

Postprint Version	1.0
Journal website	<a href="http://link.springer.com/article/10.1007%2Fs10488-015-0671-8">http://link.springer.com/article/10.1007%2Fs10488-015-0671-8</a>
Pubmed link	<a href="http://www.ncbi.nlm.nih.gov/pubmed/26198628">http://www.ncbi.nlm.nih.gov/pubmed/26198628</a>
DOI	10.1007/s10488-015-0671-8

This is a NIVEL certified Post Print, more info at <http://www.nivel.eu>

# The Association Between Disaster Vulnerability and Post-disaster Psychosocial Service Delivery Across Europe

MICHEL L. A. DÜCKERS<sup>1</sup>, ANKE B. WITTEVEEN<sup>2</sup>, JONATHAN I. BISSON<sup>3</sup>, MIRANDA OLFF<sup>4</sup>

1. Impact - National Knowledge and Advice Centre for Psychosocial Care Concerning Critical Incidents, Arq Psychotrauma Expert Group
2. Department of Psychiatry, Academic Medical Centre, University of Amsterdam
3. Institute of Psychological Medicine and Clinical Neurosciences, Cardiff University School of Medicine
4. Department of Psychiatry, Academic Medical Centre, University of Amsterdam Arq Psychotrauma Expert Group

## ABSTRACT

This study confirms that the developmental stage of post-disaster psychosocial support planning and delivery systems in Europe is associated with countries' level of disaster vulnerability. Lower vulnerability is accompanied by more evolved planning and delivery systems. Countries in north, west and central regions have more developed planning and delivery systems and lower vulnerability levels than those in the south, southeast and east. The highest proportion of variance in vulnerability is located at the regional level, most of the variance in planning and delivery systems is at the individual level. Possible implications and chances for the optimization of psychosocial services are discussed.

## INTRODUCTION

Disasters form a continuing risk for human societies all over the world (Birkmann et al. [2011](#); Welle et al. [2012](#); International Federation of Red Cross and Red Crescent Societies [2012](#), [2013](#), [2014](#)). Besides potentially large-scale devastation and damage to vital infrastructures and objects of interest, disasters and major incidents threaten the safety, well-being, health and functioning of people (Noij [2000](#); Shoaf and Rottman [2000](#); Galea et al. [2002](#); Herbert et al. [2006](#); Norris and Elrod [2006](#); Moline et al. [2006](#)).

In this context, post-disaster psychosocial support has received increased attention in disaster preparedness in the last two decades (e.g. Weaver [1995](#); Norris et al. [2002](#); Hobfoll et al. [2007](#); Reifels et al. [2013](#); Gouweloos et al. [2014](#)). Different authors

have deepened essential principles (such as the need to promote a sense of safety, hope, calming, connectedness to others, and self- and group-efficacy), the importance of timely detection of health complaints, provision of social support, stress-reduction and effective treatment of trauma-related disorders, or elaborated the quality of psychosocial support as a concept (Hobfoll et al. [2007](#); Benedek and Fullerton [2007](#); Te Brake et al. [2009](#); Bisson et al. [2010](#); North and Pfefferbaum [2013](#); Dückers [2013](#); Reifels et al. [2013](#); Dückers and Thormar [2015](#)).

Despite differences in focus, this body of work reflects a certain level of consensus on the preferred nature of psychosocial support, and acknowledges that the current state of knowledge is mostly based on expert consensus in the absence of strong scientific evidence (Bisson et al. [2010](#); North and Pfefferbaum [2013](#); Gouweloos et al. [2014](#)). Moreover, there are indications that adherence to guidelines concerning psychosocial support in Europe is low. A gap exists between guidance and practice (Te Brake and Dückers [2013](#)) and there is variation in guideline compliance in different areas of Europe (Witteveen et al. [2012](#)). Witteveen et al. concluded that countries across Europe are currently providing suboptimal psychosocial services to people exposed to disasters. They emphasized the urgent need for some countries to abandon non-effective interventions and others to develop more evidence-based and effective services to facilitate the care of those involved in future disasters.

Essentially, this can be seen as a plea to implement the evidence-based practice paradigm, not only in the traumatic stress field (Bisson [2013](#)), but also to expand and integrate it into the fields of disaster preparedness and emergency management. A set of principles, in this article referred to as a “planning and delivery system”, can play an important role in achieving this.

### **Planning and Delivery System**

When it comes to dealing with psychosocial consequences of disasters, the likely scale of the event means that societies are challenged to organize a well-planned response and recovery capacity. In a disaster setting a plethora of care providers and other people are involved in efforts to detect needs and problems of an affected population, and to intervene when necessary. Ideally, in practice they will operate as a multidisciplinary, multi-layered network, initially under the responsibility of crisis managers, and later under the responsibility of public health authorities. Planning, coordination and adaptation are considered crucial in the context of disaster and crises management (Boin and ‘t Hart [2011](#); Boin and Bynander [2014](#); Comfort [2007](#)). This is also true for psychosocial services, with the particular challenge of integrating state of the art guidelines into the planning and delivery of services by all involved (Te Brake and Dückers [2013](#); Reifels et al. [2013](#); Dückers and Thormar [2015](#)).

