differences in mask skill levels. This implied that the distribution process had nearly an equally effective impact on just about all segments of Israeli society, even after 10 years of the original distribution.

Investigating this implication further, the matched cohort samples (who were participants in the distribution process and Gulf War) were contrasted against those who did not experience the Gulf War. What was sought here was an alternative way (using a control group) to assess the distribution process. The analysis immediately demonstrated that the pre-Gulf War sample were significantly more skilled at using gas masks than those who did not participate in the original distribution process and Gulf War. More importantly, the pre and post-war samples differed on a series of basic socio-demographic characteristics, the basis upon which risks of an imminent war was perceived and the cumulative experiences with related emergencies and disasters.

To discern the critical significant differences between pre and post Gulf War group's skills in effectively using gas masks, an additional analysis was performed. The results pointed directly toward two variables: marital status and perceptions of risks. Marital status, as we have already seen, was a significant component distinguishing pre-Gulf War group levels of gas mask skills. It again appears as critical in differentiating pre and post war group differences in skill levels. Apparently, being married plays a critical role in utilizing the knowledge of and ability to effectively use gas masks, independent of having participated in the Gulf War. The second factor relates to the assessment of the risk that a war will erupt in the very near future and how they feel their friends estimate this risk. More acute perceptions of the risk of a war led to having higher skill levels in using masks. As such risk perceptions are based on assessments of the situation, it makes sense that those who did experience the Gulf War scenario, repeatedly used gas masks and were struck by potential biochemical ballistic missiles would be more sensitive to these risks. The result was that they had higher reported skill levels than those who did not experience the entire distribution process and war.

In conclusion, the analysis of pre and post Gulf War samples using a cohort matching process strongly suggest that the original distribution system was highly effective in providing and training persons to effectively use gas masks, even ten years after the war. A major differentiating factor in the ability to effectively use gas mask was found to be marital status suggesting that family responsibilities may be involved in maintaining skill levels for gas mask use. In addition, those who actually experienced the war may have been made more sensitive to the cues and nuances affecting risk perceptions of another non-conventional war, thereby reinforcing their cognizance for maintaining high skill levels in gas mask use.

Postscript

The representative national household survey was conducted in the summer of 2000, a few months before the present hostilities broke out between Palestinian Arabs and Israelis.

Table 1. Socio-demographic Profile of Pre-Gas Mask Distribution Sample and Responses to the Entrance and Exit Questionnaire

Socio-Demographic Characteristics (N=132)

Gender	**%**
Male	65.6%
Female	34.4%
Total	100.0%
Education	
Elementary	15.2%
High School	17.4%
H.S. Diploma	44.7%
College	22.7%
Total	100.0%

Age	**%**
-14 years	1.5%
15-24	7.6%
25-34	5.3%
35-44	16.0%
45-54	22.1%
55-64	38.9%
65 or more	8.4%
Total	100.0%
Mean	49.4

Responses to Entrance-Exit Questionnaire

Entrance Variables (N=132)

Information	**% Yes**
Notice	93.9
Info Correct	91.6
Instructions	98.2
Other Not Info	12.2
Emotions	
Nervous Wait	7.0
Media Stress	10.0
Ecological	
All Family	49.6
Came by Car	52.7
Came by Foot	43.5
Organization	
Long Wait	8.6
Disorderly	3.1

Exit Variables (N=111)

Info Received	**% Yes**
Clear Explain	97.3
Answer Quest	97.3
Organization	
Well Organize	100.0
Emotions	
More Nervous	12.6
Felt Safer	91.8
Service Level	
Kind/Helpful	100.0
Positive	
Very Good	74.3
Good	25.7

Figure 1. Flow Chart of Pre-Gas Mask Population into Distribution Centers by Time and Day

