Estimating Capacity Requirements for Mental Health Services After a Disaster Has Occurred: A Call for New Data

Carole E. Siegel, PhD, Eugene Laska, PhD, and Morris Meisner, PhD

Objectives. We sought to estimate the extended mental health service capacity requirements of persons affected by the September 11, 2001, terrorist attacks.

Methods. We developed a formula to estimate the extended mental health service capacity requirements following disaster situations and assessed availability of the information required by the formula.

Results. Sparse data exist on current services and supports used by people with mental health problems outside of the formal mental health specialty sector. There also are few systematically collected data on mental health sequelae of disasters.

Conclusions. We recommend research-based surveys to understand service usage in non–mental health settings and suggest that federal guidelines be established to promote uniform data collection of a core set of items in studies carried out after disasters. (*Am J Public Health.* 2004;94:582–585)

In the chaotic aftermath of a disaster, authorities are faced with the need to provide an extensive array of services to the affected population. Such a situation occurred after the terrorist attacks of September 11, 2001, when mental health and other related support systems mobilized to deliver services to persons who were psychologically or psychiatrically affected by the events.

Planning efforts required estimates of both anticipated mental health needs and the capacity required to respond to these needs. The New York State Office of Mental Health (NYSOMH), in conjunction with researchers from Columbia University's Joseph P. Mailman School of Public Health, conducted a mental health needs assessment. Their report focused on persons suffering from posttraumatic stress disorder (PTSD). For this group, they estimated the breadth of the need, the likely number of services required, and sources of payment for care.[1–3] Data were presented regarding the current capacity of the New York State mental health specialty sector, and a general formula to estimate the service capacity that would be required after a disaster appears in an appendix to that report.

The rationale for the formula and its formulation are presented in this article. By envisioning the formula being applied to cover the largest population likely to seek help, information that is currently available to numerically calculate the value of the formula was identified, as were gaps that limit the ability to provide realistic estimates. An examination of these gaps has led to recommendations for local and national data collection that would enhance the potential for appropriate capacity planning following disasters. The formula, when applied in limited scope, has immediate utility for estimating the service requirements of priority populations. An example of this use is given for persons living below 110th Street in Manhattan and who experienced PTSD after the September 11 disaster.

METHODS

Basic Formula

Extended capacity after a disaster has occurred is defined as the service capacity above the usual service delivery levels required; extended capacity is defined in terms of units of service. These units may be converted to monetary or staff requirements. Extended capacity may be required to provide services to disaster victims who experience emotional distress that is severe enough to require a mental health intervention. Victims could include both persons not currently receiving mental health services (new, or incidence, cases) and persons already receiving services whose problems have been exacerbated by the disaster (old, or prevalence, cases). New cases will require services at some rate to be agreed upon, whereas old cases may require services in addition to those they currently receive as a result of exposure to the disaster.[4] The extended capacity requirement for each group is simply the product of the number of persons in the group and the number of anticipated services required as a result of the disaster. The total extended capacity requirement is the sum of the requirements of the 2 groups.

More formally, extended capacity, ΔC, is based on the number of new cases requiring services postdisaster, N_{new}; the number of old cases requiring additional services postdisaster, N_{old}; the average number of services per person required by new cases, R_{new}; and the average number of additional services required per person for old cases, R^{+}_{old}. The equation is as follows:

$$(1) \qquad \Delta C = N_{new} R_{new} + N_{old} R^{+}_{old}.$$

A conservative estimate of extended capacity assumes that old cases will not require any additional services and that new cases will receive services at current or lower-than-current levels. That is, $R_{new} \leq R_{old}$, where R_{old} is the current service delivery rate, $R^{+}_{old} = 0$, and $\Delta C = R_{new} N_{new}$. At the other extreme, old cases may require new services, and new cases may require services at a rate that is higher than the exacerbated rate of old cases. That is, $R_{new} > R_{old} + R^{+}_{old}$, and $R^{+}_{old} > 0$. All other cases are intermediate to these 2 cases.

Range of Possibilities

Time frame. Service requirements will differ in the acute and postacute phases in the aftermath of a disaster. New cases may emerge over time, whereas distress may abate in some persons.

Population groups. Different population groups will have different diagnostic and care-seeking patterns, leading to different service requirements. Population groups can be defined in terms of geographical areas or exposure to the disaster (e.g., "first responders," adults living

closest to the scene of the disaster). They could be further classified demographically (e.g., by age group, by racial/ethnic categories).

