PROPOSAL OF A NATURAL DISASTER TRAINING PROGRAM BY CONSIDERING THE PREVIOUS VICTIMS' PROFILE[1]

IRINEU DE BRITO JUNIOR[2]
CARLOS HENRIQUE VIEGAS DE ROSIS[3]
PRISCILLA VIEIRA CARNEIRO[4]
ADRIANA LEIRAS[5]
HUGO TSUGUNOBU YOSHIDA YOSHIZAKI[6]

Introduction

Every year, millions of people are affected by man-made (e.g., wars, conflicts, and refugee crises) and natural disasters (e.g., floods, droughts, earthquakes, hurricanes, famines) that trigger humanitarian crises, and forecasts estimate that over the next 50 years, disasters will increase by fivefold in number and severity (THOMAS; KOPCZAK, 2005).

The increasing number of disasters has demonstrated the vulnerability of the societies affected by requiring additional efforts from humanitarian organizations to provide disaster relief. Humanitarian organizations, from NGOs (non-governmental organizations) to United Nations (UN) agencies and government entities, have acted to assist and to support affected communities by delivering water, drugs, medical, equipment, shelter, and food items, among others (ROTTKEMPER *et al.*, 2011).

Due to the recurrence of many types of natural disasters, these catastrophes can be viewed as cyclical (FEMA, 2012). Humanitarian operations apply strategies to the lifecycle of a disaster, characterized by four management phases: mitigation, preparation, response, and recovery. Actions taken by humanitarian organizations frequently focus

on the preparation and on the response phases (TOMASINI; VAN WASSENHOVE, 2009). According to the U.S. FEMA - Federal Emergency Management Agency (2012), mitigation activities are those that may reduce and even eliminate the probability of the occurrence of a new disaster. In the preparation phase, mechanisms to deal with factors that could not be mitigated are put into practice (TOMASINI; VAN WASSENHOVE, 2009). In general, the planning of responses and resources should be readied or made available before a disaster situation takes place.

In the mitigation and preparation phases, previous disaster situations need to be studied and analyzed to identify the most efficient responses. In most cases, the optimal solutions target the critical vulnerabilities within a society. O'Keefe *et al.* (1976) introduced the concept of vulnerability and concluded that vulnerability was a rising trend. These authors claimed that socioeconomic conditions are the main causes of natural disasters. Rodriguez *et al.* (2007) stated that risks and disasters are socially constructed phenomena influenced by political and social structures, availability of resources, stratification and inequalities among inhabitants, population growth, density, and distribution and environmental degradation. Chakravarty (2014) linked human misery and the severity of natural disasters.

Episodes such as the earthquake and tsunami in Asia (2004); the earthquake in China (2008) and New Zealand (2011); and the series of disasters in Tohoku, Japan (2011) have demonstrated the vulnerability of societies even in developed nations. Global warming has also aggravated the severity and frequency of global disasters and has been embedded in political and public debates (KUN *et al.*, 2010). In Brazil, more frequent storms are predicted in the Southeast region due to global warming (MARENGO *et al.*, 2013; PINTO Jr. *et al.*, 2013). This finding has encouraged investment in disaster prevention and preparedness.

From a Brazilian perspective, some disasters with worrisome dimensions (such as the tragedy of Rio de Janeiro mountainous region in January 2011, the landslides in Santa Catarina in 2008, and the Minas Gerais floods in January 2011) resulted in legislative initiatives, such as the creation of Law No. 12,608 of April 10, 2012 (BRAZIL, 2012a) which institutes the National Protection and Civil Defense Policy (PNPDEC), the National Protection and Civil Defense System (SINPDEC), and the National Council for Protection and Civil Defense (CONPDEC), assigning obligations regarding disaster prevention and mitigation to federal agencies within the federation tripartite (Union, States and Municipalities).

This context increases the importance of monitoring and studying natural disasters, because reliable information can reduce the subjectivity of policies and operational decisions from the Civil Defense and contribute to fighting against vulnerabilities, to make resource allocation smarter, which meets the donor's demand for efficiency (THOMAS; KOPCZAK, 2005). Monitoring includes the accounting of human and structural damages from past disasters that can be useful as support for action planning and prevention for future events. Thus, international organizations such as the United Nations Office for Disaster Risk Reduction (UNISDR, 2012a) have encouraged the creation of databases on natural disasters.

Considering the Brazilian reality, this paper presents a study on the records of natural disaster victims provided by the CEDEC - State Coordination of Civil Defense to establish the victims' profile, and aims to discuss and to recommend more effective and adequate training methods. The study is limited to the States of Rio de Janeiro (RJ), São Paulo (SP), Minas Gerais (MG) and Santa Catarina (SC). Disasters involving these states represent 88% of the deaths and 59% of the estimated damage from natural disasters in Brazil from 2005 to 2013 (EM-DAT, 2014). Moreover, according to IBGE (2011a) (Brazilian Institute of Geography and Statistics) these four states account for 43.5% of the Brazilian population and 57.1% of the national GDP - Gross Domestic Product. An analysis of available training methods in the literature and a vulnerability study of the selected states are developed to support the conclusions. The vulnerability study is conducted using a statistical analysis of the profiles of populations affected by natural disasters in those states during the period 2005 - 2012, considering age, gender, and geographical characteristics of the victims according to the most recurrent types of accidents, namely, landslides and floods. This research is based on real data provided by the Civil Defense from the States (BRAZIL, 2012b), agencies which are tasked with accounting for fatal victims of disasters.

Methodology

The research methodology considers disaster victim information cross-referenced with population information from the states of São Paulo, Rio de Janeiro, Santa Catarina and Minas Gerais. The cross-referenced data are subsequently analyzed using risk rates and logistic regression. A geographical view is also included.

Data provided by the State Civil Defense (date of occurrence, age, gender, and location of the event, and type of disaster) are cross-referenced with geo-social data from the official Brazilian statistics agency IBGE (2011b), including age and gender population distributions, and meteorological data regarding influential climate phenomena (El Niño, Neutral and La Niña) (NOAA, 2014), as well as geographical information on the locations of the occurrences. The analysis is performed using logit regression (detailed in section 2.2) and calculations of Risk Ratios. The Risk Ratio and the Odds Ratio are measures that define the likelihood of a group to suffer an event, in which 1 is the average. For example, value 1 is the normal proportion between the population and the number of victims, 0 denotes that the group is not affected by that type of event, and 2 means that the group is twice as likely to be affected by that type of event. The analysis subsequently highlights the risk factors (vulnerabilities) according to each type of catastrophe and to each segment of the population.