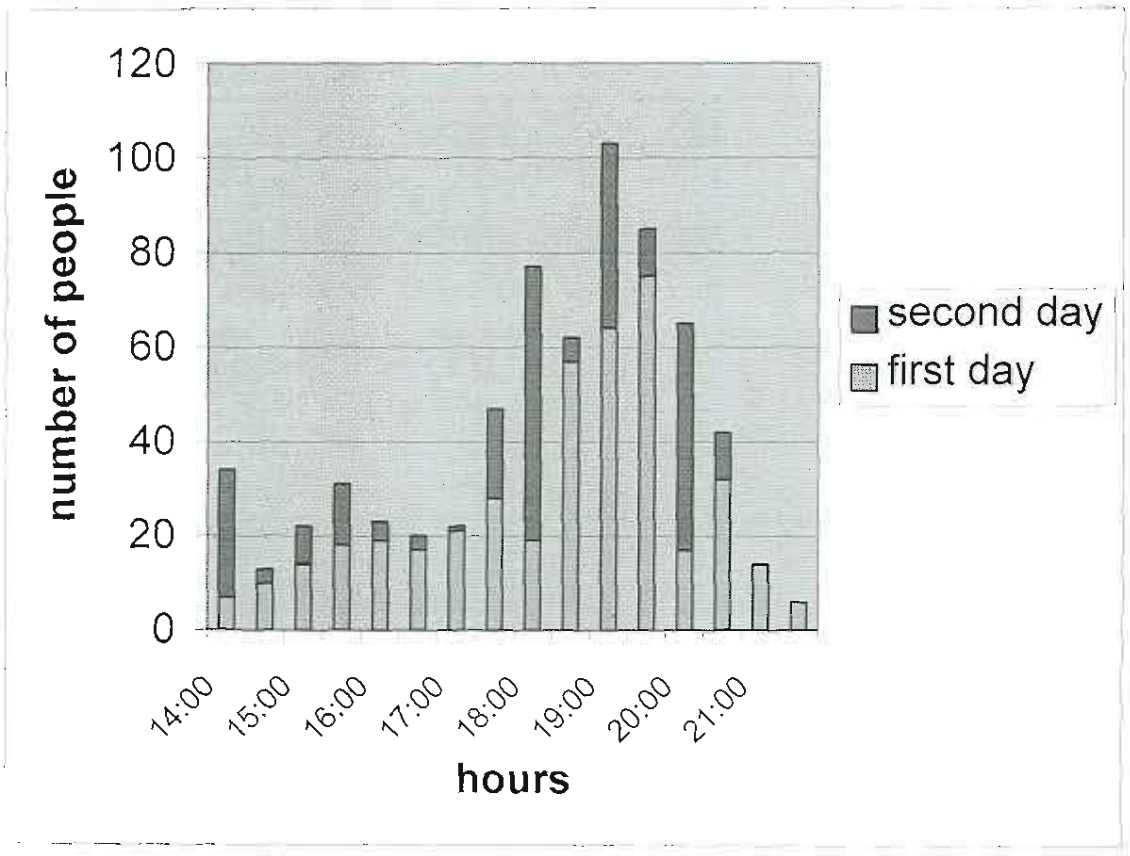

Table 2. Socio-Demographic Group Differences in Responses to Entrance and Exit Questionnaire For the Pre-Gas Mask Distribution Sample (Chi Square Coefficients and Significance Level)

Entrance Variables				Exit Variables			
Information	**Gender**	**Age**	**Education**	**Info Received**	**Gender**	**Age**	**Education**
Notice	3.32	3.29	8.02	Clear Explain	0.0	4.27	4.46
Info Correct	0.16	2.34	1.03	Answer Ques	1.59	4.42	4.51
Instructions	1.09	3.58	3.04	**Organization**			
Not Informed	3.96	2.38	5.48	Well Organ	0.0	-	-
Emotions				**Emotions**			
Nervous	0.59	2.51	4.04	More Tense	0.49	6.03	
Media Stress	5.88	6.97	4.42	Felt Safer	0.08	2.61	3.70
Ecological				**Service Level**			
All Family	3.52*	4.33	10.39**	Kind/Helpful	4.27	-	9.50**
Organization				Positive			
Long Wait	0.18	2.37	5.38	Very Good			
Disorderly	2.14	4.59	3.82	Good			

* $p>0.05$ **$p>0.01$

Table 3. ANOVA of Basic Theoretical Explanatory Variables by Skill Level in Gas Masks Use Among Matched Cohort Sample (N=132)