Diagnoses/disorders. Victims of disasters are at risk for experiencing a gamut of mental health disorders ranging in type and severity. For new cases, the disorders expected to occur after a disaster include, but are not limited to, acute stress disorder, PTSD, depression, anxiety, panic disorder, and traumatic grief. Diagnoses for existing cases cover all their current diagnoses and possibly new ones similar to those of the new cases.

Services. The types of services that will be required are diagnostic specific and are likely to include assessments, crisis counseling, psychoeducation, psychotherapy, and pharmacotherapy. The number of services required to treat cases will change over time, with higher rates of treatment expected in the initial phases following the disaster.

Sector/service venue. It is well known that even under normal times, persons experiencing mental distress may seek help in service venues other than the organized mental health sector.[5,6] In particular, persons who experience nonpsychotic disorders are quite likely to seek services first from non–mental health specialists. For example, persons with depressive disorders will often turn to primary care physicians,[7] and persons from particular cultural groups may first seek services from traditional healers.[8] Many who experience distress at subclinical threshold levels seek services from the clergy or self-help groups. Regier[5] first noted this collection of providers from whom persons experiencing mental distress seek help and labeled them as members of a de facto mental health system. More than likely, these same providers will be approached by disaster victims for help. To model the extended mental health service requirement following a disaster, data are required on how many of those from different population and clinical groups will seek and receive services from these de facto venues.

Comprehensively, the sectors where persons are expected to seek services include mental health services provided by programs funded, certified, or operated by state offices of mental health; the Department of Veterans Affairs (VA); general hospital emergency rooms; and other non–mental health sectors such as schools, social service agencies, and family agencies (referred to hereafter as "non–mental health sectors"). Services may also be provided by individuals who are mental health specialists in private practices that are not part of a state office of mental health ("mental health specialists"); primary care physicians in private practices, clergy, and self-help groups ("other specialists"); and others in nonformal settings.

Persons with existing severe disorders or persons who experience distress that reaches clinical diagnostic thresholds are likely to be served by a state office of mental health, the VA, or mental health individuals. Persons with disorders that do not reach threshold levels are likely to use the remaining sectors. They may well account for the bulk of the new service needs, especially in the acute phase after a disaster has occurred. The provider list could be expanded to include sectors that serve persons with alcohol and substance abuse disorders, depending on the scope and purview of the capacity assessment.

General Formula

The general formula sums the basic formula in equation 1 over the range of possibilities to provide an estimate of total extended capacity requirements, ΔC. It relates to a length of time after the disaster, T; service sectors, S; population groups that use these sectors, g(S); disorders of the groups that seek services in the sector, d(g(S)); and units of service type u required for a disorder, u(d(g(S))). For a fixed T, total extended capacity requirements are expressed as

$$(2) \qquad \Delta C(T) = \Sigma_u \Sigma_d \Sigma_g \Sigma_S \Delta C\ (T, S, g, d, u),$$

where we have suppressed the notation indicating the sequential dependencies of groups on sectors, diagnoses on groups, and services on diagnoses.

To avoid double counting, the assumption is made that population groups do not overlap and that service requirements are distinct across diagnoses and sectors. (Note, however, that when the formula is used in limited scope, any population group can be singled out and its extended capacity requirement estimated.) The formula also assumes that no 2 diagnoses are associated with the same service requirement. Although a particular service requirement of a person with comorbidities might be counted with respect to each diagnosis, this will not happen if the range of service requirements is restricted to those closely connected to the diagnosis. If this is not possible, the comorbid condition itself could be introduced as a diagnosis and the service requirement could be attributed to the comorbid diagnosis.

It is also possible that service requirements cannot be distinctly ascribed to a sector. Use of multiple sectors for similar needs has been documented for veterans. It has been observed that a small percentage (<5%) of veterans use similar type services from both VA and non–federally funded providers (C. Siegel, PhD, S. Lin, PhD, E. Laska, PhD, unpublished data, 2003). If estimates of the usage of multiple venues for similar services were available, then a model-based adjustment to the total estimate could be made.[9]

Although the estimate of extended capacity does not depend on current service capacities, the ability to provide the services required clearly does. An important step is to estimate whether extended capacity requirements can be met, the projected shortfalls, and the concomitant budgetary and staffing requirements.[10]

