Original article :

Community awareness about disaster preparedness: Principal component analysis (PCA)

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Abstract

Background:
Responsibility for disaster preparedness is not limited to healthcare institutions and healthcare providers; communities must also be involved. Knowledge of community members' awareness of disaster preparedness will enhance and strengthen a community's resilience to disaster. This study therefore explored factors related to community members' perceptions of disaster.

Methods:
A cross-sectional study was conducted, and principal component analysis (PCA) was used to extract essential factors from the data. Questionnaires were used to collect ordinal (yes; no) and Likert scale (ranging from 1 = strongly disagree to 5 = strongly agree) data from visitors to the Department of Applied Medical Sciences at Taif University. The questions were designed to understand how participants prepare for disasters. Descriptive analysis and PCA were conducted using a PCA extraction method. Varimax rotation was

الملخص

الخلفية:
لا تقتصر مسؤولية التأهب للكوارث على المؤسسات ومقدمي الرعاية الصحية بل يجب أن يشارك المجتمع أيضًا في الاستعداد للكوارث. إن معرفة العوامل المتعلقة بإدراك أفراد المجتمع للتأهب للكوارث ستعزز وتقوي مرونة المجتمع في مواجهة الكوارث. لذلك تهدف هذه الدراسة لاستكشاف العوامل المتعلقة بتصورات أفراد المجتمع تجاه تحضيراتهم للكوارث.

طرق البحث:
تم إجراء دراسة مقطعية مستعرضة وتم استخدام تحليل المكونات الرئيسية لاستخراج العوامل الأساسية من البيانات حيث تم استخدام الاستبيانات لجمع البيانات تشمل عدة أسئلة ذات الأجوبة بنعم ولا وأيضا الأسئلة التي تتطلب الأجوبة باستخدام مقياس ليكرت (يتراوح من ١ = لا أوافق بشدة إلى ٥ = موافق بشدة) تم جميع البيانات من عينة من افراد المجتمع عند زيارتهم لكلية العلوم الطبية التطبيقية. تم تصميم الأسئلة لفهم كيفية الاستعداد للكوارث حيث تم تحليل البيانات وصفيا وذلك عبر التحليل العاملي.

النتائج:
من بين المشاركين في العينة، أجاب ٣٨٣ (٦٥,٢٠٪) على الاستطلاع. كانت الأغلبية من الذكور، بينما كانت نسبة الإناث فوق

used with Kaiser normalization, and loading on the factor had to be above 0.40.

Results:
Of the participants sampled, 383 (65.20%) responded to the survey. The majority were male, and just over a quarter were female. Community members were found to lack emergency and disaster kits, safety measures, and fire extinguishers in their homes. In total, three factors were extracted by the PCA: (1) perception of government efforts, (2) readiness of community members, and (3) general knowledge regarding disasters.

Conclusions:
This study showed a lack of preparedness for and awareness of disasters. It is therefore recommended that the government facilitate and educate community members to ensure that all families have a well-established disaster plan.

Keywords:
Community; Saudi Arabia; Disasters; Plan; Preparedness

الربع بقليل. كان أعضاء المجتمع يفتقرون إلى حقائب الطوارئ والكوارث، وتدابير السلامة، وطفاية الحريق في منازلهم. في المجموع، تم استخلاص ثلاثة عوامل من قبل محكمة التحكيم الدائمة على النحو التالي: (١) التصورات حول الجهود الحكومية، (٢) جاهزية أعضاء المجتمع، و (٣) المعرفة العامة فيما يتعلق بالكوارث.

الخلاصة:
وعلى ضوء هذه النتائج أظهرت هذه الدراسة عدم الاستعداد والوعي بالكوارث. لذلك توصي الدراسة بزيادة الوعي التثقيف لجميع أفراد المجتمع وأيضا التأكد من ان جميع الأسر لديها خطة كوارث راسخة وقابلة للتطبيق

Introduction

Responsibility for disaster preparedness is not limited to healthcare institutes and healthcare providers; the community must also be involved. Communities play a major role in preventing disasters, responding to them by following warning instructions [1]. When communities hear, believe, and act on warning instructions and information regarding disaster risks and hazards, they can be mitigated, which builds community residences [1, 2]. Developing community responsibility for managing disasters starts by providing communities with information about all aspects of disaster management.

Hazards that might cause damage and disturbance to a community's functions can be either natural or man-made; these hazards cause danger, which increases the probability of disaster [3-6]. Risk refers to the probability that a disaster will occur. Dangerous events can be prevented,

and risk can be mitigated to reduce the probability of a causal event. Community members' awareness of risk, especially of events that may lead to tragedy, enhances and facilitates disaster prevention, helping people deal with disasters effectively if they occur [7]. The steps of risk modification are as follows: (A) assessing sources of damage, (B) examining sources of damage, (C) analyzing sources of damage, (D) summarizing findings, (E) combining information, and (F) developing a plan and sharing it. A community must recognize all steps [1-3] and participate in them to prevent hazards.