Socio-Demographic	Sum of Squares	DF	F	Sig.
Gender	29.9	131	.174	.67
Education	208.4	131	.836	.36
Children	396.9	131	2.41	.12
Income	139.8	131	.515	.47
Age	23374.6	131	.410	.52
Marital Status	22.6	131	7.024	.01
Ethnic	29.3	131	.029	.86
Religion	12.5	131	.501	.48
Risk Perceptions				
War	840.3	131	.021	.88
Media	88.3	131	.012	.91
Friends	144.7	131	.324	.57
Officials	7.5	131	.263	.60
Social Networks				
Neighbors	19.6	131	2.83	.09
Helpful Neighs	8.2	108	2.54	.11
Neighborhood	5.6	117	.162	.68
Family Close-by	81.5	128	1.24	.26
Family Relations	7.4	124	.279	.59
Past Experiences				
Combined	108.1	131	.867	.35
Helpful Coping	48.4	46	.138	.71

References

AAP. 2000. "Chemical-biological Terrorism and Its Impact on Children: A Subject Review, American Academy of Pediatrics." *Pediatrics* 105: 662-670.

Betts-Symonds, George. 1995. "Major Disaster Management in Chemical Warfare." *Accident and Emergency Nursing* 2: 122-129.

Blanchard-Boehm, R. Denise. 1995. "The Influence of Past Experience with Hazards on Future Response: A Consideration for Scientists and Emergency Managers." *Journal of Academy of Business Administration* 2: 21-37.

Borkman, Jeffrey, Pesach Shvartzman, Shmuel Reis, and Avigail G. Morris. 1993. Stories from the Sealed Room: Patient Interview during the Gulf War." *Family Practice* 10:188-192.

Bradford, Janet K. 1993. *Biological Hazards and Emergency Management.* Boulder, CO: Working Paper 82, Natural Hazards Research and Application Information Center, University of Colorado.

Carmeli, A., N. Lieberman, and N. Mevorach. 1993. "Anxiety-related Somatic Reactions during Missile Attacks." *Israel Journal of Medical Sciences* 27: 677-680.

Centers for Disease Control. 2000. "Biological and Chemical Terrorism: Strategic Plan for Preparedness and Response: Recommendations of CDC Strategic Planning Workgroup." *Morbidity and Mortality Weekly Review* 49: 1-14.

Chester, C.V. and G.P. Zimmerman. 1985. "Civil Defense Implications of Biological Weapons-1984." *Emergency Planning Digest* 12:2-7

Central Intelligence Agency. 1999. *Facts about terrorism.* Washington, DC: U.S. Government Printing Office.

Clifford, Roy. 1956. *The Rio Grande Flood: A Comparative Study of Border Communities.* Washington, DC: Disaster Study 7, National Research Council-National Academy of Sciences.

Covello, Vincent T. 1983. "Perception of Technological Risks: A Literature Review." *Technological Forecasting and Social Change* 23:285-297

Cutter, Susan L. (ed.). 1994. *Environmental Risks and Hazards.* Englewood Cliffs, NJ: Prentice-Hall.

Dooley, David, Ralph Catalano, Shiraz Mishra, and Seth Serxner. 1992. "Earthquake Preparedness: Predictors in a Community Survey." *Journal of Applied Psychology* 22: 451-470.

The Economist. 1998. "Preparing for the Worst." 346 (21 Februay).

Faupel, Charles E. and Susan P. Styles. 1993. "Disaster Education, Household Preparedness, and Stress Responses following Hurricane Hugo." *Environment and Behavior* 25:228-249.

FEMA. 1993. *Family Disaster Preparedness: Proceedings from the 1993 Family Protection Conference*. Washington, DC: Publication RR-38, U.S. Federal Emergency Management Agency.

Fidler, D. P. 1999. "Facing the Global Challenges Posed by Biological Weapons." *Journal of Microbiology and Infections* 1: 1059-1066.

Fisher, Henry W. 2000. "Mitigation and Response Planning in a Bio-terrorist Attack." *Disaster Prevention and Management* 9:360-368.

Franz, D. R. and R. Zajtchuck. 2000. "Biological Terrorism: Understanding the Threat, Preparation, and Medical Response." *Diseases Monthly* 46:125-190.

