Science for the Community: Assessing Mental Health After 9/11

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Reactions to the September 11 attacks across the United States were pervasive, and persons throughout the country reported experiences akin to posttraumatic stress disorder (PTSD) in the first week following the attacks. In the New York area, 2 major surveys conducted 4 to 8 weeks after the attacks found that approximately 1 in 10 persons probably met full criteria for PTSD related to September 11. Although tobacco, alcohol, and marijuana use did increase, it was largely among persons already using these substances. The greatest increase, not surprisingly, occurred among persons with PTSD and major depressive disorder. Nationwide during the same time period, rates of PTSD related to September 11 were estimated at 2.7% to 4.3%, a striking finding in that the attacks were witnessed primarily on television outside the New York area. In all studies, having anxiety symptoms or meeting criteria for PTSD was strongly associated with number of hours of television watched on September 11 and in the days afterward. A number of explanations for this new finding are possible. These data can inform our understanding of trauma-related diagnoses, further the evolving diagnostic definitions of the *Diagnostic and Statistical Manual of Mental Disorders*, and contribute to etiologic models of PTSD. Future directions for postdisaster survey research are briefly discussed.

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". . . men [and women] of science are becoming conscious of the responsibility towards society conferred by their knowledge, and are feeling it a duty to take a larger part in the direction of public affairs . . . ."

—Bertrand Russell, *The Scientific Outlook*, 1931[1]

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In the first weeks after the World Trade Center attack, academia and government alike became urgently involved in ascertaining the possible psychological consequences of a large-scale terrorist attack. It soon became clear that remarkably little rigorous research was available to inform predictions despite the fact that such events have been relatively common since the development of modern epidemiologic methods.

The literature on traumatic events and stressors suggested that mental health problems could manifest in a number of different ways such as: (1) widespread stress reactions that would eventually resolve as individuals came to terms with the reality of the event and its consequences for daily life after September 11; (2) relapse of preexisting psychiatric disorders, due to either exposure to the attack or stress from secondary consequences (e.g., unemployment, displacement from home or work, fears about the ongoing threat of more attacks); (3) new-onset psychiatric disorders that typically follow disaster, such as posttraumatic stress disorder (PTSD), major depressive disorder, phobias, or substance abuse[2]; and (4) subthreshold symptoms of affective, anxiety, and substance abuse disorders. The scope, severity, or duration of each of these problems that could reasonably be expected in the New York City area after the September 11 attacks were impossible to predict with confidence, and, at the same time, were of considerable importance to public mental health planning for therapeutic interventions.

The factors that contribute to the development of PTSD are relatively well established. They include the severity of the trauma itself, the intensity of the emotional response to the traumatic event, prior trauma exposure, prior psychiatric disorder, family psychiatric disorder, the response of a person's social milieu to the individual's experience, other posttrauma environmental variables, and genetic factors.[3] Female gender and Hispanic ethnicity have also been shown to be risk factors in some studies, although the explanation for these findings remains controversial.[4–6] However, in the context of the September 11 attacks, 2 major uncertainties made a priori estimates of the scope of the psychological effect of the attacks difficult. First, there were no reliable data on the number of people exposed to the attacks. There were no estimates as to the number of people who were in the downtown area close to the World Trade Center towers or who saw the events through the straight sightlines afforded by New York City avenues or across the rivers. Second, the very definition of "exposure" became a difficult issue after the September 11 attacks. Although after previous disasters it had been assumed that exposure was limited to the vicinity of a disaster and those directly affected, the attacks of September 11 were relayed by television instantaneously to all residents of New York City and around the world. It became plausible that more people than ever before had in real time[2,7] witnessed the terrorist attacks and experienced the fear and horror that had previously been considered the hallmarks only of persons directly affected.

Although there is extensive epidemiologic literature on the mental health consequences of disaster,[2,7] the study that appeared most relevant to 9/11 was conducted after the Oklahoma City bombing of 1995.

