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# Social vulnerability indicators in disasters: Findings from a systematic review



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#### ABSTRACT

Social factors are one of the most important causes of vulnerability of exposed communities to disasters. Until now, however, most studies have been done in the developed countries. Thus, the aim of this paper is to review the social vulnerability indices and their validity in disasters within the period 1985–2015 and to develop a suitable classification to make sense of social vulnerability indices in the Iranian context. This study took place in 2015. It used bibliographies, citation databases, and other available records to find an answer to the question of what are the valid social vulnerability indicators in disasters. It examined 43 peer-reviewed English and Persian language journals. Initially, it found 32 indicators and 150 variables, but it was possible to subsume them into a few valid social vulnerability indicators. These were gender, public health condition, public infrastructures and migration. They are the five top categories of social vulnerability index in natural disasters settings. Consequently, additional research is needed to develop the indices of social vulnerability in man-made disasters and to develop appropriate variable weighting schemes and valid indices.

#### 1. Introduction

There have been many descriptions of social vulnerability over the last two decades, but still lacking is a comprehensive definition that will meet the requirements of various social and humanistic disciplines. The use of the concept of vulnerability in the disaster literature started in the 1970s [16]. During the 1980s, the recognition grew of the importance of fundamental characteristics of environmental, economic, social and political causes of vulnerability. These included population density, gender discrimination, socioeconomic status, and public health conditions and are widely considered to be the most important causes of vulnerability of individuals exposed to disasters and emergencies [25,29,30,46,47,52,48,32,54,58]. In Iran, despite its exposure to earthquakes and other hazards, very few studies of social vulnerability have been done, a matter we wish to address by extracting and categorizing the relevant indicators.

Social vulnerability taps on a broad range of susceptibilities at the individual and community level: lack of access to resources and lifelines, insufficient information and well-being; and certain beliefs and customs [34,14,3,56,7]. Also, some indicators measuring deficiencies in infrastructure make people with compromised statuses more socially vulnerable to environmental hazards [17,25]. On the other hand, social vulnerability is context-dependent and is often associated with the degree of exposure to extreme events, and with the preparedness and resilience of individuals and social groups [51,53,24]. Nevertheless, there is no answer to the question of what indicators should be used in specific contexts to guide mitigation tools to reduce the harmful consequences of natural or man-made disasters. There is a need to assess vulnerability indices and their validity for contributing to informed policy making [20]. Validity means the selected indicators are replicable and represent their underlying concepts appropriately. They are used in international studies to measure the social vulnerability of many countries and areas. However, there is no universal answer to above question, which is a function of the culture and organization of different societies.

Iran is prone to various disasters, and it can profit by developing internationally valid Social Vulnerability Indices for simplifying complex events, guide disaster risk management and establish appropriate

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Received 11 June 2016; Received in revised form 17 September 2016; Accepted 18 September 2016 Available online 21 September 2016 2212-4209/ © 2016 Published by Elsevier Ltd. mitigation programs, particularly for man-made catastrophes. Some available texts have focused on Indicators of Social Vulnerability in natural disasters. A challenging area in this field is what changes if any, are necessary to use natural hazard indicators in studies of the vulnerability of populations to man-made hazards. This review aims to show which indicators could be used to measure the social vulnerability of populations in disasters and the extent of their validity.

#### 2. Methods

#### 2.1. Data sources

This study conducted in September 2015. For the purpose of this review, both bibliographic and citation databases were the main sources of information. They were accessed both in February and in August of 2014. The bibliographic sites were Pubmed, Elsevier, Scopus, and the citation sites ProQuest, and Springer and Iran Medex for Persian articles. We searched the ProQuest database which has only contains dissertations from different parts of the world in English language. Also reviewed were other available electronic resources such as books, the website of universities, and documents and reports from international organizations. The references of the items identified were another fruitful source of appropriate material. In what is a type of "snowball method" for finding more sources that went on during the entire data collection.

#### 2.2. Search strategy

Excepting snowball material, all other sources of written material were obtained using the same search strategy. The following terms were used when using Medical Subject Headings (MeSH)): ("Social vulnerability") AND (indicators OR components) AND (disast\* OR natural hazard\* OR technological hazard\*).