Gao, Ling Ling, Aubrey Miller, and William J. Daniels. 2000. "Chemical and Biological Terrorism Preparedness: Web-based Resources." *Applied Occupational and Environmental Hygiene* 15: 592-595.

Golan, E., M. Arad, J. Atsmon, J. Shemer, and H. Nehama. 1992. "Medical Limitations of Gas Masks for Civilian Populations: The 1991 Experience." *Military Medicine* 157: 444-446.

Goldsmith, J. R. 1992-93. "Prevention, Gas Masks, and Sealed Rooms: A Public Health Perspective." *Public Health Review* 20: 342-346.

Hayes, D.P. and M. Marrese. 1991. "Chemical-Biological Warfare: Medical Logistics and Defense." *Military Medicine* 156: 321-327.

Henderson, Donald A. 1999. "The Looming Threat of Bioterrorism." *Science* 283: 1279-1282.

Hirose, Hirotada and Tomoichi Ishizuka, 1983. Causal analysis of earthquake concern and preparing behavior in the North Izu peninsula, *Japanese Psychological Research* 25: 103-111.

Hiss, J. and B. Arensburg. 1992. "Suffocation from Misuse of Gas Masks during the Gulf War." *British Medical Journal* 304: 92.

Howard, J. D., 1995. "Suffocation from Use of Modified Gas Mask." *American Journal of Forensic Medicine and Pathology* 16: 140-141.

Ikeda, Ken'ichi. 1982. "Warning of Disaster and Evacuation Behavior in a Japanese Chemical Fire." *Journal of Hazardous Materials* 7:51-62.

Inter Press Service. 1998. "Israel Dispenses Soothing Words and Gas Masks." 4 February 4.

Jane's Defence Weekly, 1998. "Israel Seeks Protection from Chemical Attack." *Jane's Defence Weekly* 18 February.

Kark, J. D., S. Goldman and L. Epstein. 1995. *Journal of the American Medical Association* 273: 1208-1210.

Kirschenbaum, Alan. 1992. "Warning and Evacuation during Mass Disasters: A Multivariate Decision-making Model." *International Journal of Mass Emergencies and Disasters* 10: 91-114.

———. 1996. Residential Ambiguity and Relocation Decisions: Populations and Areas at Risk." *International Journal of Mass Emergencies and Disasters* 14: 79-96.

Lavee, Y., and A. Ben-David. 1993. "Families under War: Stresses and Strains of Israeli Families during The Gulf War." *Journal of Traumatic Stress* 6: 239-254.

Lindell, Michael K. and Ronald W. Perry. 1992. *Behavior Foundations of Community Emergency Planning*. Washington, DC: Hemisphere Press.

Linkie, M. 2000. "The Defense Threat Reduction Agency: A Note on The United States' Approach to the Threat of Chemical and Biological Warfare." *Journal of Contemporary Health Law Policy* 16: 531-563.

MMWR. 2000. "Suspected Brucellosis Case Prompts Investigation of Possible Bioterrorism-Related Activity–New Hampshire And Massachusetts." *Morbidity and Mortality Weekly Review* 49: 509-512.

Macintyre, A. G., G. W. Christopher, E. Eitzen, R. Gum, S. Weir, C. DeAtley, K. Tonat and J. A. Barbera. 2000. "Weapons of Mass Destruction Events with Contaminated Causualities: Effective Planning for Health Care Facilities." *Journal of the American Medical Association* 283: 242-249.

Mileti, Dennis S. 1980. "Human Adjustment to the Risk of Environmental Extremes." *Sociology and Social Research* 64: 327-347.

Mileti, Dennis S. and John H. Sorensen. 1990. "Communications of Emergency Public Warnings: A Social Science Perspective and State-of-the-art Assessment." Oak Ridge, TN: Oak Ridge National Laboratory, U.S. Department of Energy.

Morrow, Betty Hearn and Elaine Enarson. 1994. "Making the Case for Gendered Disaster Research." Bielefeld, Germany: paper presented at the XIIth World Congress of Sociology.

Norris, Fran H., Tenbroeck Smith, and Krzysztof Kaniasty. 1999. "Revisiting the Experience-Behavior Hypothesis: The Effects of Hurricane Hugo on Hazard Preparedness and Other Self-Protective Acts." *Basic and Applied Social Psychology* 21: 37-47.