THE OKLAHOMA CITY BOMBING

Perhaps the most thorough mental health study of a terrorist bombing attack before the September 11 attacks was that of North and associates[8] concerning the bombing of the Murrah Federal Building on April 19, 1995, a blast that caused 182 deaths and left 684 people injured. In a sample of adults directly exposed to the bombing (defined as having been within 200 meters of the explosion), 34% met criteria for PTSD and 22.5% met criteria for major depressive disorder 6 months afterward. The authors also found that, among those not meeting full criteria, a majority reported some trauma-related symptoms. This is important because relatively recent research has shown that subthreshold PTSD symptoms can also be a source of disability.[9,10] A number of risk factors for developing PTSD after the bombing were identified, and the majority of psychiatric disorders in these adults was found to have onset since the bombing.

Although this study[8] documented the existence of severe but treatable disorders in these persons, only 16% of survivors saw a psychiatrist, and the majority of individuals received debriefing, which is no longer recommended as an effective intervention to reduce PTSD symptoms. Remarkably, no treatment studies in this adult population were conducted. It was assumed that tens of thousands of persons had been directly exposed to the collapse of the World Trade Center; if rates of psychiatric disorder after September 11 were to be comparable to those following the Oklahoma City bombing, the greater New York community was at risk for a dramatic increase in trauma-related problems and disorders.

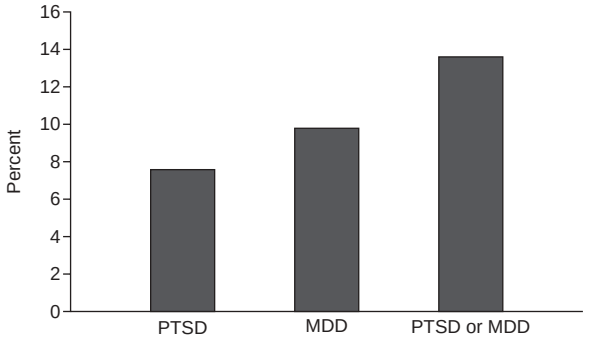
A NATIONAL SURVEY OF STRESS REACTIONS AFTER THE SEPTEMBER 11, 2001 TERRORIST ATTACKS

The first major survey after September 11 was conducted 5 to 7 days after the attacks.[11] A telephone survey of 768 adults across the United States asked 5 screening questions about PTSD symptoms, children's responses to the event, coping strategies, and media exposure. These symptoms were selected for assessment because they were the 5 most common symptoms reported in the study of the Oklahoma City bombing[8]: feeling upset by reminders, having vivid reexperiencing of the event, having difficulty concentrating, experiencing insomnia, and feeling irritable. Forty-four percent of adults reported having at least 1 symptom. Although this study did not attempt to measure symptoms that could be consistent with a diagnosis of PTSD (particularly since none of the avoidance symptoms [criterion C in the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition] were assessed), it did document powerful emotional reactions across the nation evoked by media viewing. Symptoms were most common where direct exposure was most likely (i.e., the greater New York area), and also in densely populated areas where fears of subsequent attacks were probably most heightened. The attack seemed to provoke a profound uncertainty about the future, undermine assumptions about personal safety, and evoke a new sense of vulnerability for the nation as a whole. Most adults turned to religion (90%), open discussion (98%), community activities (60%), and making charitable donations (35%) in an effort to cope with their reactions. In this study,[11] symptoms were highly associated with long hours of television viewing (58% viewing more than 13 hours vs. 37% viewing 0–3 hours). Although after this study it was impossible to determine what the rates of PTSD and other trauma-related problems would be in the weeks and months to come, it was particularly surprising that so many persons with no direct exposure to the September 11 attacks would have symptoms of PTSD.

THE SECOND MONTH AFTER 9/11

Longitudinal research has clearly shown that in most cases, the intensity of an acute reaction to trauma will di-

Figure 1. Rates of Posttraumatic Stress Disorder (PTSD) in Manhattan South of 110th Street 5 to 8 Weeks After September 11[a]



[a]Rates of PTSD and major depressive disorder (MDD) do not sum because of significant comorbidity.