An integrated, post-disaster psychosocial support approach should incorporate: (1) cooperation between professionals, trained volunteers and authorities belonging to different organizations, (2) coordination of planning and delivery, (3) organizations adhering to evidence-informed guidelines, (4) integration in disaster plans, (5) facilitation by government legislation, and (6) regular testing of the plans. Elements

such as these are embedded in evidence-informed guidelines (Bisson et al. [2010](#); also see Te Brake et al. [2009](#) and Suzuki et al. [2012](#)). Despite their relevance, the elements of a planning and delivery system have not been studied extensively. The starting point for the current study is the assumption that such a system is helpful in guaranteeing a high quality level in psychosocial service delivery, but that little is known about the factors that explain whether or not an integrated system is adopted.

### **Relation with Disaster Vulnerability**

Dückers and Thormar ([2015](#)) postulated that some countries and regions are in a better position to serve communities and individual citizens because they are better equipped in terms of, for instance, education, access to general practitioners and hospitals, higher levels of public and private health expenditure, a lower proportion living in poverty, higher levels of income equality, and lower corruption. These are only a few of the indicators the United Nations University and Alliance Development Works included in the development of the world vulnerability index. Country characteristics can be divided into three categories: (1) *susceptibility*: the likelihood of harm, loss and disruption, (2) *lack of coping capacities*: minimization of negative impacts of hazards through direct action and available resources, and (3) *lack of adaptive capacities*: measures and strategies dealing with and attempting to address negative impacts of hazards (Birkmann et al. [2011](#); Welle et al. [2012](#)). This index can be used to illustrate that some countries are more vulnerable than others in terms of disaster impact and response and recovery potential.

It is likely that the quality of psychosocial support planning and delivery systems is linked to the vulnerability level. One might even view the system as a particular manifestation of the level of vulnerability. Less vulnerable countries with good governance, less corruption, better health care, et cetera are then hypothesized to provide a more fertile environment for well-organized psychosocial support in reaction to adversity. The association has never been tested.

### **Objective**

The objectives of this study are to determine whether post-disaster psychosocial support planning and delivery systems vary across Europe, to verify if more evolved systems are accompanied by lower vulnerability and vice versa, and to identify elements, at different levels, that can inform improvement planning.

### **METHODS**

The study was conducted using existing data sets. The psychosocial support planning and delivery system was operationalized using data from The European Network for Traumatic Stress (TENTS) mapping survey (Witteveen et al. [2012](#)). Disaster vulnerability was measured using the world vulnerability index (Welle et al. [2012](#)).

## Measuring Planning and Delivery Systems

In the context of the TENTS-project, funded by the European Union, a web-based survey was developed. Drafts of the survey were circulated for consultation to achieve optimal face and content validity. It was subsequently piloted, adjusted and re-tested before being integrated in the website. The survey included dichotomous, multiple choice and open-ended questions which were divided into different sections (details can be found in Witteveen et al. [2012](#)).

The survey was translated (and back translated) into seven local languages (i.e. Turkish, Finnish, Hungarian, Polish, Spanish, Swedish and French) and administered between May and December 2008. An invitation e-mail was sent to 652 individuals who were identified as a source of information within a particular country. They were invited to complete the survey for their affiliated organization. Nearly half of them (N = 286; 44 %) completed the questionnaire. Most participants were providers of psychosocial care (50.3 %) and/or (mental health care) managers (30.1 %). The rest were researchers (18.5 %), educators (15.7 %), policy makers (8 %) or a combination of those. Around half of all participants reported that their affiliated organization had one main function, for example being a hospital or clinic. 82.2 % of all participants indicated that their organization was involved in some kind of psychosocial support or care, 55.2 % in both psychosocial care delivery and its planning and coordination, while 10.8 % reported that their affiliated organization was only involved in planning and coordinating the post-disaster psychosocial response. Another 10 % indicated that they were involved in something else unrelated to psychosocial care or planning and coordination of the disaster response, such as trauma research.

Although the mapping tool contains several sections, only the section “*planning and delivery systems*” was used to measure the status of the planning and delivery system. Responses to the following questions were coded into binary variables (‘Yes’ into 1; ‘No’, ‘Don’t know’, and ‘Not applicable’ into 0):

1. Does your organization cooperate with other organizations in the planning and delivery of psychosocial support/care for victims of disaster or major emergency situations?
2. Is there some form of central coordination for the planning and delivery of psychosocial services for victims of disasters or major emergency situations in your organization or region?
3. Is psychosocial care a topic covered in this multi-organization or multi-agency coordination for disaster-victims?
4. Does your organization follow specific post-disaster guidelines?
5. Are these guidelines incorporated in a specific disaster-plan (contingency plan/emergency response plan)?

6. Is the disaster plan supported by any legislation, laws or governmental regulation?

7. Is the disaster plan tested on a regular basis?

A post-disaster psychosocial support planning and delivery system score was calculated by adding up these seven items and dividing the total by seven (Cronbach's alpha: 0.90; no items were removed because that would lead to a lower reliability coefficient), resulting in a maximum value of one and a minimum value of zero.

### **Measuring Disaster Vulnerability**

Disaster vulnerability can be defined as: "The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard" (UNISDR [2009](#)). Vulnerability is usually a socially constructed potential for harm, expressed on a scale from no damage to total loss. Since losses vary geographically, over time, and among different social groups, vulnerability also varies over time and space (Cutter et al. [2003](#)).