Risk Ratio Analysis

This analysis aims to determine risk groups comparing the percentage of a particular group of victims in a given state and the percentage of that group in the population, similar to the study conducted by Chou *et al.* (2004). Population data were

obtained from IBGE, which publishes data collected through census and estimation (IBGE, 2011b).

The factors taken into consideration for MG, SC and SP states were:

- Gender: male and female.
- Age: child (0 to 14), youth (15 to 24), adult (25 to 60) and elder (more than 60).
- Climate influence: El Niño, La Niña and neutral.
  For RJ state, due to the limited data, the factors considered were:
- Gender: no distinction.
- Age: child (0 to 14), adult (15 to 60) and elder (more than 60).
- Climate influence: El Niño, La Niña and neutral.

Logistic regression

Nominal logistic regression models are used with data in the form of response categories without a natural order. This model is widely used to analyze binary or binomial responses and explanatory variables (DOBSON; BARNETT, 2008). A reference category is arbitrarily chosen and named the first category. The logit regression for the other categories are:

$$logit\ \pi_1 = \log\left(\frac{\pi_j}{\pi_1}\right) = x_i^T \beta_j, for\ j = 2, ..., J \tag{1}$$

The effects of the explanatory factors are interpreted in terms of odds ratios (OR) rather than parameters β. Considering a binary explanatory variable x, which indicates whether a factor is present ($x = 1$) or absent ($x = 0$), the odds ratio for j ($j = 2, ..., J$) relative to the reference category $j = 1$ is:

$$\log OR_j = \log\left(\frac{\pi_{jp}}{\pi_{1p}}\right) - \log\left(\frac{\pi_{ja}}{\pi_{1a}}\right) = \beta_{1j} \tag{2}$$

where π_{jp}, π_{ja} denote the probabilities of response category j if exposure is present or absent.

For data validation, a logistic regression model similar to that used in multivariate epidemiological studies was selected. In the logistic model, the values of a series of independent variables are used to predict the occurrence of the disaster (dependent variable). Thus, all the variables considered in the model are controlled together. Because a series of independent variables are used, this represents a multivariable problem, and the factors may be crossed. The measure of association calculated from the logistic model is the odds ratio. The adjusted odds ratios are obtained by comparing individuals who differ only in the characteristic of interest and holding the values of other variables constant (DOBSON; BARNETT, 2008).

Literature review

This section presents a review of previously reported training programs and vulnerability studies to support the applicability of the results of this study.

Training programs

Training in disaster preparedness should be adapted in content, format and duration according to the purpose and target audience. Some examples of international and Brazilian training efforts are listed in Table 1.

Table 1: International and Brazilian training programs

Goal(s) of training	Methods	Expected effects
Informing the general public at the sub-national level of disasters that commonly strike Kenya (UNISDR, 2012b)	Workshops, lectures and discussions; maximum of two days	Quicker response; more efficient and effective participation of the population
Scaling up of community-based health workforce for emergencies (GHWA *et al.*, 2011)	Periodic training of volunteers, social assistants and health professionals	Qualification of the affected population to perform basic health care before the arrival of public agents
Enabling local government leaders to conduct self-assessments and take effective measures concerning disaster risk reduction (UNISDR, 2012b)	Use of a handbook containing guidelines, checklists and formularies	Enhancement of governance regarding disaster preparedness and response capability
Aiding in implementation of effective warning systems (The World Bank and UN, 2010)	Instructions considering both the technical requisites of the system as well as recommendations for organizing simulation exercises	Successful evacuation in case of a real disaster
Developing a culture of disaster resilience and prevention through education (UNICEF and UNISDR, 2011)	Introduction of disaster risk reduction issues into official curricula of schools, including simulation exercises	Reduction of high costs and uncertainties associated with complex response operations by investing in effective preventive actions
Integrating professional organizations directly involved in emergency response into the Brazilian state civil defense system (Dalmau *et al.*, 2005; Gomes and Alves, 2004)	Textbook, classes, videos, and conferences via e-learning	Enhanced coordination among various organizations (public organs, companies and NGOs) during disaster response
Instructing inhabitants of landslide-prone areas in Brazil to recognize dangerous situations and act effectively to reduce local disaster risks (Pellizzetti *et al*., 2007)	Lectures, games and discussions	Reduction of number of victims in areas of higher risk will reduce the required efforts in disaster response
Informing local communities in Brazil about hydrological disasters (Kobiyama *et al*., 2010)	Theoretical and practical classes	Reduction of the number of victims in areas of higher risk will reduce required efforts in disaster response

West and Orr (2007) claim that despite the magnitude of a disaster and the emergency planning available, there is a lack of knowledge regarding people's perception of their vulnerabilities and those factors that affect their motivation to evacuate in the case of disaster. It is not clear which factors influence the perceptions of vulnerability, how citizens assess various governmental and nongovernmental information sources, or the extent to which gender plays a role in decision-making under disasters. These authors observe that women and minorities are more likely to evacuate if recommended by the government or media. A portion of the greatest losses of life took place when people disregarded the official recommendations to evacuate. During the Hurricane Katrina disaster (New Orleans), those who ignored or did not receive government warnings or who were unable to leave due to the lack of transportation were much more likely to die when the floodwaters arrived.

The media acts a critic of the response operations rather than a source of information as public attention fades away. To overcome this fatigue, the media should focus on survivor stories (CHO; GOWER, 2006; NEUMAN *et al.*, 1992), a more constructive approach that would help people to understand the emotional burdens of disaster and thus motivate them to act preventively.

In comparing the roles of journalists and public information officers, Abdolrasulnia *et al.* (2007) state that different perspectives and organizational processes often limit the effective communication between these groups. These authors suggest involvement of journalists in humanitarian organizations by participating in drills and meetings, and sharing informational resources to enhance the dissemination of accurate and appropriate information.

Merchant *et al.* (2011) mentioned the use of social media to spread and to share useful information regarding health services in disaster situations. In fact, any type of demand and offer matching can be boosted by social media, assisting both victims and humanitarian organizations in performing more efficiently during disaster response. To address the problem of information reliability in emergency situations, two initiatives are suggested:

- Dissemination of easy-to-understand videos and messages via social media (MERCHANT *et al.*, 2011) that instructs the population to report information with quality and reliability as well as to make rational decisions; and
- Training of volunteers or humanitarian organizations as certified entities in publishing, updating, and monitoring public information using social media, as exemplified by the efforts of the Red Cross (BRIONES *et al.*, 2011).