Limited Versions

Most likely, however, estimates of extended capacity will be desired for high-priority situations that limit the range of possibilities covered in the general formula. For example, an estimate may be required of the extended capacity needs of a specific population group for special types of disorders with their service requirements, delivered in the service sectors in which these services are apt to be delivered. To obtain estimates limited in scope, $\Delta C\ (T, S, g, d, u)$ is summed over specific subsets that delineate the coverage of the capacity estimate. For example, if a sector S* requires an estimate of its total extended capacity requirement for T months after the disaster, it is $\Sigma_u \Sigma_d \Sigma_g \Delta C\ (T, S^*, g, d, u)$. An estimate of high and immediate priority might consider the extended capacity required to treat, in the formal mental health sector S*, within the first 6 months postdisaster, first responders (population group g*) experiencing PTSD (say disorder d*), where they would require within 6 months an amount u* of specialized treatment *u**. The estimate formula is $\Delta C\ (6, S^*, g^*, d^*, u^*)$. Estimates restricted to geographical areas most directly affected by

the attacks would also be of high priority. In this case, g is held fixed to represent the geographic area, and all else in equation (2) is summed.

RESULTS

Obtaining Data to Valuate the Formula

Little of the information required to estimate extended capacity is available or can be extrapolated from studies on disasters before September 11. Recent studies conducted after September 11[11–13] do provide some new data that are useful for budget justifications and planning for increased staffing requirements.

N_{old} may be obtained directly for some sectors from utilization data related to recent time frames before the disaster. These data are available in New York State for the NYSOMH and for the VA. Some sector usage data can be extrapolated from the Epidemiologic Catchment Area Study[5] and the National Comorbidity Survey.[6] Both studies provide an estimate of the proportion of persons with mental disorders who seek services in these other sectors, and the latter study provides some limited data on actual utilization.

Studies of other disasters and studies mounted soon after a disaster has occurred do provide information on the risk of a disease, given exposure to the new disaster. The risk times the population size is N_{new}.

There are few estimates of R^{+}_{old} and R_{new} available from studies conducted of other disasters. R^{+}_{old} could be informed by the current service delivery rate$=C_{old}/N_{old}$, where C_{old}=current capacity. Local providers and other key informants can be asked to estimate exacerbation rates, but they might find it difficult to make guesses specific to diagnostic groups or service types. Consensus approaches would need to be used to avoid overinflated estimates.

A Valuation of the Formula

One of the most likely estimates to be required immediately after a disaster is the capacity requirements for populations that are close to the disaster and that experience severe emotional distress. Some data have appeared since September 11 that enable an estimate to be made of extended capacity requirements for the New York City adult population living below 110th Street (close to the disaster site) who experienced PTSD. Galea et al.[11] estimated the percentage of new cases with PTSD among this group. They randomly sampled adult persons from the area 5 to 8 weeks after September 11 and administered a telephone interview to assess their psychiatric symptoms. They found that 7.5% of the sample had symptoms severe enough to classify them as having PTSD related to the September 11 attacks.

Persons with this serious diagnosis would most likely require services within the formal mental health specialty sector, but prior studies suggest that not all of these persons will seek services. Boscarino et al.[12] reported that 19.4% of those interviewed in the Galea sample had mental health visits, but estimates for utilization specific to PTSD and specific to symptoms related to the disaster were not provided. Kessler et al.[14] reported that 28% of persons with PTSD sought services, and we used this higher estimate in our calculation.

The population size of adult persons living in Manhattan below 110th street is 919 000. Assuming no exacerbation of symptoms in old cases, a conservative estimate of extended capacity requirements is based on the number of new cases, N_{new}, that will emerge and their rate, R_{new}, of service usage. The calculation of N_{new} is $.075 \times .28 \times 919\,000 = 19\,299$. Jack and Glied[3] concluded that in a 6-month period, treatment among those with a diagnosis of PTSD should consist on average of 7 outpatient visits and 6 monthly medication visits at a cost in New York City of approximately $1500 per person. Using these data for R_{new} in the conservative version of the formula provides an estimate of an extended capacity requirement of the formal mental health sector for this population/diagnostic group in the 6-month period after September 11 of $R_{new}\,N_{new} = 135\,093$ PTSD visits and 115 794 medication visits, with a total cost of $28 948 500.