At a global level the United Nation's world vulnerability index is the most comprehensive tool to assess the disaster risk that a society or country is exposed to by external and internal factors (Birkmann et al. [2011](#); Welle et al. [2012](#)). The index is based on multiple indicators. Matrices were calculated for 173 countries; detailed information is publicly available and described in the World Risk Report 2012. The data collection required for its calculation is freely available and can be accessed via the internet, which ensures transparency and verifiability. Robust statistical imputation techniques were conducted to cover missing data (Templ et al. [2006](#)). In order to be mathematically aggregated into indices, the indicators were transformed in dimensionless rank levels between 0 and 1, i.e. they can be read as percentage values. The index illustrates that a country's disaster risk may depend on several factors, so that a country also has several means at its disposal to reduce risks (Birkmann et al. [2010](#)). As mentioned in the previous section, disaster vulnerability comprises the components of susceptibility, lack of coping capacities and lack of adaptive capacities (Birkmann et al. [2011](#)); these are further elaborated below.

### **Susceptibility**

Susceptibility generally refers to the likelihood of harm, loss and disruption in an extreme event triggered by a natural or man-made hazard. Thus susceptibility describes structural characteristics and framework conditions of a society. Several subcategories outlining the living conditions in a country have been chosen to represent susceptibility in the vulnerability index: public infrastructure (share of population without access to improved sanitation and share of population without access to clean water), nutrition (share of population undernourished), poverty and dependencies (share of under 15- and over 65-year-olds in the working population and share of population living on less than USD 1.25 per day), and economic capacity and income distribution (gross domestic product per capita, purchasing

power parity and the Gini index for income inequality). A fifth subcategory, housing conditions, is considered an important susceptibility factor, however, it has not been included in the index so far due to a lack of global data.

### **Lack of Coping Capacities**

Coping capacities comprise various abilities of individuals, societies and exposed elements (e.g. critical infrastructure such as nuclear power plants) to minimize negative impacts of natural and man-made hazards through direct action and available resources. Coping capacities encompass measures and abilities that are immediately available to reduce harm and damage if an event occurs. Five subcategories of coping capacities are distinguished. Three of the subcategories are currently covered by data: government and authorities (Corruption Perceptions Index and Failed States Index), medical services (number of physicians per 10,000 inhabitants and number of hospital beds per 10,000 inhabitants), and material coverage (insurance and life insurance excluded). The other two subcategories covering disaster preparedness and early warning, along with social networks, are included in the coping capacities component. However, currently no global data referring to them is available. Hence it has so far not been possible to give them a place in the index. The lack of coping capacities index value is derived by subtracting the coping capacities value from one.

### **Lack of Adaptive Capacities**

Adaptation is a long-term process that includes structural changes (Birkmann et al. [2010](#); Lavell et al. [2012](#)). Adaptation encompasses measures and strategies dealing with and attempting to address negative impacts of future natural hazards and climate change. Five subcategories are included to generate a value describing capacities for long-term adaptation and change within a society. Besides life expectancy at birth, four subcategories of suitable data are available: education and research (adult literacy rate and combined gross school enrolment), gender equity (gender parity in education and proportion of female representatives in the national parliament), environmental status/ecosystem protection (water resources, biodiversity and habitat protection, forest management, and agricultural management), and investments (public and private health expenditure). Owing to insufficient global data, the subcategory of adaptation strategies could not be integrated into the calculations. As with coping capacities, a lack of adaptive capacities value is included in the index.

### **Analysis**

The data were used to calculate a psychosocial support planning and delivery system, and disaster vulnerability score for each region. The expected association between disaster vulnerability and the planning and delivery system is shown in Fig. [1](#), with lower vulnerability to disaster (lower susceptibility, higher coping and adaptive capacity) accompanied by a higher system score. Differences between regional scores and the association between system and vulnerability at the regional level were assessed using non-parametric tests in SPSS 22. Regional differences were examined using Kruskal–Wallis tests and Mann–Whitney U tests, the association between system and vulnerability with Spearman’s rho.

**[FIGURE 1]**

Additionally, multilevel analyses were applied to take the hierarchical structure of the data into account. Disaster vulnerability country data is nested in six regions (two levels). Psychosocial support planning and delivery system data was obtained from individual respondents, nested in countries within regions (three levels). These levels might be meaningful: units in the same cluster can be more similar to each other than to others. To control for this possibility, an intercept was estimated in MLwiN 2.31 for both variables, together with the intercept variance at the different levels. The planning and delivery system and disaster vulnerability were analysed in different steps. Levels were added one by one in order to understand the difference between models with one, two or three levels. A deviance test was used to compare each model with its predecessor; deviance can be regarded as a measure of lack of fit between model and data, the larger the deviance ( $-2 \log$ likelihood; IGLS), the poorer the fit to the data. The deviance test is a tool to assess whether each subsequent model leads to a substantial reduction in deviance.

**RESULTS**

Two patterns of the extent to which participants of the TENTS mapping survey perceived the items concerning a psychosocial support planning and delivery system present in their own setting are shown in Fig. 2. Overall, the most common elements of the planning and delivery system were, in descending order, cooperation between organizations, some sort of central coordination for planning and delivery, psychosocial care coverage in multi-agency coordination, presence of specific post-disaster guidelines, the incorporation of these guidelines in a disaster plan, support of the disaster plan by government laws and regulation, and regular testing of the disaster plan. There were significant differences in terms of presence of the elements across the regions of Europe; the highest presence was in the north, with a gradually decline, through west, central, south and southeast Europe to the east.