Understanding risk perception is of special interest in designing and conducting effective training in disaster risk reduction. Attention should be focused not only on the contents of the lessons but also on the way in which the information is communicated. Certain significant results from researches on human perception of risk are listed below:

- Loss aversion bias: People care more about the costs of undertaking a selected action than the gains, even if the two are equally sized (RABIN, 1998, 2002);
- Inertia: New efforts towards prevention are less likely to be embraced than protective measures already in place (KAHNEMAN *et al.*, 1990);

- Over and underestimation: People tend to overestimate low probability events and underestimate large probability events (KAHNEMAN; TVERSKY, 1979);
- Experience: People underestimate risks that they have not experienced and overestimate those that they have recently experienced (JACKSON, 1981; HUNG *et al.*, 2007);
- Framing matters: People generally believe a disease to be less dangerous when "fatalities" are conveyed as percentage probabilities (12.86%) than as proportions or fractions (1,286 out of 10,000) (YAMAGISHI, 1997). Psychology students at the University of Zurich perceived a higher threat of a flood when it was presented as a 40-year risk (33% probability) as opposed to an annual risk (1% probability) (KELLER *et al.*, 2006);
- Implicit costs: Kunreuther and Pauly (2004) hypothesize that the explicit or implicit costs of discovering the true probability of rare events explains why people often fail to purchase insurance against low-probability high-loss events.

In general, the findings regarding risk perception illustrate the natural tendency of human beings to underestimate risk. Thus, in the absence of constant efforts to engage the population in emergency preparedness, two structural problems are expected: 1) actions will be mostly reactive instead of preventive, and 2) disaster response operations will be inefficient, badly coordinated, and associated with poor performance of the humanitarian supply chain.

Vulnerability issues

The work by O'Keefe *et al.* (1976) was the first publication in a wide-circulation journal to report the interface between natural disasters and the vulnerable human population segments. At that time, they explained that the increase in the number of victims of natural disasters was caused by population growth: '*As population continues to expand, and the resources continue to be controlled by a minority, the real standard of living drops for much of world's population*'. In other words, the more a population grows, the more vulnerable it becomes. To reduce this vulnerability, preventive planning should be established and consider the relevant geographical and geological aspects as well as socio-economic and cultural characteristics.

According to Neumayer and Plümper (2007) and O'Keefe *et al.* (1976), gender, biological, and physiological differences in the human capacity for disaster response can lead to different mortality rates because men may be physiologically better equipped to survive the physical impact of a disaster (among other reasons). For example, if a woman has less strength than a man, she will be more easily swept away by water, snow or land. Additionally, under disaster scenarios, women usually move more slowly in crucial physical activities, such as running, climbing trees, and reaching rescue points.

Chou *et al.* (2004) studied the risk of death in earthquakes. The literature suggests that mental and physical health limitations can affect the disaster response. In addition, health and socioeconomic status (SES) may be two important determinants of earthquake

vulnerability, but little is known about the relationship between these risk factors and earthquake-related deaths.

Petley (2012) studied the world distribution of landslides and presented a spatial distribution. Brazilian States were included in this allocation, and an increasing trend and a correlation with El Niño in South America were reported. A discussion regarding the lack and quality of data was initiated, more notably in disaster databases and in locations such as Ethiopia and North Korea.

Neumayer and Plümper (2007) explained the difference in the impact of natural disasters on life expectancy in females compared with males, not only for different physical exposures and physiological or biological gender differences but also due to the various vulnerabilities that are socially constructed and originate from the social roles that men and women voluntarily or involuntarily assume as well as patterns of gender discrimination. They claimed that unequal exposures to risk are a consequence of the socio-economic system and provided the first systematic and quantitative analysis of gender differences in natural disaster mortality. They also found that for natural disasters, on average, the stronger the disaster, the more women killed than men or women killed at a younger age than men.

Doocy *et al.* (2011) analyzed whether geographic location was a key determinant of access to health services and humanitarian assistance for Iraqi refugees in Jordan and Syria. They observed that the population concentration in densely populated urban areas and in distant and remote places are factors that prevent humanitarian assistance from meeting the specific demands and contexts of this population.

Siena and Valencio (2009) address the increasing social vulnerability due to climate change and also evaluate a gender perspective where men carry out external activities and locate the female presence inside the residence, in domestic activities performed along the day.

Case study

This section presents the vulnerability studies with a comparative study of the states according to climate, age, gender and geographical viewpoints, according the disaster type (landslides and floods).

For the regression analyses, reference variables were chosen according to the best representation of the Odds Ratio (OR). The data were codified in a binary way with one record per individual. Associations between the outcome (type of accident) and independent variables (age (b_{1-3}), month (b_{4-6}), climate influence (b_{7-8}) and gender (b_9)) were modelled using multiple logistic regression in order to determine which factors influence the occurrence of natural disaster victims with 90% confidence intervals. Odds ratio was considered with the following variables:

- Gender: Female or Male;
- Age: Children, Youth, Adult, Elderly;
- Climate influence: El Niño, La Niña, None.

Software R, version 2.15.3, (2013 The R Foundation for Statistical Computing), was used for the logit regression analysis (function glm, family=binomial). The results are presented in the following sections.

The climate study analyzes the effect of events such as El Niño and La Niña on the number of deaths caused by floods and landslides. El Niño is an atmospheric and oceanic phenomenon characterized by an abnormal heating of the superficial waters in the tropical region of the Pacific Ocean. This event can influence the global climate because it changes wind behaviors at a worldwide level and also affects rainfall patterns in tropical and temperate regions. La Niña is another atmospheric and oceanic event with characteristics opposing those of the El Niño phenomenon; it is characterized by an abnormal cooling of the superficial waters in the Tropical Pacific Ocean. Although La Niña's impacts are usually the opposite of those of El Niño, this does not mean that the consequences of the two phenomena display the same intensity in the same areas (INPE, 2012).

As the São Paulo, Minas Gerais e Santa Catarina Civil Defense provided gender data, this information enabled a better evaluation of vulnerabilities. Information about age was included in this analysis, too. For Rio de Janeiro State, these data were not provided. From a geographical perspective, the disasters were studied according to city location similarly to Petley (2012). This perspective assists in quantifying the increase in risk in tracking risk areas.

Landslides

Climatic events study

In Table 2, a death count is presented (absolute and relative) as well as the risk rates. The last column contains a count of the number of events in each state.