Table 1. Rates of Probable Posttraumatic Stress Disorder (PTSD) Across the United States[a]

	Probable PTSD		
Proximity to Crash Sites	%	(SE)	p Value
New York City metropolitan area	11.2	(2.2)*	.007
Washington, DC metropolitan area	2.7	(1.2)	
Other metropolitan areas	3.6	(0.9)	
Rest of United States	4.0	(1.0)*	
United States total (N = 2264)	4.3	(0.8)	
Television viewing per day (h)			
< 4 (N = 578)	0.8	(0.5)*	.002
4–7 (N = 774)	3.9	(1.3)	
8–11 (N = 436)	4.2	(1.5)	
> 12 (N = 472)	10.1	(2.9)*	
Television content index[b]			
0–4 (N = 422)	1.5	(1.0)*	.01
5 (N = 535)	2.4	(0.9)	
6 (N = 810)	2.0	(0.8)	
7 (N = 497)	11.9	(2.9)*	

[a]Adapted with permission from Schlenger et al.[15]
[b]Content index summed from the following items: plane crashing into the World Trade Center, the collapse, someone jumping or falling, someone dead or getting killed, someone seriously injured, other grisly or gruesome image, persons running to escape.
*Compared using 2-tailed chi-square test.

minish with time. The risk of chronic PTSD varies considerably with the severity of the trauma, estimates range from 2% to 70% 3 months or more after a trauma.[12] Follow-up assessments were therefore critical in gauging the prevalence of disorders related to 9/11 that would require intervention. Two important studies, both epidemiologic telephone surveys, found very similar rates of probable psychiatric disorder in the New York area, and 1 presents a comparison with the rest of the United States.

The first published study, conducted in English or Spanish, surveyed Manhattan residents south of 110th Street (N = 988) and achieved a cooperation rate of 64.3%.[13] Symptoms of both PTSD and major depressive disorder were assessed using structured interviews conducted by trained laypersons over the telephone. The demographics of the sample were representative of Manhattan but unusual for the general population: 71% were white, 43% were married, and 39% earned more than $100,000/year, with a mean age of 42 ± 15 years.

The findings were alarming. Twenty-eight percent of respondents said they were in lower Manhattan the morning of September 11; 38% said they directly witnessed the attack. The current prevalence of new-onset PTSD and of new-onset major depressive disorder was 7.5% and 9.7%, respectively (Figure 1). Overall, 13.6% of respondents reported one disorder or the other (since there was considerable overlap as is consistent with the PTSD literature). Based on the population of the area surveyed, these data estimate that there were 67,000 persons with PTSD and 87,000 persons with major depressive disorder. The prevalence of subthreshold PTSD in this survey wave was 17.4%, and 57.8% of persons reported at least 1 symptom of PTSD. The most common current PTSD symptoms were intrusive memories (27.4%), insomnia (24.5%), jumpiness/startling easily (23.6%), and a sense of foreshortened future (21.2%).[14] The prevalence of PTSD documented in this study is shown in Figure 1.

PTSD was more common in Hispanics (odds ratio [OR] = 2.6) and more prevalent if the person had 2 or more stressors preceding 9/11 (OR = 5.5), experienced a panic attack during or immediately after the attack (OR = 7.6), lived south of Canal Street in lower Manhattan (OR = 2.9), or lost possessions (OR = 5.6). Predictors for major depressive disorder were similar to those for PTSD, although personal losses were stronger predictors of major depressive disorder. Risk factors for PTSD were similar to risk factors that increase rates of PTSD as a result of other kinds of trauma. Indeed, residents of Manhattan appeared to be experiencing a shared trauma.

Further analyses also documented a significant association between hours of television viewing and content of television images and PTSD.[4] This association was strongest among persons directly affected by the attacks.[14]

A second study of the same time period assessed reactions in the greater New York area as well as across the country.[15] This Web-based study surveyed 2273 adults to assess PTSD symptoms and overall psychological distress specifically related to the September 11 attacks. Two self-report instruments were used: the Posttraumatic Symptom Checklist to assess PTSD,[16] and the Brief Symptom Inventory[17] to assess general rates of symptomatology. Statistical weights were created such that findings reflected the U.S. adult population based on recent census estimates.

The prevalence of current PTSD related to 9/11 was 11.2% in the greater New York area and 4.3% across the United States as a whole (Table 1). Rates in Washington, D.C., the site of the attack on the Pentagon, were 2.7%. The investigators also studied a number of possible risk factors such as demographics (age, gender, income, etc.), proximity to the World Trade Center, having a family

member or friend killed or injured, number of hours of television watched on September 11, and the content of television viewing. Predictors of PTSD were the following: age (being younger increased risk for PTSD), gender (females were more at risk), having been at Ground Zero, and number of hours of television watched.