**[FIGURE 2]**

Table 1 contains general descriptive information on the data (i.e. mean, median, inter-quartile range, minimum and maximum values) and the regional average planning and delivery system and disaster vulnerability scores. The European average for the planning and delivery system was 0.39. The highest averages were found in north, west and central Europe. South, southeast and east Europe had the lowest averages. The pattern in the disaster vulnerability score was similar; the lowest value was in the west, the highest in the southeast.

**[TABLE 1]**

Figure 3 shows a scatterplot with the regional planning and delivery system score on the y-axis and disaster vulnerability on the x-axis. System score and disaster vulnerability differ significantly between the six regions (Kruskal–Wallis test;  $P < 0.001$ ) and between north–west–central and south–southeast–east (Mann–Whitney U test;  $P < 0.001$ ). The non-parametric correlation between regional

planning and delivery system, and vulnerability averages is 0.89 (Spearman's rho;  $P < 0.05$ ).

### [FIGURE 3]

In Table 2 the results of the multilevel analysis are shown. In three models the average planning and delivery system score (intercept; fixed effects) is estimated together with the variance at different levels (random effects). A model with one level (individual respondents) is presented, followed by a two-level model (individuals in regions), and then a three-level model (individuals in countries, nested in regions). The results of the two-level model illustrate that ninety percent of the variance is found at the individual level, and ten percent at the regional level. After including the country level in the three-level model, the individual level variance drops back to eighty percent. The results show that, besides regional differences, variation exists at the country level. According to the deviance tests, each subsequent model represents a significant improvement compared to the previous one. The three-level model fits the data best.

### [TABLE 2]

The columns in the right of Table 2 display the results for disaster vulnerability. The average vulnerability score (fixed effects) and the total variance in vulnerability at the country and regional level (random effects) were estimated in two models. The deviance test indicates that adding the regional level leads to a significant improvement in fit. In contrast to the variance in planning and delivery system, most of the variance in vulnerability was situated at the higher level of the region, not at the country level. In this sample of 36 countries, the region accounts for approximately three quarters of the variance in disaster vulnerability.

## DISCUSSION

A first important finding from this study is that, at the level of European regions, the status of post-disaster psychosocial support planning and delivery systems is strongly related to the capacity of countries to absorb, respond to and recover from the impact of disaster, i.e. the components of disaster vulnerability. Secondly, both planning and delivery systems and disaster vulnerability vary significantly between six European regions, with more differences between countries and individuals when it comes to planning and delivery systems, and primarily regional variation, with less country level variation, when it comes to vulnerability. North, west and central Europe differ significantly from south, southeast and east Europe in planning and delivery systems, and vulnerability. Thirdly, some regions are definitely more advanced when it comes to the developmental stage of the planning and delivery system than others. This is reflected in a higher prevalence of the various system elements and, hence, in a higher average system score. It is also visible in the type of system elements. The limited presence or absence of integration of guidelines in disaster plans, supportive legislation and periodic testing of plans, all lowered the overall system score in each of the regions.



## Implications

These findings have several implications. The variation in planning and delivery systems at the level of regions, countries and individual respondents suggests that there is room for improvement.

Starting with the regional level, the strong relation with vulnerability is meaningful in this respect, with the remark that the plotted trend line in Fig. 3 is somewhat inaccurate. On the high-system-score side at the left side of the graph a ceiling effect is likely: at a certain point lower vulnerability levels are probably no longer accompanied by higher system scores. Also, it is likely that the line in the low-system-score quarter would bend steeply to the right if the scatterplot included more vulnerable countries.

Although associations are not the same as causality, in the case of disaster vulnerability, it is more plausible that vulnerability influences planning and delivery systems than the other way around. Vulnerability consists of aspects that can be seen as exogenous variables, and it has already been shown that these aspects are strongly interrelated at the national level (Birkmann et al. 2011). Additionally, the findings of the multilevel analysis point at homogeneity in vulnerability in Europe at the regional level. What would be expected from attempts to enhance planning and delivery systems indirectly via vulnerability characteristics at the country or regional level? This would require long-term investments with an uncertain outcome. What is more, at these levels the expected improvement rate is relatively small as most of the variance is found at the individual respondent level. Optimization strategies should, therefore, focus directly on enhancing planning and delivery systems and their components locally, with implementation strategies, tailored not only to the context of different regions and countries but, most importantly of all, to local settings. This is a bit paradoxical given the focus placed on vulnerability in this study, but then again, the findings should be seen as encouragement to look beyond vulnerability features at higher levels. Researchers and policy-makers should carefully consider local key people and processes. Importantly, they should also contribute to incorporating capacity and knowledge into the collaborative development, testing and dissemination of quality improvement strategies and instruments. This is where real progress can be made, at the level where services are provided in interaction with people confronted by adversity.

When all the elements are present, planning and delivery systems should stimulate the various network partners to integrate guidelines in their joint, local, and frequently updated planning routine. In this manner, planning and delivery systems could accommodate guideline implementation and evidence-based work in disaster settings. Some regions, countries and local networks are better equipped to run a post-disaster psychosocial support program for an affected population than others. Further research into programs run after different events and in different circumstances would be welcome and would be of interest to those who seek to optimize the quality of psychosocial support at different levels in Europe and the rest of the world. New forms of intervention with a potentially large public health impact, such as mobile health approaches, may be a way to reach those areas that are less

well equipped to administer post-disaster psychosocial support programs (Olf [2015](#); Olf et al. [2015](#)).