Table 2: Landslides vulnerability according to climatic events

State period	Influence	Landslide deaths			Years	
		Qtt.	%	Risk Ratio	Qtt.	%
RJ 2000-2011	El Niño	**162**	**64.3**	**1.93**	4	33.3
	La Niña	0	0	0	3	25.0
	Neutral	90	35.7	0.86	5	41.7
SP 2005-2013	El Niño	**59**	**59.6**	**1.34**	4	44.4
	La Niña	4	4	0.18	2	22.3
	Neutral	36	36.4	1.09	3	33.3
MG 2007-2013	El Niño	**28**	**54.9**	**1.28**	3	42.9
	La Niña	6	11.8	0.41	2	28.5
	Neutral	17	33.3	1.17	2	28.6
SC 2008-2012	El Niño	0	0	0	2	40.0
	La Niña	1	0.9	0.05	1	20.0
	Neutral	**106**	**99.1**	**2.48**	2	40.0

Source: Authors using data from States Civil Defense

As shown in Table 2, in both states, there is a noticeable increase in the number of landslide deaths with the presence of El Niño (higher risk ratios; where Risk Ratio = %Deaths ÷ %Years). Multivariate logit also detected a strong influence of El Niño for landslides in São Paulo (OR = 2.2), Minas Gerais (OR = 2.03) and an even greater influence in Rio de Janeiro (OR = 6.4).

In turn, for Santa Catarina, most deaths were caused by landslides in a single disaster in the Itajai Valley during 2008, according to the classification of the CEDEC-SC. The OR values tends to 0 for El Niño e La Niña and could not be analyzed, and the state does not have enough data for a study. The reference variables were: male (gender), elderly (age range), and neutral (climate regime).

Age study

According to Table 3 and the multivariate regressions, the analysis shows the most vulnerable group in São Paulo is that of children (OR 4.17), while in all the others states, the elderly group is the most vulnerable population. The multivariate logit shows that all the other groups had low OR. In Minas Gerais, the OR was 0.23 for youth and 0.45 for adults. In Rio de Janeiro, the OR for adults is 0.87. In Santa Catarina, the OR is not accurate because the deaths are concentrated in few cases of disasters. For landslides, the reference variables were: male (gender), elderly (age range), and neutral (climate regime).

Gender study

Table 3 shows the number of deaths deriving from landslide, relating the number of casualties by age and gender to the proportion of the population of each segment in the State. In São Paulo and in Santa Catarina, the most vulnerable group can be observed to be composed of girls under 14 (higher risk ratio; where Risk Ratio = %Cases ÷ %Population).

The results of the multivariate logit regression confirmed the influence of gender (OR = 2.29) as well as a significant influence on children (OR = 7.75) in São Paulo. For landslides, the reference variables were: Male (Gender), Elders (Age); December (Month); None (Climate influence). For Rio de Janeiro State, gender data were not provided.

Geographical perspective

Figure 1 shows the frequency of landslides is highly affected by the location in all the states. Most disasters are concentrated in the eastern portion of the states, close to the mountain ranges (Serra do Mar, Serra da Mantiqueira and Serra da Bocaina) and the sea. The metropolitan region of Rio de Janeiro city, in which a large proportion of the state population is concentrated, is highly affected by landslides.

Table 3: Landslides vulnerability according to gender and age

State	Age (years)	Male					Female				
		Cases		Population		Risk Ratio	Cases		Population		Risk Ratio
		Qtt.	%	Qtt.	%		Qtt.	%	Qtt.	%	
SP	0 – 14	14	14.1	4,506,645	10.9	**1.29**	29	29.3	4,354,273	10.6	**2.76**
	15 – 24	5	5.1	3,502,704	8.5	0.61	5	5.1	3,438,892	8.3	0.61
	25 – 59	18	18.2	10,004,998	24.2	0.75	18	18.2	10,683,251	25.9	0.7
	> 60	7	7.1	2,063,526	5	**1.42**	3	3	2,707,910	6.6	0.45
	Total	44	44.4	20,077,873	48.7	0.91	55	55.6	21,184,326	51.3	1.11
MG	0 – 14	10	19.6	2,233,803	11.4	**1.72**	5	9.8	2,160,218	11	0.89
	15 - 24	3	5.9	1,742,126	8.9	0.66	1	2	1,710,643	8.7	0.23
	25 - 59	9	17.6	4,626,335	23.6	0.75	10	19.6	4,813,640	24.6	0.8
	> 60	6	11.8	1,039,613	5.3	**2.2**	7	13.7	1,270,952	6.5	**2.12**
	Total	28	54.9	9,641,877	49.2	1.12	23	45.1	9,955,453	50.8	0.89
SC	0 - 14	15	14	694,857	11.1	1.26	18	16.8	666,456	10.7	**1.58**
	15 - 24	8	7.5	563,493	9	0.83	5	4.7	547,351	8.8	0.53
	25 - 59	22	20.6	1,546,879	24.8	0.83	18	16.8	1,571,487	25.2	0.7
	> 60	11	10.3	296,131	4.7	**2.17**	10	9.3	361,782	5.8	**1.61**
	Total	56	52.3	3,101,360	49.6	1.05	51	47.7	3,147,076	50.4	0.95
		Male and Female									
RJ	0 - 14	58	23.0	3,385,639	21.2	1.09	-	-	-	-	-
	15 - 59	157	62.3	10,523,682	65.8	0.95	-	-	-	-	-
	> 60	37	14.7	2,080,608	13	1.13	-	-	-	-	-
	Total	252		15,989,929	100	-	-	-	-	-	-

Source: Authors using data from IBGE (2010) and Civil Defense from the States

Figure 1: Location of fatal victims of landslides in São Paulo, Rio de Janeiro, Minas Gerais and Santa Catarina
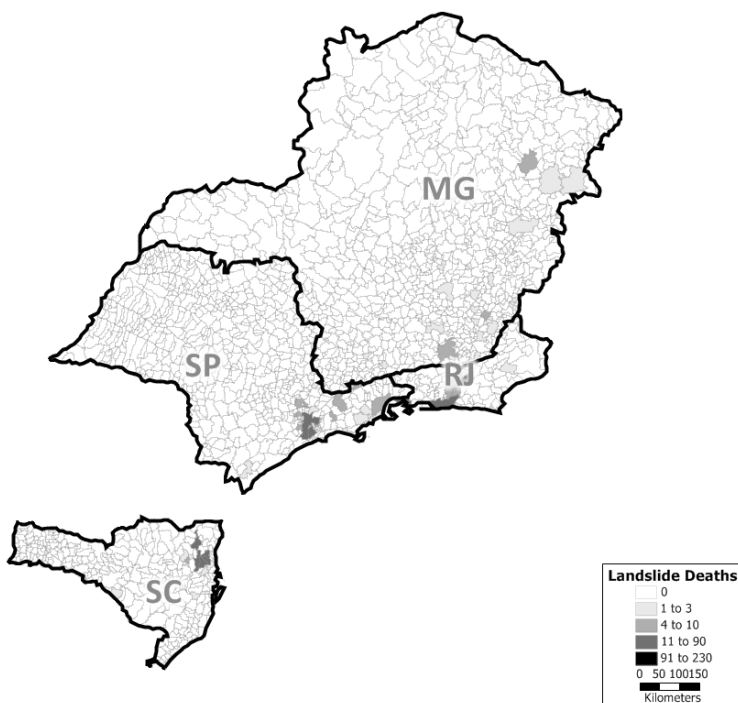
Source: Authors using data from States Civil Defense

Floods

Climatic events study

In Table 4, a death count is presented for each State (absolute and relative) as well as the risk rates.