CONCLUSIONS

Information that is currently available includes epidemiological estimates of mental disorders and mental health service utilization after disaster incidents,[11,15,16] epidemiological information on the incidence of mental disorders in the general population and the naturalistic use of the various service sectors predisaster,[5,6] and sector-specific administrative service utilization data sets on pre- and postdisaster utilization (e.g., state data sets, VA data sets, county-level data sets).

These data, however, neither adequately cover the scope nor provide the comprehensive information required to accurately estimate the full range of extended capacity requirements. The information available from other disaster incidents does not span all manifestations nor all venues in which persons seek help. Further, these data may be only partially applicable to those affected by a new disaster because of differences in population demographics and service system characteristics.

Sector-specific data sets on utilization are limited to the organized specialty mental health services and are unavailable for the sectors most likely to be used after a disaster has occurred (e.g., general hospital emergency rooms, non–mental health sectors, mental health individuals, private primary care physicians, other non–mental health individuals). Data that are reported on these latter sectors in epidemiological studies conducted to date[5,6] provide information on the likelihood of using the sector and offer only limited data on actual utilization, with estimates based on small sample sizes. Other administrative data sets on utilization that are available are payer specific (e.g., Medicaid data sets, behavioral health care data sets). Although useful for examining the disaster impact on payers, they are less useful for planning for services in the locations where they are needed.

Finally, although there are resource data on the number of persons in a given profession who are capable of providing mental health services, these numbers are not readily convertible to estimates of current mental health capacity. Persons in these professions (e.g., social workers) may already be included in other sector counts or may not provide mental health services. If they do provide such services, the amount provided is unknown.

There are 2 classes of information that would be useful for estimating service requirements related to disasters. The first is current service usage of the various sectors of the de facto mental health system. This information would enable natural pathways to care to be identified, current capacities to be documented better, and multiple use of sectors to be understood better. The second class of information is data that are collected more systematically

about future disaster incidents and their mental health sequelae. These 2 data sets would enable better modeling of needs that would emerge after a disaster occurs.

One effective way to collect sector usage data would be through a 2-part survey, a provider inventory and a survey of usage of a provider by persons with mental health problems. The first part would inventory, within a sector, individuals and agencies that are capable of providing both formal and informal mental health services, producing in effect a resource directory for that sector. The coverage area of the survey should coincide with geographical areas that have been designated as service areas for disaster response. Mounting such a survey in a large urban area such as New York City would be a daunting task, but once computerized mechanisms are in place, the resource could serve as an invaluable management tool if a disaster were to occur (as well as in normal times). It would increase the ability to coordinate services and also provide a basis for estimating training and recruiting requirements, should enhanced capacity be required.

The inventory is needed to conduct the second part of the survey in which data are collected to enable estimation of the number and types of persons with mental health problems who are seen by each provider.

The NYSOMH Patient Characteristics Survey provides one approach that could be followed. Providers of mental health services that are funded, contracted, or operated by New York State are surveyed on the characteristics and services used by persons seen in a representative week. If data are collected during periods of normalcy, the 1-week counts can be annualized or inflated to other time periods using a statistical method currently employed by the NYSOMH.[17,18] Analogously, for a particular sector, all providers in the sector could be surveyed using a 1-week time frame to ascertain the number of persons using their services for mental problems, their characteristics, and their service use. For greater precision, screening of persons seen by the provider for mental disorders could also be part of the survey.

Because full census surveys might not be feasible, sampling strategies could be employed, especially if details on the types of mental distress that manifest themselves are to be collected. During times of normalcy, these data can be adjusted to establish base capacity rates. If the survey is repeated after a disaster, perhaps at several different time points, more could be learned about manifesting problems and the new capacities that have emerged to deal with them. Data collected in this manner would facilitate the parsing of government budget allocations for disaster situations to the sectors in proportion to the assistance they provide to the population in need.

Other information needs to be extrapolated from data of studies of disaster situations. Currently, investigators collect data according to their own protocols, resulting in studies having limited commonality in data elements. Guidelines are needed for data collection of at least a core set of items. This could include specific details of the disaster, specified time frames, delineated population groups, specification of problems, specific treatment system variables, time frames to report duration of service needs, specific outcomes, and bases for cost estimates. Having such data would facilitate synthesis and extrapolation to other disaster incidents.