The variation within Europe is informative; at the same time the countries assessed are concentrated in a relatively low zone of the world-wide disaster vulnerability distribution. The findings cannot be generalized to those countries that would score significantly higher like, for example, Haiti, Bangladesh and the Philippines (see the country data in the World Risk Report). It would be interesting and informative to extend the mapping survey to these and other areas of the world. This is especially important as it has the potential to further develop insight into the cultural dimensions of country vulnerability and post-disaster psychosocial service delivery. It has, for instance, recently been suggested that over two-thirds of the variance in national vulnerability can be explained by cultural factors: less vulnerable countries are inhabited by more individualistic cultures with a more equal power balance, less uncertainty avoidance, a more long-term orientation, higher indulgence, and less restraint (Dückers et al. [2015](#)). The implications for planning and delivery systems require further inquiry. It is conceivable that the lower availability of institutional and professional capacities and systems in more vulnerable countries—as found in this study—is accompanied, or even compensated, by aspects of social capital such as community engagement and support that in turn might serve as an alternative route to the realization of psychosocial principles. Research into these and other issues can help clarify the meaning of concepts such as vulnerability or resilience at the societal level, both in a theoretical as well as a practical sense.

## Limitations

Although the best data available was used, this study does have some limitations. Firstly, the TENTS mapping survey had a non-response of over 50 per cent. The survey mapped only the availability of certain psychosocial services, and not the extent or frequency of delivery of these psychosocial services to people confronted with disaster. Differences between areas in function or types of organization represented may have influenced the mapping results (Witteveen et al. [2012](#)). Specific questions were selected to operationalize the psychosocial support planning and delivery system. Since an existing data set was used, this limited the options to capture more details or employ other potentially relevant components such as available resources and training programs for professionals and volunteers in line with the requirements identified by Pearce et al. ([2012](#)).

Secondly, some limitations of the world vulnerability index must be mentioned. An array of datasets from different sources is used to bring together social and economic dimensions and natural hazard analysis in the vulnerability index. The datasets used are not designed for this purpose; they are incorporated simply because they are available (Heesen et al. [2014](#)). That said, indicators have been assigned to three constructs with a good reliability coefficient and the index has been thoroughly tested (Alliance Development Works [2012](#)). Although the index is a helpful source to understand disaster risk internationally, the statistical work on it is still work in progress and there is scope for a follow-up analysis covering more relevant data.

## Conclusion

In this study the variation in post-disaster psychosocial support planning and delivery systems and disaster vulnerability was examined at different levels. The association between both concepts was assessed at the regional level. Lower vulnerability was accompanied by more evolved systems. The multilevel perspective found that disaster vulnerability is apparently a country trait with regional variability. It also confirmed that psychosocial support planning and delivery systems differ at the level of region and country, but are most of all local combinations of elements, helping or hindering individual experts and professionals involved in the practice of post-disaster psychosocial service delivery. More extensive assessments and comparisons at the local, national, and international level are vital for a better understanding of psychosocial aid in the response and aftermath of disasters, in particular, its determinants, nature, working mechanisms, and contribution to well-being, health and other outcomes.