Table 4: Flood vulnerability according to climatic events

State period	Influence	Flood deaths			Years	
		Qtt.	%	Risk Ratio	Qtt.	%
RJ 2000-2011	El Niño	**301**	**74.5**	**2.23**	4	33.3
	La Niña	21	5.2	0.21	3	25.0
	Neutral	82	20.3	0.49	5	41.7
SP 2005-2013	El Niño	40	40.8	0.92	4	44.4
	La Niña	12	12.2	0.55	2	22.3
	Neutral	**46**	**46.9**	**1.41**	3	33.3
MG 2007-2013	El Niño	19	32.8	0.76	3	42.9
	La Niña	11	19	0.66	2	28.5
	Neutral	**28**	**48.2**	**1.69**	2	28.6
SC 2008-2012	El Niño	1	50	1.25	2	40.0
	La Niña	1	50	2.5	1	20.0
	Neutral	0	0	0	2	40.0

Source: Authors using data from States Civil Defense

Table 4 shows the influence of Neutral periods in São Paulo and in Minas Gerais on floods. The multivariate logit detected in general a low influence of La Niña and El Niño (OR 0.56 for La Niña and 0.73 for El Niño in São Paulo), OR 0.42 for El Niño and 1.01 for La Niña in Minas Gerais, OR 0.53 for El Niño and OR 0 for La Niña in Rio e Janeiro, because the Neutral period has the strongest influence. For floods, the reference variables were: male (gender), elderly (age range), and neutral (climate regime).

Age study

As shown in Table 5, concerning floods, the population profile did not show a strong influence, with only small fluctuations if we consider the proper proportions of each age group in the population. There is no conclusion regarding age.

Multivariate logit detected for floods in São Paulo, the OR for children and adults are 0.29 and 0.63, respectively. Minas Gerais shows a great influence on adults (OR 1.93) and youth (OR 1.41) but children are only 0.72. Santa Catarina has few data for floods; thus, the OR calculation is not accurate. In Rio de Janeiro, the adults and children populations are the most affected (OR of 3.65 and 3.34, respectively). Based on Table 5 and the logit regression, the influence of age for floods cannot be concluded. For floods, the reference variables were: male (gender), elderly (age range), and neutral (climate regime).

Gender study

As shown in Table 5, the most vulnerable group is composed of adult men and elders.

Table 5: Floods vulnerability according to gender and age

State	Age (years)	Male Cases Qtt.	Cases %	Male Population Qtt.	Population %	Male Risk Ratio	Female Cases Qtt.	Cases %	Female Population Qtt.	Population %	Female Risk Ratio
SP	0 – 14	14	14.3	4,506,645	10.9	1.35	4	4.1	4,354,273	10.6	0.39
	15 – 24	3	3.1	3,502,704	8.5	0.37	5	5.1	3,438,892	8.3	0.6
	25 – 59	39	39.8	10,004,998	24.2	**1.64**	18	18.4	10,683,251	25.9	0.71
	> 60	9	9.2	2,063,526	5	**1.84**	6	6.1	2,707,910	6.6	0.93
	Total	65	66.3	20,077,873	48.7	1.36	33	33.7	21,184,326	51.3	0.66
MG	0 - 14	4	6.9	2,233,803	11.4	0.61	5	8.6	2,160,218	11	0.78
	15 - 24	4	6.9	1,742,126	8.9	0.78	5	8.6	1,710,643	8.7	0.99
	25 - 59	21	36.2	4,626,335	23.6	**1.53**	10	17.2	4,813,640	24.6	0.7
	> 60	7	12.1	1,039,613	5.3	**2.27**	2	3.4	1,270,952	6.5	0.53
	Total	36	62.1	9,641,877	49.2	1.26	22	37.9	9,955,453	50.8	0.75
		Male and Female									
RJ	0 - 14	107	26.5	3,385,639	21.2	1.24	-	-	-	-	-
	15 - 59	275	68.1	10,523,682	65.8	0.98	-	-	-	-	-
	> 60	22	5.4	2,080,608	13	0.42	-	-	-	-	-
	Total	404		15,989,929	100		-	-	-	-	-

Source: Authors using data from IBGE (2010) and Civil Defense from the States

The Risk Ratios and the multivariate logit regression results have shown that women have a slightly lesser probability of becoming flood victims, with OR 0.72 in São Paulo and 0.75 for Minas Gerais. The state of Santa Catarina could not be evaluated in this aspect, because the state did not have sufficient flood cases for a reasonable study. In the case of Rio de Janeiro, the records do not register gender, which prevented the comparison. For Floods, the reference variables were: female (gender), elders (age); March/April (month); None (climate influence).

Geographical perspective

In both states, as shown Figure 2, flood casualties are widespread, which means that there are no significant differences imposed by city location in the case of floods.

Figure 2: Location of fatal victims of floods in São Paulo, Rio de Janeiro, Minas Gerais and Santa Catarina

Source: Authors using data from States Civil Defense

Discussions

This section presents an evaluation of the results from the previous section and a comparison of these results with those of the literature review. The vulnerabilities are explored, and the training methods are analyzed to fit those vulnerabilities.

Regression and risk ratio analysis

The most significant results of the vulnerability study according to the most significant risk factors could be summarized as:

- Climate influence: Risk of landslides during El Niño periods, risk of floods during neutral periods and low probabilities for floods and landslides during La Niña periods.

- Age: Children and the elderly are the most vulnerable to landslides and no pattern was identified for floods.
- Gender: Influence of female gender, with strong probability for girls under 14 years of age for landslides and man under 14 and the elderly (male and female) are also affected. For floods, influence of the male gender especially adults and elders.
- Geographical perspective: high risk of landslide on the east coast of SP, RJ, MG and SC, specially the metropolitan region of Rio de Janeiro city. For floods, no pattern was identified.

The gender findings were previously observed by Neumayer and Plümper (2007) who explained those results using physical characteristics (strength and agility) and socioeconomic factors explained by Siena and Valencio (2009). From discussions with members of the Civil Defense and the Fire Department, one possible explanation for this observation is the fact that girls spend a larger amount of time inside their residences, which are more prone to landslides.