Developing such guidelines will require a federally sponsored effort and mandates to establish a core set of items to be uniformly collected. With such data, when new disasters occur, needs assessment models could be used to relate the nature of the disaster to the nature and extent of the problems that would be expected to arise and the capacity required to deal with them. ■

About the Authors

All of the authors are with the Nathan S. Kline Institute for Psychiatric Research, Orangeburg, NY.

Requests for reprints should be sent to Carole E. Siegel, PhD, Epidemiology and Health Services Research Laboratory, Nathan S. Kline Institute for Psychiatric Research, 140 Old Orangeburg Rd, Orangeburg, NY 10962 (e-mail: siegel@nki.rfmh.org).

This article was accepted May 15, 2003.

Contributors

C.E. Siegel identified sources for the data required for this article. All authors contributed to the mathematical formulation.

Acknowledgments

This project was supported in part by a National Institute of Mental Health grant (3P50 MH51359) to the Center for the Study of Issues in Public Mental Health of the Nathan S. Kline Institute for Psychiatric Research, and in part by the NYSOMH.

The views expressed in this article are strictly those of the authors and do not represent agency endorsements.

Human Participant Protection

No protocol approval was needed for this study.

References

1. Herman D, Felton C, Susser E. *New York State: Mental Health Needs Assessment Related to Terrorist Attacks in the US.* Albany, NY: New York State Office of Mental Health; 2001.

2. Herman D, Felton C, Susser E. Mental health needs in New York state following the September 11th attacks. *J Urban Health.* 2002;79(3):322–331.

3. Jack K, Glied S. The public costs of mental health response: lessons from the New York City post-9/11 needs assessment. *J Urban Health.* 2002;79(3):332–339.

4. Franklin CL, Young D, Zimmerman M. Psychiatric patients' vulnerability in the wake of the September 11th terrorist attacks. *J Nerv Ment Dis.* 2002;190:833–838.

5. Regier DA, Narrow WE, Rae DS, Manderscheid RW, Locke BZ, Goodwin FK. The de facto US mental and addictive disorders service system. Epidemiologic catchment area prospective 1-year prevalence rates of disorders and services. *Arch Gen Psychiatry.* 1993;50:85–94.

6. Kessler RC, McGonagle KA, Zhao S, et al. Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States. Results from the National Comorbidity Study. *Arch Gen Psychiatry.* 1994;51:8–19.

7. Wells KB, Sturm R, Sherbourne CD, Meredith LS, eds. *Caring for Depression.* Cambridge, Mass: Harvard University Press; 1996.

8. Rogler LH, Cortes DE. Help-seeking pathways: a unifying concept in mental health care. *Am J Psychiatry.* 1993;150:554–561.

9. Laska EM, Meisner M, Wanderling J, Siegel C. Estimating population size and duplication rates when records cannot be linked. *Stat Med.* 2003;22:3403–3417.

10. Siegel C, Wanderling J, Laska EM. Coping with disasters: estimation of additional capacity of the mental health system to meet extended service demands [abstract]. *J Ment Health Policy Econ.* 2003;6(suppl 1):S46.

11. Galea S, Ahern J, Resnick H, et al. Psychological sequelae of the September 11 terrorist attacks in New York City. *N Eng J Med.* 2002;346:982–987.

12. Boscarino J, Galea S, Ahern J, Resnick H, Vlahov D. Utilization of mental health services following the September 11th terrorist attacks in Manhattan, New York City. *Int J Emerg Ment Health.* 2002;4(3):143–155.

13. DeLisi LE, Maurizio A, Yost M, et al. A survey of New Yorkers after the Sept. 11, 2001, terrorist attacks. *Am J Psychiatry.* 2003;160:780–783.

14. Kessler RC, Zhao S, Katz SJ, et al. Past-year use of outpatient services for psychiatric problems in the National Comorbidity Study. *Am J Psychiatry.* 1999;156:115–123.

15. North CS, Nixon SJ, Shariat S, et al. Psychiatric disorders among survivors of the Oklahoma City bombing. *JAMA.* 1999;282:755–762.

16. Call JA, Pfefferbaum B. Lessons from the first two years of Project Heartland, Oklahoma's mental health response to the 1995 bombing. *Psychiatr Serv.* 1999; 50:953–955.

17. Laska E, Meisner M, Siegel C. Estimating the size of a population from a single sample. *Biometrics.* 1988; 44:461–472.

18. Laska E, Meisner M, Siegel C. Estimating population size when duplicates are present. *Stat Med.* 1996; 15:1635–1646.