## References

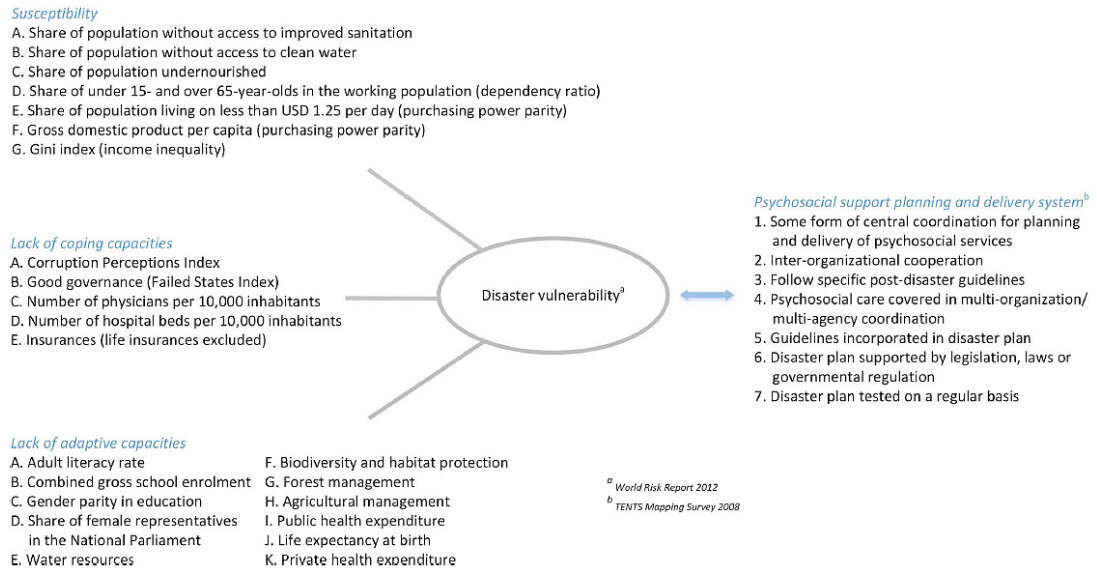
1. Alliance Development Works (2012). Accessed November 18, 2014 from [http://www.worldriskreport.com/uploads/media/Methods\\_used\\_01.pdf](http://www.worldriskreport.com/uploads/media/Methods_used_01.pdf).
2. Benedek, D. M., & Fullerton, C. S. (2007). Translating five essential elements into programs and practice. *Psychiatry*, 70, 345–349.C CrossRef
3. Birkmann, J., Buckle, P., Jaeger, J., Pelling, M., Setiadi, N., Garschagen, M., et al. (2010). Extreme events and disasters: A window of opportunity for change? Analysis of changes, formal and informal responses after mega disasters. *Natural Hazards*, 55, 637–669.C CrossRef
4. Birkmann, J., Welle, T., Krause, D., Wolfertz, J., Suarez, D.-C., & Setiadi, N. J. (2011). World Risk Index: Concept and results. In Alliance Development Works (Ed.), *World Risk Report 2011* (pp. 13–42). Berlin: Alliance Development Works.
5. Bisson, J. I. (2013). Disseminating and implementing evidence-based practice. *European Journal of Psychotraumatology*, 4, 21252. doi:10.3402/ejpt.v4i0.21252.C CrossRef
6. Bisson, J. I., Tavakoly, B., Witteveen, A. B., Ajdukovic, D., Jehel, L., Johansen, V. J., et al. (2010). TENTS guidelines: Development of post-disaster psychosocial care guidelines through a Delphi process. *British Journal of Psychiatry*, 196, 69–74.P PubMedCrossRef
7. Boin, A., & 't Hart, P. (2011). Organising for effective emergency management: Lessons from research. *The Australian Journal of Public Administration*, 69, 357–371.C CrossRef
8. Boin, A., & Bynander, F. (2014). Explaining success and failure in crisis coordination. *Geografiska Annaler: Series A, Physical Geography*, 96, 12072.
9. Comfort, L. K. (2007). Crisis management in hindsight: Cognition, communication, coordination, and control. *Public Administration Review*, 67, 189–197.C CrossRef
10. Cutter, S. L., Boruff, B. J., & Lynn Shirley, W. (2003). Social vulnerability to environmental hazards. *Social Science Quarterly*, 84, 242–261.C CrossRef
11. Dücker, M. L. A. (2013). Five essential principles of post-disaster psychosocial care: Looking back and forward with Stevan Hobfoll. *European Journal of Psychotraumatology*, 4, 21914. doi:10.3402/ejpt.v4i0.21914.C CrossRef
12. Dücker, M., Frerks, G., & Birkmann, J. (2015). Exploring the plexus of context and consequences: An empirical test of a theory of disaster vulnerability. *International Journal of Disaster Risk Reduction*, 3, 85–95.C CrossRef
13. Dücker, M. L. A., & Thormar, S. B. (2015). Post-disaster psychosocial support and quality improvement: A conceptual framework for understanding and improving the quality of psychosocial support programs. *Nursing & Health Sciences*, 17, 159–165.C CrossRef