Flood results can be explained by socioeconomic and cultural factors and the characteristics of male jobs (SIENA; VALENCIO, 2009). Another possible reason that should be discussed is the fact that in emergencies and rescues, men tend to underestimate risks (as compared with women); for example, men will often try to save their belongings during a flood.

Similar results on geographical perspective were achieved by Petley, (2012).

Training program applicability

Almost all of the programs listed in 3.1 Training programs herein can be targeted towards risk-prone areas or applied to years with the most dangerous climate influences; these actions would increase the efficiency of those programs. According to the regional patterns, the eastern region of São Paulo, Minas Gerais and Santa Catarina States and the metropolitan area of Rio de Janeiro are the areas most vulnerable to landslides (PETLEY, 2012).

From the climate perspective, years in which the El Niño effect takes place should be considered higher risk, especially during the preparation phase. Because the most critical situations are landslides that occur under an El Niño influence and mostly affect children and elders, the implementation of a training program targeting these segments of the population is recommended

However, few programs can be easily targeted to specific segments of the population; either they attempt to reach all the people or they are targeted to specialized personnel, such as rescue teams, a locally designed workforce or regional leaders. The training programs that are able to reach those specific groups are highlighted as follows:

- Introduction of disaster risk reduction issues into the official curricula of schools. Because this program affects students directly, it can be used to address disasters that pose higher danger to children, according to the program created by the UNICEF and UNISDR (2011).

- Implementation of effective warning systems and organization of simulation exercises in communities and schools. Because this program simulates disaster situations, solutions that provide more protection to high-risk groups could be implemented, including tailored evacuation sequences or routes for children or elders with mobility difficulties, according to the program executed by The World Bank and the UN (2010).
- Information for local communities on hydrological disasters. Theoretical and practical classes could target children in schools and elders in nursing homes. TV and radio broadcasts may be used for this purpose as well.
- Instructing inhabitants of landslide-prone areas to recognize dangerous situations and to act effectively to reduce local disaster risks. Conducted by lectures, games and discussions, this approach is particularly effective for children. State Universities and Research Centers could be recruited to assist, according to the program cited by Kobiyama *et al.* (2010) and Pellizzetti *et al.* (2007).

On the other hand, floods in São Paulo affect mostly the adult male population. As pointed out by the fire department, this is due to these groups greater exposure to risks arising from the underestimation of the danger. Thus, awareness programs would be necessary.

Instructing children from landslide-prone areas to recognize dangerous situations using lectures, games, and discussions may have positive results. Additionally, informing elders of hydrological disasters by holding theoretical and practical classes, implementing an effective warning system and organizing simulation exercises could assist this group in overcoming mobility difficulties during danger situations, thus reducing their vulnerability.

The media also plays a fundamental role in this process. The information delivered by the media via TV, radio broadcasts and the web should be tailored according to the regional and climate influences. Disclosures should be regionalized and targeted according to the vulnerabilities of each region. Phenomena such as El Niño or La Niña are known in advance, and media campaigns should warn the population about the most susceptible regions when these events occur. As an example, this educational orientation can implement different campaigns for the West and East regions of the state of São Paulo, Minas Gerais and Santa Catarina (because landslides are concentrated only in the East) as well as in the mountainous and densely populated cities of Rio de Janeiro. The media should also transmit warnings to the population primarily when there is a risk of floods and landslides. It is important for these warnings to be carried out with the endorsement of official agencies such as the Civil Defense to gain greater credibility with the population and publicize cases of people who survived a disaster because they heeded the issued warnings.

Conclusions

In this study on the profile of victims of natural disasters in Brazil, the statistical study delimits some risk groups within the population that should be targeted for public

policies. The issues presented can help government officials to direct mitigation, prevention, and preparation training programs in Brazil by considering the profile of the populations most affected by natural disasters.

The study of victims' profile allows verifying some characteristics of disasters in the states studied (RJ, SP, MG, SC) and to define risk factors to the population. These factors may be useful to government bodies for political awareness and prevention, because they identify and define target groups related with the most vulnerable part of the population. Thus, preventive efforts of mobilization, communication and training would be much more effective, as they would be customized and focused on their respective targets. Landslides and floods history follow a similar trend for all the states, pointing to risk groups considered more physically fragile, as pointed out by Neumayer and Plumper (2007), which indicate the demand for policies focused on these groups, for example, the dissemination trough advertisement tools (leaflets and posters) or television info about home evacuation during the occurrence of heavy rains.

In addition, the media also plays an crucial role by warning and informing the general population on a regular basis. Because it has positive repercussion in disaster prevention, media results could be enhanced by targeting the most vulnerable segments of the population for each type of disaster. For instance, the media could warn children about landslide dangers in cartoon commercials.

References

ABDOLRASULNIA, M.; LOWREY, W.; EVANS, W.; GOWER, K.K.; ROBINSON, J.A.; GINTER, P.M.; MCCORMICK, L.C. Effective media communication of disasters: pressing problems and recommendations. **BMC Public Health**, v. 7, n. 147, p. 97, 2007.

BRAZIL. Governo Federal do Brasil (National Plan Risk Management and Disaster Response Federal Government of Brazil). **Plano Nacional de Gestão de Riscos e Resposta a Desastres**, 2012a. Available at: <http://www.pac.gov.br/pub/up/relatorio/d0d2a5b6f24df2fea75e7f5401c70e0d.pdf>. Accessed in Apr. 15, 2012.

BRAZIL. Secretaria Nacional de Defesa Civil (National Department of Civil Defense), **Banco de Dados de Registros de Desastres (National Disaster Database)**, 2012b. Available at: <http://150.162.127.14:8080/e-soll.ceped.aspx (password required)>. Accessed in July 20, 2012.

BRIONES, R. L.; KUCH, B.; FISHER; L. B.; JIN, Y. Keeping up with the digital age: How the American Red Cross uses social media to build relationships. **Public relations review**, v. 37, n. 1, p. 37 – 43, 2011.

CHAKRAVARTY, A.K. Humanitarian, relief chain: Rapid response under uncertainty. **International Journal of Production Economics,** v. 151, p. 146–157, 2014.

CHO, S.H.; GOWER, K.K. Framing effect on public's response to crisis: human interest frame and crisis type influencing responsibility and blame. **Public Relations Review**, v. 32, n. 4, p. 420-422, 2006.

CHOU, Y.-J.; HUANG, N.; LEE, C.-H.; TSAI, S.-L.; CHEN, L-S.; CHANG, H.-J. Who Is at Risk of Death in an Earthquake? **American Journal of Epidemiology**, v. 160, n. 7, p. 688–695, 2004.