SUMMARY

Taken together, these studies found considerable rates of full, current PTSD secondary to 9/11 in the greater New York area 5 to 8 weeks after the attacks. More surprisingly, PTSD symptoms related to the attacks were documented across the country with rates ranging from 2.7% to 4.3%. These rates are probably equivalent to the general population prevalence of PTSD caused by all other types of trauma combined. Although contemporary studies that assess current PTSD (as opposed to lifetime rates) are lacking for the United States, 1 large study in Canada found that prevalence rates of current PTSD caused by *all* types of trauma were 2.7% for women and 1.2% for men.[10]

INCREASED USE OF CIGARETTES, ALCOHOL, AND MARIJUANA AMONG MANHATTAN, NEW YORK, RESIDENTS AFTER THE SEPTEMBER 11 TERRORIST ATTACKS

There was much speculation about increased substance use in the greater New York area in the weeks and months after September 11, including concerns that (1) people with histories of substance abuse were relapsing, (2) persons who had never had problems before were developing abuse patterns, and (3) persons already using substances were increasing their use. It was unclear, however, to what degree each of these patterns might be true, if at all.

Vlahov et al[18] reported that 28.8% of persons had increased use of alcohol, cigarettes, or marijuana after the September 11 attacks. However, almost all of this increase occurred among those who were already using these substances. There was no documented, extensive, new-onset use of alcohol, cigarettes, and marijuana. Moreover, the survey found that a substantial proportion of those who increased cigarette and marijuana use met criteria for PTSD and that a significantly greater proportion of those who increased cigarette, marijuana, and alcohol use met criteria for major depressive disorder. These findings allow public health interventions to focus primarily on those already using substances and those with significant psychiatric symptoms, thereby greatly narrowing the need for educational and treatment efforts for these problems.

THE EFFECT OF 9/11 ON CHILDREN

Approximately 6 months after September 11, the New York Board of Education initiated an epidemiologic survey of school children to assess the effects of the attacks. Hoven and colleagues[19] surveyed children in all 5 NYC boroughs. Previous research with adults suggests that the likelihood of chronicity is high after 6 months of illness, and that the vast majority of persons with PTSD related to a terrorist event have immediate onset (rather than delayed onset).[20] Thus, this work had the potential to provide estimates of PTSD that persisted in the long term after the attacks.

The survey of 8300 students inquired about PTSD symptoms and fearful behaviors with onset after September 11. Of children surveyed, 11% met criteria for PTSD, which translates by extrapolation into 121,000 cases among the 1.1 million children in this school district. Also, approximately 10% reported fears of public spaces, equivalent to about 110,000 children. The most prevalent individual symptoms were the following: thoughts about the attacks (76%), trying hard to avoid thinking or talking about September 11 (45%), insomnia (24%), nightmares (17%), and avoiding reminders of the attack (18%). As with adult trauma, when individual symptoms are considered, it is impossible to determine which symptoms should be considered pathological and which represent a normative reaction or a manifestation of other disorders or problems. Furthermore, there are limited epidemiologic data addressing how adaptive or normative responses to psychological trauma vary with developmental phase. Although the finding of insomnia in 1 out of 4 children is alarming from a public health point of view, the finding that 3 out of 4 children still thought about the attacks is probably normative for a major event, reminders of which were very much present in daily life.

In the survey described above, parents were also asked about their children's receipt of counseling services. Overall, this study found that 22% of the children had received some form of counseling.[21] More than half of this counseling (58%) was delivered in the schools. However, it was the parent's own level of distress, rather than the child's behavioral symptoms, that was associated with children receiving counseling in this study. These findings, taken together with the findings of Hoven and colleagues,[19] suggest there was a large number of children who may have had psychological symptoms that could respond to mental health intervention, but who were not being referred to counseling services.

FUTURE RESEARCH DIRECTIONS IN POSTDISASTER EPIDEMIOLOGY

The research already available constitutes one of the most remarkable epidemiologic efforts in the history of disaster research for its speed, consistency, and utility for public health planning. The necessary follow-up studies are currently under way. Nevertheless, there are many gaps in our knowledge. Most importantly, interventions

that make evidence-based treatments widely available and evaluate their effectiveness have not been studied after major disasters. In addition, there are at least 3 other future areas of research that merit consideration at this point in the New York City postdisaster context.