14. Galea, S., Ahern, J., Resnick, H., Kilpatrick, D., Bucuvalas, M., Gold, J., et al. (2002). Psychological sequelae of the September 11 terrorist attacks in New York City. *New England Journal of Medicine*, 346, 982–987. PubMedCrossRef
15. Gouweloos, J., Dückers, M., Te Brake, H., Kleber, R., & Drogendijk, A. (2014). Psychosocial care to affected citizens and communities in case of CBRN incidents: A systematic review. *Environment International*, 72, 46–65. PubMedCrossRef
16. Heesen, J., Lorenz, D. F., Nagenborg, M., Wenzel, B., & Voss, M. (2014). Blind spots on Achilles' heel: The limitations of vulnerability and resilience mapping in research. *International Journal of Disaster Risk Science*, 5, 74–85. CrossRef
17. Herbert, R., Moline, J., Skloot, G., Metzger, K., Baron, S., Luft, B., et al. (2006). The World Trade Center disaster and the health of workers: Five-year assessment of a unique medical screening program. *Environmental Health Perspectives*, 114, 1853–1858. PubMedCentralPubMed
18. Hobfoll, S. E., Watson, P., Bell, C. C., Bryant, R. A., Brymer, M. J., Friedman, M. J., et al. (2007). Five essential elements of immediate and mid-term mass trauma intervention: Empirical evidence. *Psychiatry*, 70, 283–315. PubMedCrossRef
19. International Federation of Red Cross and Red Crescent Societies. (2012). *World Disasters Report 2012*. Geneva: IFRC.
20. International Federation of Red Cross and Red Crescent Societies. (2013). *World Disasters Report 2013: Focus on Technology and the Future of Humanitarian Action*. Geneva: IFRC.
21. International Federation of Red Cross and Red Crescent Societies. (2014). *World Disasters Report 2014: Focus on Culture and Risk*. Geneva: IFRC.
22. Lavell, A., Oppenheimer, M., Diop, C., Hess, J., Lempert, R., Li, J., et al. (2012). Climate change: New dimensions in disaster risk, exposure, vulnerability, and resilience. In C. B. Field, V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G.-K. Plattner, S. K. Allen, M. Tignor, & P. M. Midgley (Eds.), *Managing the risks of extreme events and disasters to advance climate change adaptation. A special report of working groups I and II of the Intergovernmental Panel on Climate Change (IPCC)* (pp. 25–64). Cambridge and New York: Cambridge University Press.
23. Moline, J., Herbert, R., & Nguyen, N. (2006). Health consequences of the September 11 World Trade Center attacks: A review. *Cancer Investigation*, 24, 294–301. PubMedCrossRef
24. Noij, E. K. (2000). The public health consequences of disasters. *Prehospital and Disaster Medicine*, 15, 147–157.
25. Norris, F. H., & Elrod, C. L. (2006). Psychosocial consequences of disaster: A review of past research. In F. H. Norris, S. Galea, M. J. Friedman, & P. J. Watson (Eds.), *Methods for disaster mental health research*. New York: Guilford.
26. Norris, F. H., Friedman, M. J., Watson, P. J., Byrne, C. M., Diaz, E., & Kaniasty, K. (2002). 60,000 disaster victims speak: Part I. An empirical review of the empirical literature, 1981–2001. *Psychiatry*, 65, 207–239. PubMedCrossRef
27. North, C. S., & Pfefferbaum, B. (2013). Mental health response to community disasters: A systematic review. *JAMA Journal of the American Medical Association*, 310, 507–518. PubMedCrossRef
28. Olf, M. (2015). Mobile mental health: A challenging research agenda. *European Journal of Psychotraumatology*, 6, 27882. doi:10.3402/ejpt.v6.27882. PubMed
29. Olf, M., Van Zuiden, M., & Bakker, A. (2015). Early interventions: From e-health to neurobiology. *European Journal of Psychotraumatology*, 6, 28545. doi:10.3402/ejpt.v6.28545. PubMed
30. Pearce, J., Jones, C., Morrison, S., Olf, M., van Buschbach, S., Witteveen, A. B., et al. (2012). Using a Delphi process to develop an effective train-the-trainers program to train health and social care professionals throughout Europe. *Journal of Traumatic Stress*, 3, 337–343. CrossRef
31. Reifels, L., Pietrantonio, L., Prati, G., Kim, Y., Kilpatrick, D. G., Dyb, G., et al. (2013). Lessons learned about psychosocial responses to disaster and mass trauma: An international perspective. *European Journal of Psychotraumatology*, 4, 22897. doi:10.3402/ejpt.v4i0.22897. CrossRef

32. Shoaf, K. I., & Rottman, S. J. (2000). Public health impact of disasters. *Australian Journal of Emergency Management*, 15, 58–63.
33. Suzuki, Y., Fukasawa, M., Nakajima, S., Narisawa, T., & Kim, Y. (2012). Development of disaster mental health guidelines through the Delphi process in Japan. *International Journal of Mental Health Systems*, 6, 7. PubMedCentralPubMedCrossRef
34. Te Brake, H., & Dückers, M. (2013). Early psychosocial interventions after disasters, terrorism and other shocking events: Is there a gap between norms and practice in Europe? *European Journal of Psychotraumatology*, 4, 19093. doi:10.3402/ejpt.v4i0.19093.CrossRef
35. Te Brake, H., Dückers, M., De Vries, M., Van Duin, D., Rooze, M., & Spreeuwenberg, C. (2009). Early psychosocial interventions after disasters, terrorism, and other shocking events: Guideline development. *Nursing & Health Sciences*, 11, 336–343.CrossRef
36. Templ, M., Filzmoser, P., Hron, K. (2006). Robust Imputation of Missing Values in Compositional Data Using the Package rob Compositions. The Comprehensive R Archive Network.
37. United Nations International Strategy for Disaster Reduction. (2009). *UNISDR Terminology on Disaster Risk Reduction*. Geneva: UNISDR.
38. Weaver, J. D. (1995). Disasters: Mental health interventions. *Crisis management series*. Sarasota, FL: Professional Resource Press/Professional Resource Exchange.
39. Welle, T., Birkmann, J., Rhyner, J., Witting, M., & Wolfertz, J. (2012). World Risk Index 2012: Concept, updating and results. In Alliance Development Works (Ed.), *World Risk Report 2012* (pp. 11–26). Berlin: Alliance Development Works.
40. Witteveen, A. B., Bisson, J. I., Ajdukovic, D., Arnberg, F. K., Bergh Johannesson, K., Bolding, H. B., et al. (2012). Post-disaster psychosocial services across Europe: The TENTS project. *Social Science and Medicine*, 75, 1708–1714.