DALMAU, M.; TANI, V.Z.; IRAPUAN, P.L.; VALENTE, A.M. Prevenção e redução de desastres para a sociedade catarinense: a experiência de educação a distância do Ceped/ UFSC com a Defesa Civil de Santa Catarina. In: SIMPEP, 12., 2005, Bauru-SP.

DOBSON, A. J.; BARNETT, A.G. **An introduction to generalized linear models**. 3rd ed. Boca Raton: CRC Press, 2008.

DOOCY, S.; SIROIS, A.; ANDERSON, J.; TILEVA, M.; BIERMANN, E.; STOREY, J. D.; BURNHAM G. Food security and humanitarian assistance among displaced Iraqi populations in Jordan and Syria. **Social Science & Medicine**, v. 72, p. 273-282, 2011.

EM-DAT - THE INTERNATIONAL DISASTER DATABASE; CRED - CENTRE FOR RESEARCH ON THE EPIDEMIOLOGY OF DISASTERS. **Disaster Trends. Details Disaster List**, 2014. Available at: <http://www.emdat.be/search-details-disaster-list>. Accessed in Feb.19, 2014.

FEMA - FEDERAL EMERGENCY MANAGEMENT AGENCY. US DEPARTMENT OF HOMELAND SECURITY, EMERGENCY MANAGEMENT INSTITUTE. **Emergency Management**, 2012. Available at: http://training.fema.gov/emiweb/ downloads/is1_Unit1.pdf. Accessed in Apr. 02, 2012.

GHWA - GLOBAL HEALTH WORKFORCE ALLIANCE; WHO - WORLD HEALTH ORGANIZATION; IFRC - INTERNATIONAL FEDERATION OF RED CROSS AND RED CRESCENT SOCIETIES; UNICEF - UNITED NATIONS CHILDREN'S FUND; UNHCR - UNITED NATIONS HIGH COMMISSIONER OF REFUGEES. **Scaling up the community-based health workforce for emergencies**, October, 2011. Available at: < http://www.who.int/workforcealliance/knowledge/publications/alliance/ jointstatement_chwemergency_en.pdf?ua=1 >. Accessed in July 20, 2012.

GOMES JR, C.A.A.; ALVES, M.L**. Capacitação em defesa civil: sistema de comando em operações - SCO**, Florianópolis: Lagoa Editora, 2004. 136 p.

HUNG, H. V.; SHAW, R.; KOBAYASHI, M. Flood Risk Management for the Riverside Urban Areas of Hanoi. **Disaster Prevention and Management**, v. 16, n. 2, p. 245–58, 2007.

IBGE - INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. **Produto Interno Bruto**, 2011a. Available at: <http://www.ibge.gov.br/home/presidencia/noticias/ images/2522_3643_173712_106392.gif>. Accessed in Feb. 19, 2014.

IBGE - INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. **Censo 2010**, 2011b. Available at: <http://www.ibge.gov.br/english>. Accessed in Dec. 20, 2012.

INPE - INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS. **EL Niño e La Niña**, 2012. Available at: <http://enos.cptec.inpe.br/>. Accessed in Sep. 24, 2012.

JACKSON, E.L. Response to Earthquake Hazard: The West Coast of America. **Environment and Behavior**, v. 13, n. 4, p. 387–416,1981.

KAHNEMAN, D.; TVERSKY, A. Prospect Theory: An Analysis of Decision Under Risk. **Econometrica**, v. 47, n. 2, p. 263–91, 1979.

KAHNEMAN, D.; KNETSCH, J.L.; THALER, R.H. Experimental Tests of the Endowment Effect and the Coase Theorem. **Journal of Political Economy**, v. 98, n. 6, p. 1325–48, 1990.

KELLER, C.; SIEGRIST, M.; GUTSCHER, H. The Role of the Affect and Availability Heuristics in Risk Communication. **Risk Analysis**, v. 26, n. 3, p. 631–639, 2006.

KOBIYAMA, M.; MONTEIRO, L.R.; MICHEL, G.P. Aprender hidrologia para prevenção de desastres naturais. In: Seminário de Extensão Universitária da Região Sul, 28.,2010, Florianópolis.

KUN, P.; WANG, Z.; CHEN, X.; L,E H.; GONG, X.; ZHANG, L.;YAO, L. Public health status and influence factors after 2008 Wenchuan earthquake among survivors in Sichuan province, China: cross-sectional trial. **Public Health**, v.124, p. 573 – 580, 2010.

KUNREUTHER, H.; PAULY, M. Neglecting Disaster: Why Don't People Insure Against Large Losses? **The Journal of Risk and Uncertainty**, v. 28, n. 1, p. 5-21, 2004.

MARENGO, J. A.; VALVERDE, M. C.; OBREGON, G. O. Observed and projected changes in rainfall extremes in the Metropolitan Area of São Paulo. **Climate Research**, v. 57, p. 61-72, 2013. doi: 10.3354/cr01160

MERCHANT, R.M.; ELMER, S; LURIE, N. "Integrating social media into emergency-preparedness efforts". **The New England Journal of Medicine**, v. 365, n. 4, p. 289-291, 2011.

NEUMAN, W.R.; JUST, M.R.; CRIGLER, A.N. **Common Knowledge: News and the Construction of Political Meaning**. University of Chicago, Chicago, IL, 1992.

NEUMAYER, E.; PLÜMPER, T. The Gendered Nature of Natural Disasters: The Impact of Catastrophic Events on the Gender Gap in Life Expectancy, 1981–2002. **Annals of the Association of American Geographers**, v. 97, n. 3, p. 551-66, 2007.

NOAA - NATIONAL WEATHER SERVICE, CENTER FOR WEATHER AND CLIMATE PREDICTION, Climate Prediction Center. **Historical El Niño/ La Niña episodes (1950-present)**. Maryland, 2014. Available at: <http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml>. Accessed in Feb. 21, 2014.

O'KEEFE, P.; WESTGATE K.; WISNER, B. Taking the naturalness out of natural disasters. **Nature**, v. 260, p. 566–567, 1976.

PELLIZZETTI, M.A.; WITT, E.A.; VIEIRA, R. Fenomenologia e as atividades educativas não-formais realizadas junto à comunidade da Rua Emil Wehmuth, no Bairro da Velha Grande, Blumenau, SC. **OLAM Ciência & Tecnologia**, v. 7, n. 2, p. 223-243, 2007.

PETLEY, D. Global patterns of loss of life from landslides. **Geology**, v. 40, p. 927-930, Oct. 2012.

PINTO O. JR.; I. PINTO, R. C. A.; FERRO, M. A. S. A study of the long-term variability of thunderstorm days in southeast Brazil. **Journal of Geophysical Research: Atmospheres**. v. 118, n. 11, p. 5231–5246, 2013. doi:10.1002/jgrd.50282

RABIN, M. Psychology and Economics. **Journal of Economic Literature**, v. 36, n. 1, p. 11-46, 1998.