Complete Diagnostic Assessments by Trained Clinicians

None of the studies published thus far used trained clinicians for their assessments, and none conducted complete diagnostic interviews. Such studies are expensive and time consuming and cannot be carried out without a significant expenditure of resources. Nonetheless, as the major concerns now shift to characterizing those with chronic problems, more thorough and clinically informed assessments would be of great value to developing interventions and planning for public health needs.

The finding of relatively high rates of PTSD related to media exposure to the attacks across the United States was particularly controversial.[22,23] Clinical interviews that determined whether such findings were indeed secondary to 9/11 would have been particularly informative. Although witnessing an event through the media theoretically fulfills the definition of trauma in the DSM-IV, true PTSD in such circumstances has never before been documented. It is, however, possible that, in some persons, the belief that their personal safety was threatened, coupled with weeks of reinforcement of this danger from media coverage, may have produced a subjective response to 9/11 sufficient to produce PTSD symptoms.

Subthreshold PTSD

Epidemiologic studies rely on the existence of a valid and reliable system of making diagnoses. The creation of the DSM and International Statistical Classification of Diseases and Related Health Problems has made possible worldwide study of psychiatric disorders such that findings can be generalized across subject populations. However, this model is based on the assumption that psychopathology can be identified as a syndrome (i.e., a cluster of symptoms, signs, and behaviors).

A consequence of reliance on the categorical model of disorder is that such surveys of PTSD have tended to neglect persons with symptoms that fall short of full criteria. Subthreshold PTSD may occur in persons who have partially recovered from full PTSD either through treatment or through spontaneous improvement, or from the development of subthreshold symptoms after trauma that persist in that form only. As studies of the prevalence of subthreshold symptomatology after 9/11 are conducted, it is possible that overall rates of full syndromal PTSD will decrease with time as expected, but many persons will be left with subthreshold symptoms such as hypervigilance, insomnia, irritability, or emotional numbing associated with clinically meaningful functional impairment. As with syndrome-based research, attention to longitudinal course is the most powerful way to assess whether symptoms represent true subthreshold PTSD versus the manifestation of other disorders or problematic reactions.[24]

Assessment of the Nonpathological Consequences of September 11 and of Resilience Factors

There are no rigorous studies of the broader set of psychological and social consequences of the attacks, including assessments of nonpathological reactions, behavioral changes as a result of September 11, and changes in cognitive schema and world view. This area of study has been extensively explored by ethnographic and other researchers but has not been examined using epidemiologic methodology. Questions with important public health implications, for example, would include: How many persons left the New York area after September 11, and why? How many parents had their children change schools? In what ways did persons alter their media viewing? Did persons become more, or less, religious? Did persons place greater value on family and community, and what were the ramifications of such? and Did adults alter their work habits and career paths? These questions have implications for postdisaster recovery, for models of the progression of psychological symptoms, and for developing public health interventions related to possible future attacks.

The issue of resilience after psychological trauma is also timely and important. Encouragingly, the majority of persons directly exposed to the attacks did not develop PTSD, suggesting that the field could learn much from the study of their character traits, coping strategies, healthy defenses, and biological features.

CONCLUSIONS

Reactions to the September 11 attacks across the United States were pervasive, and persons throughout the country reported experiences akin to posttraumatic symptoms in the first 5 to 7 days after the attacks. Consistent with prior observations of community responses to disaster, persons turned to family, social networks, altruistic action, and dialogue in an effort to understand the meaning and ramifications of an event that was radically inconsistent with assumptions about personal and national safety among many U.S. citizens. In the second month after the attacks, 2 major representative telephone surveys of this time period were in agreement that approximately 1 in 10 New Yorkers probably met full criteria for PTSD related to September 11. The first study[13,14] surveyed a representative sample in Manhattan below 110th Street, and the second[14] in the greater New York area of approximately 13 million persons.

Predictors of risk of developing PTSD and major depressive disorder were consistent with the trauma literature, and included Hispanic ethnicity, prior stressors, panic

during the event, living in lower Manhattan, losing possessions in the attack, age, and female gender. The national survey of Schlenger et al[15] also found a PTSD prevalence of 2.7% to 4.3% in adults outside of the New York area. Although relatively low, the finding is striking in comparison to known point prevalence rates of PTSD prior to September 11, and because the acute reaction to the trauma for most was provoked by witnessing the attack on television.