#### 2.3. Inclusion criteria

Included articles were that published in academic journals, focused on empirical research and were within the scope set by the research question. Also, the papers related to the process of identifying and measuring the social vulnerability indices, even if they were narrative, included in this study.

#### 2.4. Exclusion criteria

Excluded articles were those published before 1985, appeared in non-academic journals, focused on modeling and theory development of social vulnerability without conducting substantive empirical studies, were written in Persian and the English languages. Once identified, they were followed by descriptive and thematic analyses.

Finally, the PRISMA<sup>1</sup> Checklist appraisal tool was completed for the manuscript. Fig. 1 gives a quick review of how this study assembled the data used in the analysis..

#### 3. Results

The gross number of articles in bibliographic, citation databases, and other resources were 185, 111 and 35, respectively. After the initial search, we used the snowball method to identify 15 other articles. Altogether 43 qualified articles were analyzed in this study.

#### 3.1. Descriptive analysis

While the Asian continent has the highest frequency and magnitude of disasters in the world, more studies come from the USA than from any other country. The most commonly used methods for the analysis of social vulnerability were Analytical Hierarchy Process (AHP), Principal Component Analysis (PCA), and Geographic Information System (GIS) which was used in 15 articles to map and help manage, identify and visualize the Social Vulnerability Index (SoVI) of specific areas. The concept of social vulnerability in disasters has been paid much more attention in the recent six years than in previous years. The large proportion of published studies in the period 2010-15 confirmed this claim. The findings also indicate that an enormous proportion of papers (83%) tried to determine the proper indicators of social vulnerability in different types of natural disasters such as an earthquake, flood, and hurricane. By way of contrast, less than 7% of the studies focused on the social vulnerability of man-made disasters and emergencies. The rest (10%) analyzed social vulnerability in both natural and technological hazards. The instances of included articles and their characteristics have been shown in Table 1.

#### 3.2. Thematic analysis

We could exclude 32 indicators and 160 relevant variables for measuring social vulnerability during the analysis of 43 reviewed papers. It means that most of the studies had the same indicators of social vulnerability which were given different names, and more than one variable was used to tap the same underlying indicator.

For instance, the indicator of female population were measured by four different variables in the reviewed studies. The relevant variables were defined as percentage of female, percentage of female headed households, ratio of widows and women with three children or more dependent on the objectives and place of studies.

All of the studies used social vulnerability indicators such as percent of females in a population, age, education, social and economic status, public health condition, employment, and accessibility to medical resources and public infrastructures. The other indices of social vulnerability most commonly used were housing unit status, distribution of working populations in different sectors, and physically challenged and special needs population.

Also, the indicators of social vulnerability have been categorized in less than 50% of reviewed articles. For instance, Flanagan et al. categorized these indicators in to 4 groups in their study at 2011. These categories were socioeconomic status, household composition/ disability, minority status/language and housing/transportation. In the other study the categories of social vulnerability were population density, gender, age, disability and illiterate. So, theses categorizing seem to be described in the terms of time and place.

#### 4. Discussion

During the period of this study, increasingly used were indicators of social vulnerability. However, only a few of the studies tried to validate them (see Table 2). It is important to underscore that there are two sides to the validity of an index, conceptual and methodological validity [18,21]. The literature review shows that the validity of social vulnerability indices in Iran is little known. Most probably, the complexity of calculating social vulnerability indices and the lack of access to accurate statistics are the reasons that such studies have not attracted sustained research attention from scholars in Iran. At present, there are only four published studies of people's social vulnerability to the earthquake hazard in Iran [3,22,41,57]. One research highlighted the role of knowledge and risk attitude on the likely severity of the social vulnerability. The results showed that promotion of knowledge and proper attitude towards risk is not enough to decrease social vulnerability; instead, studies of

<sup>&</sup>lt;sup>1</sup> Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). PRISMA checklist is an evidence-based minimum set of items for reporting in systematic reviews. You can control your manuscript with it before sending for a journal. (http:// www.prisma-statement.org/)

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