RABIN, M. A Perspective on Psychology and Economics. **European Economic Review**, v. 46, n. 4-5, p. 657–85, 2002.

RODRIGUEZ, H.; QUARANTELLI, E.L.; DYNES, R.R. **Handbook of Disaster Research**, New York: Springer, 2007.

ROTTKEMPER, B.; FISCHER, K.; BLECKEN, A.;DANNE, C. Inventory relocation for overlapping disaster settings in humanitarian operations. **OR Spectrum**, v. 33, n. 3, p. 721-749, 2011.

SIENA, M.; VALENCIO, N. F. L. S. Gênero e Desastres: uma perspectiva brasileira sobre o tema. In: Valencio, N.; Siena, M.; Marchezini, V.; Gonçalves, J.C.. (Org.). **Sociologia dos Desastres: construção, interfaces e perspectivas no Brasil**. São Carlos: RiMa, 2009. p. 58-66.

THE WORLD BANK and UN. **Natural hazards, unnatural disasters: The economics of effective prevention**. Washington DC, 2010. Available at: <http://www.gfdrr.org/gfdrr/node/281>. Accessed in July 20, 2012.

THOMAS, A.S.; KOPCZAK, L.R. **From logistics to supply chain management: The path forward in the humanitarian sector**. San Francisco: Fritz Institute, 2005. Available at: <http://www.fritzinstitute.org/PDFs/WhitePaper/Fromlogisticsto.pdf>. Accessed in Mar. 03, 2011.

TOMASINI, R. M.; VAN WASSENHOVE, L. N. From preparedness to partnerships: case study research on humanitarian logistics. **International Transactions in Operational Research**, v. 16, p. 549–559, 2009.

UNICEF - UNITED NATIONS CHILDREN'S FUND; UNISDR - UNITED NATIONS INTERNATIONAL STRATEGY FOR DISASTER REDUCTION. **Children and disasters: building resilience through education**, 2011. Available at: <http://www.unisdr.org/we/inform/publications/24583>. Accessed in July 20, 2012.

UNISDR - THE UNITED NATIONS' OFFICE FOR DISASTER RISK REDUCTION. **How to make cities more resilient: a handbook for local government leaders**. Geneva, 2012a. Available at: <http://www.unisdr.org/we/inform/publications/26462>. Accessed in July 20, 2012.

UNISDR - THE UNITED NATIONS' OFFICE FOR DISASTER RISK REDUCTION. SECRETARIAT. **Training package on natural hazards and early warning for training of trainers' in Kenya**. Nairobi, 2012b. Available at: <http://www.unisdr.org/we/inform/publications/26445>. Accessed in July 20, 2012.

WEST, D. M.; ORR, M. Race, Gender, and Communications in Natural Disasters. **The Policy Studies Journal**, v. 35, n. 4, p. 569-586, 2007.

YAMAGISHI, K. When a 12.86% Mortality Is More Dangerous Than 24.14%: Implications for Risk Communication, **Applied Cognitive Psychology**, v. 11, n. 6, p. 495–506, 1997.

PROPOSAL OF A NATURAL DISASTER TRAINING PROGRAM BY CONSIDERING THE PREVIOUS VICTIMS' PROFILE

IRINEU DE BRITO JUNIOR
CARLOS HENRIQUE VIEGAS DE ROSIS
PRISCILLA VIEIRA CARNEIRO
ADRIANA LEIRAS
HUGO TSUGUNOBU YOSHIDA YOSHIZAKI

Abstract: In past decades, disasters have increased in number and intensity. Humanitarian organizations have looked for approaches to prevent and to prepare for disasters. This situation requires the study of previous disasters so that decisions can target the main vulnerabilities. The purpose of this paper is to assist policies for prevention and preparedness through training programs for disaster preparation in Brazil considering the profile of the populations affected by disasters. Literature reviews of vulnerability studies and training methods focused on natural disasters prevention are conducted, and a statistical analysis of data on victims of natural disasters in four Brazilian states is carried out. Finally, training methods are discussed according to the vulnerabilities identified in the study. The conclusions note training programs and methods that should be more effective and targeted in Brazil. The findings can assist disaster mitigation and preparedness in the states studied.

Keywords: Humanitarian logistics; Training programs; Disaster prevention; Population vulnerabilities Natural disasters.

Resumo: Nas últimas décadas, desastres naturais têm aumentado em número e intensidade. Organizações humanitárias têm procurado métodos para prevenção e preparação para desastres. Esta situação requer análise de desastres anteriores para que decisões sejam direcionadas às principais vulnerabilidades. Este trabalho objetiva auxiliar as políticas de prevenção e mitigação, por meio de programas de treinamento voltados a preparação para desastres no Brasil, considerando o perfil das populações afetadas. Estudos sobre vulnerabilidade e métodos de treinamento voltados para a prevenção de desastres são conduzidas, assim como análise estatística de dados sobre vítimas de desastres naturais em quatro estados brasileiros. Finalmente, métodos de treinamento são discutidos de acordo com as vulnerabilidades identificadas no estudo. As conclusões observam que programas e métodos

de treinamento devem ser mais eficazes e direcionados no Brasil. Estes resultados podem ajudar na mitigação e prevenção de desastres nos estados analisados.

Palavras-chave: Logística humanitária; Programas de treinamento; Prevenção de desastres; Vulnerabilidades populacionais; Desastres naturais.

Resumen: En pasadas décadas los desastres han incrementado en número e intensidad. Organizaciones humanitarias han buscado métodos para la prevención y preparación ante desastres. Esto requiere el estudio de anteriores desastres, tal que las decisiones puedan enfocarse en las principales vulnerabilidades. Este trabajo tiene como objetivo impulsar las políticas de prevención y preparación a través de programas de capacitación orientados a la preparación ante desastres en Brasil, considerando el perfil de las poblaciones afectadas. Se conducen estudios sobre vulnerabilidad y métodos de capacitación en prevención de desastres naturales, y se realiza un análisis estadístico sobre las víctimas de desastres naturales en cuatro estados brasileros. Finalmente, se discuten métodos de capacitación de acuerdo a las vulnerabilidades identificadas en el estudio. Se concluye que los programas y métodos de capacitación deben ser más efectivos y orientados a Brasil. Estos resultados pueden ayudar a la mitigación y prevención de desastres en los estados analizados.

Palabras clave: Logística humanitaria; Programas de capacitación, Prevención de desastres; Vulnerabilidad de la población, Desastres naturales.