Concerns that the additional stressors of post–September 11 New York City would instigate an epidemic of new-onset substance abuse were largely unfounded. Although tobacco, alcohol, and marijuana use did increase, it was largely among persons already using these substances. The greatest increase, not surprisingly, occurred among persons with PTSD and major depressive disorder.

All studies to date document a heretofore unrecognized importance of the role of the media in event exposures. Having anxiety symptoms or meeting criteria for PTSD were strongly associated with number of hours of television watched on September 11 and in the days afterward in both major population surveys that have been reported thus far. This could have several interpretations, and it seems likely that the causal explanations will be multidimensional. Some persons, driven by vigilance for new dangers, may have overexposed themselves to traumatic information. Television viewing for others, already symptomatic, may have constituted an effort to grapple with the unreality and incoherence of their experience. After future disasters, hypothesis-driven epidemiology can extend our understanding of trauma-related diagnoses, further the evolving diagnostic definitions of the DSM, contribute to etiologic models of PTSD, and assist in planning public health interventions.

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Questions and Answers

Question: The design of treatment intervention studies conducted in the immediate aftermath of a mass trauma would seem to be an important issue. What are the ethical concerns related to studies of this sort?

Dr. Marshall: One of the key issues involves what constitutes valid clinical science, and in particular, when the use of a control or comparison group in treatment research is necessary. All treatment research involves some degree of risk, as do all treatment interventions, for that matter. But studies that are not scientifically valid are not ethical by definition. Given proper informed consent and safety monitoring procedures, it is our view that randomized, controlled studies are essential to making progress in the field of therapeutics. The question then becomes, what should the control group be? The answer to this depends on the research hypothesis being tested. One option is a placebo control, or a psychosocial control that is purported to be lacking specific and active components. Other options include an active-comparator trial in which all treatment arms contain an active intervention. Yet another design might include varying combinations

of components thought to be effective (a dismantling design).

Question: How should the diagnosis of PTSD be approached after a community trauma, such as occurred in New York on September 11? Are there threshold criteria for PTSD, or should symptoms be considered as a spectrum ranging from normative reactions to frank pathology?

Dr. Marshall: Diagnosis is the gateway for treatment planning. In the acute aftermath of trauma, it is possible to make a diagnosis of PTSD but impossible to determine with certainty whether this reaction will resolve with time or result in chronic disorder. This was a critical issue after September 11 because it was impossible to deploy resources and personnel that could reach the hundreds of thousands of people found to be suffering with PTSD symptoms 5 to 8 weeks after the attacks. In short, posttraumatic symptoms represent a dynamic process that requires multiple longitudinal observations. This problem has many aspects and has not been carefully considered. Some have argued, for example, that "normal" reactions should not be a focus of intervention, with normal defined as reactions that will eventually subside without intervention. This is simply incorrect. It may be normal, given the limitations of normal physiology, to sustain a broken wrist after falling from a height of 10 feet; it would be absurd to conclude, however, that the person should be left to recover without intervention, following a "natural course." In fact, new research with acutely traumatized, symptomatic persons suggests that a brief course of cognitive-behavioral therapy may accelerate recovery *[Bryant RA, et al. J Consult Clin Psychol 1998;66:862–866; Bryant RA, et al. Am J Psychiatry 1999;156:1780–1786; Foa EB, et al. J Consult Clin Psychol 1995;63:948–955]*, as well as reduce risk of chronicity.

Our work *[Marshall RD, et al. Am J Psychiatry 2001;158:1467–1473]* and that of others *[Stein MB, et al. Am J Psychiatry 1997;154:1114–1119]* have shown that subthreshold PTSD is associated with disability; until research is available, we recommend treating subthreshold symptoms with the same medications and psychotherapies as full PTSD.

Question: How important is it to have trained mental health professionals involved in assessing persons in the immediate aftermath of a trauma?

Dr. Marshall: Many investigators believe this is a preferable response strategy. It is also impossible to implement this assessment for large-scale, rapidly deployed screening programs such as those supported by the Federal Emergency Management Agency. Furthermore, many have argued that involvement of respected community members such as teachers, pastors, and rabbis in screening programs reduces potential stigma for community members. I am unaware of any research that supports this contention, but it is a strongly argued perspective in many circles. Regardless, personnel used for assessment must be trained by expert clinicians. ❑