Okudera, H, H. Morita1, T. Iwashita, T. Shibata, T. Otagiri, S. Kobayashi, and N. Yangisawa, 1997. "Unexpected Nerve Gas Exposure in the City of Matsumoto: Report of Rescue Activity in the First Sarin Gas Terrorism." *American Journal of Emergency Medicine* 15: 527-528.

Pavlin, J. A., 2000. "Bioterrorism and the Importance of the Public Health Laboratory." *Military Medicine* 165: 25-27.

Palm, Risa and M. Hodgson. 1991. *After the California Earthquake Experience: Attitude and Behavior Change.* Chicago, IL: University of Chicago Press.

Perry, Ronald W. and Michael K. Lindell. 1997. "Aged Citizens in the Warning Phase of Disasters: Re-examining the Evidence." *International Journal of Aging and Human Development* 44: 257-267.

Perry, Ronald W., Michael K. Lindell, and Marjorie R. Greene. 1981. *Evacuation Planning in Emergency Management.* Lexington, MA: Heath Lexington Books.

Rogers, George O., 1990. "Evaluating Protective Actions for Chemical Agent Emergencies." Oak Ridge, TN: Oak Ridge National Laboratory, U.S. Department of Energy.

———. 1997. "Dynamic Risk Perception in Two Communities: Risk Events and Changes in Perceived Risk." *Journal of Environmental Planning and Management* 40: 59-79.

Reutter, S. 1999. "Hazards of Chemical Weapons Release during War: New Perspectives." *Environmental Health Perspectives* 107: 985-990.

Ritchie, E. C. 1992. "Treatment of Gas Mask Phobia." *Military Medicine* 157: 104-106.

Ruestemli, Ahmet and A. Nuray Karanci. 1999. "Correlates of Earthquake Cognitions and Preparedness Behavior in a Victimized Population." *Journal of Social Psychology* 139: 91-101.

Russell, L., James D. Goltz and Linda B. Bourque. 1995. "Preparedness and Hazard Mitigation Action Before and After Two Earthquakes." *Environment and Behavior* 27: 744-770.

Shavit, Yossi, Claude S. Fischer, and Yael Koresh. 1994. "Kin and Non-kin under Collective Threat: Israeli Networks during the Gulf War." *Social Forces* 72: 117-1215.

Sims, John. H. and Duane D. Baumann. 1983. "Educational Programs and Human Response to Natural Hazards." *Environment and Behavior* 15: 165-189.

Slovic, Paul. 1991. "Perception of Risk: Reflections on the Psychometric Paradigm." Pp. 117-152 in *Theories of Risk*, edited by D. Golding and S. Kriminsky. London: Praeger Press.

Shirley M. Smith. 1983. "Disaster: Family Disruption in the Wake of Natural Disaster. In *Stress and the Family*, Volume 2, *Coping with Catastrophes*, edited by C.R. Figley and H.I. McCubbin. NewYork: Brunner/Mazel Pub.

Turner Ralph H., Joanne M. Nigg, and Denise Heller Paz. 1986. *Waiting for Disaster: Earthquake Watch in California.* Berkeley, CA: University of California Press.

U.S. Department of Defense. 2000. *Terrorism: Biological and Chemical Weapons.* Washington, DC: U.S. Government Printing Office.

Wall Street Journal. 1998. "Israelis Hoard Emergency Supplies, Fearing Chemical/Biological Attack." 18 February.

Weinstein, Neil D. 1987. *Taking Care: Understanding and Encouraging Self-protective Behavior*. New York: Cambridge University Press.

Wilson, David G., 1987. "Stay Indoors or Evacuate to Avoid Exposure to Toxic Gas." *Emergency Preparation Digest* 14:19-24.

Zalewski, Simon, Shlomo Vinker, Shlomo Monnickendam, Orli Cohen, Miriam Disegni, and Eliezer Kitai. 2000. "Israel under Threat of Biological Warfare—The Reactions of Our Patients during the 1998 Persian Gulf Crisis." *Family Medicine* 32: 342-345.