**TABLES AND FIGURES**

**Fig. 1 Expected association between disaster vulnerability and psychosocial support planning and delivery system**



**Fig. 2 Psychosocial support planning and delivery system: elements present according to respondents**

**Fig. 1** Expected association between disaster vulnerability and psychosocial support planning and delivery system

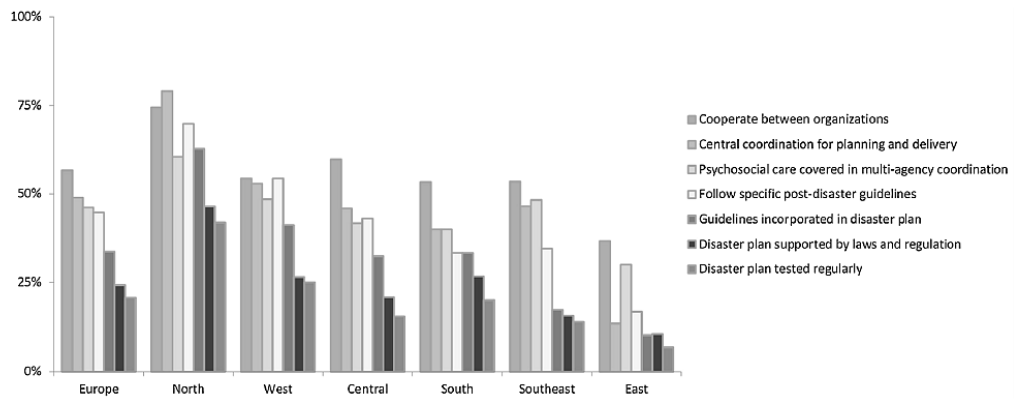


Table 1 Psychosocial support planning and delivery system and disaster vulnerability: distributional information and regional averages

	Distributional information				European regions					
	Mean	Median	IQR	Min–Max	North	West	Central	South	Southeast	East
Psychosocial support planning and delivery system	0.39 (284) <sup>a</sup>	0.43	0.71	0–1.00	0.62 (43)	0.43 (68)	0.37 (71)	0.35 (15)	0.33 (58)	0.18 (29)
Disaster vulnerability	34.51 (36) <sup>b</sup>	34.70	8.94	26.87–47.31	27.34 (5)	29.81 (6)	27.79 (3)	34.97 (4)	40.98 (11)	36.10 (7)

Countries per region (+ = country with disaster vulnerability data but not represented in TENTS mapping survey): *North* Denmark, Finland, Iceland<sup>+</sup>, Norway, Sweden; *West* Belgium, France, Ireland<sup>+</sup>, Luxembourg<sup>+</sup>, The Netherlands, United Kingdom; *Central* Austria, Germany, Switzerland; *South* Italy, Spain, Portugal; *Southeast* Bulgaria, Bosnia-Herzegovina, Croatia, Cyprus, Former Yugoslavian Republic of Macedonia, Georgia, Greece, Romania, Serbia, Slovenia, Turkey; *East* Czech Republic, Estonia<sup>+</sup>, Hungary<sup>+</sup>, Latvia, Lithuania, Poland, Slovakia

IQR inter-quartile range, *Min* minimum, *Max* maximum

<sup>a</sup>Between parentheses, total number of respondents TENTS mapping survey (Witteveen et al. 2012)

<sup>b</sup>Between parentheses, total number of countries (data obtained from World Risk Report 2012)

Fig. 3 Scatterplot regional averages

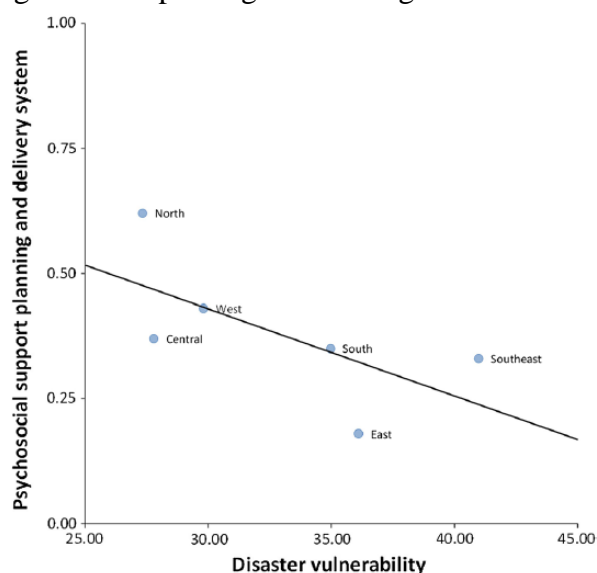


Table 2 Multilevel models: estimated intercepts and variance at different levels

	Psychosocial support planning and delivery system			Disaster vulnerability	
	Model 1	Model 2	Model 3	Model 1	Model 2
	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Fixed effects					
Average (intercept)	0.39 (0.02)	0.39 (0.05)	0.40 (0.06)	34.51 (0.99)	32.92 (2.04)
Random effects					
Intercept variance at					
Level 1 (individual)	0.14 (0.01)	0.13 (0.01)	0.12 (0.01)	NA	NA
Level 2 (country)	–	–	0.02 (0.01)	35.27 (8.31)	8.79 (2.27)
Level 3 (region)	–	0.01 (0.01)	0.01 (0.01)	–	23.21 (14.39)
Percentage of variance at					
Level 1 (individual)	100 %	90 %	81 %	NA	NA
Level 2 (country)	–	–	11 %	100 %	27 %
Level 3 (region)	–	10 %	8 %	–	73 %
N	284			36	
–2 loglikelihood (IGLS)	246.677	233.275	225.891	230.432	196.914
Deviance test	Reference	P < 0.001	P < 0.01	Reference	P < 0.001

Five models are tested in sequential steps. The average psychosocial support planning and delivery system score is estimated in three models: (1) individuals, (2) individuals nested in regions, and (3) individuals nested in countries, nested in regions. The average disaster vulnerability score (intercept) is estimated in two models: (1) countries and (2) countries nested in regions. In all five models the intercept variance at different levels is estimated SE standard error, NA not applicable, IGLS iterative generalized least squares