Existing literature highlights the importance of a high level of community contribution in responding to a disaster. Families and local communities are on the frontlines of disasters, and they can contribute by applying safety measures [8]. Safety measures may include at least one family member completing training (e.g. conducting drills), having a basic emergency supply kit at home with items including a first aid kit, mask, non-prescription medications (e.g. pain relievers), cell phones with chargers and a backup battery, and a fire extinguisher. By following safety measures in a timely manner, community members can significantly reduce disasters' effects and associated injuries and mortality [8].

Preparing the community is key to enhancing community members' attitudes, and this preparation may be achieved through strategies such as educational activities and programs to raise awareness. Another strategy is to empower community members to be good citizens and who take responsibility for managing a disaster together. Several studies have been conducted to evaluate the level of disaster preparedness of Saudi Arabian health institutions and healthcare providers, as a result of which more strategies and competencies have been developed to ensure healthcare providers are prepared to respond to disasters and crises and recover very quickly [9-14]. However, none of the studies evaluating the level of disaster preparedness have focused on the availability and awareness of safety measures at home. The aim of this study was to assess perceptions and explore related factors.

Methods

The study used a non-experimental research design with a self-report survey. Data were collected from community members who were sent links to online questionnaires on SurveyMonkey. The sample comprised community members visiting the Department of Applied Medical Sciences at Taif University, who com-

pleted the survey and shared it with their relatives. The study was open to all community members above age 18 who were able to write and read. This study excluded all non-Saudi participants. The sampling methods for this study were convivence using an online survey. The sample size was calculated to meet the requirements of factor analysis; as the population size was not known, the sampling calculation was based on the requirements of PAC, and the sample size was determined to be 100. Sample sizes must be above 100 to ensure the reliability of findings. This has been supported by many experts in the field of factor analysis [15, 16]. After starting to collect data, the researcher boosted online survey response rates by sending emails or messages to participants who were willing to participate in the study. The authors followed ethical principles, and the participants' submission of their responses to the authors indicated their agreement to participate in the study.

The authors developed the survey based on the literature review, and it collected demographic data, including age, gender, social status, and qualifications (data). The survey asked a variety of "yes" or "no" questions about whether they had an emergency kit, whether they had experienced a disaster or tragic event, what safety equipment they had available at home, and whether they had a fire extinguisher at home. The reliability of this part of the survey was 0.78, which indicates relatable as the variable lies within the normal range. The third part of the survey collected data about participants' perceptions and level of awareness of community disasters using a 16-item Likert scale questionnaire (1 = strongly disagree, 2 = disagree, 3 = natural, 4 = agree, 5 = strongly agree). The reliability score of the third part, after all redundant items were deleted, was within the normal range (0.80).

Data analysis was conducted using SPSS version 24 [17] to calculate frequencies and percentages of demographic data and of data from "yes" or "no" questions. Means and standard deviations of all items rated using a Likert scale were recorded. A value below 2.5 (50%) indicated a low level of preparedness, a value between 2 (50%) and 4 (80%) indicated a moderate level of preparedness, and a value above 4 indicated a high level of preparedness. PCA was used to remove redundant items and categorize the remaining ones into factors. The PCA protocol was adapted according the guidelines for exploratory factor analysis [16]. An independent samples t-test was conducted to compare the extracted factors with those of male and female subgroups and subgroups of those who did and did not have an emergency and disaster kit.

Results

Of the sampled participants, 383 (65.20%) responded to the survey. The majority were male, and just over a quarter were female. The majority of participants were married (64%). In terms of education level, most participants were in the undergraduate group and the primary school group had the lowest number of participants. Table 1 presents participants' demographic data, including gender, marital status, and education level.

Table 1:Demographic data

Category	Subgroup	Frequency	Percent
Gender	Male	253	65.2
	Female	130	33.5
Total		383	98.7
Age	20–29	172	44.3
	30–39	118	30.4
	40–49	57	14.7
	50 and above	41	10.6
Total		388	100.0
Marital Status	Single	132	34.0
	Married	247	63.7
	Other	9	2.3
Total		388	100.0
Education Level	Primary	5	1.3
	Secondary	72	18.6
	Bachelor	282	72.7
	Postgraduate	29	7.5
Total		388	100.0

Interestingly, only around a third (35.8%) of participants had an emergency and disaster kit, while around two thirds (64.2%) had no kit. Around 77% had not experienced a disaster in their lives, while just below a quarter had. Only a few participants were able to implement safety measures in their home, while more than 60% had taken no safety measures. Similarly, most participants had no fire extinguisher at home. Table 2 presents the frequencies and percentages of participants' experiences.

Table 2: Safety measures at Home for Disaster Preparedness

Category	Subgroup	Frequency	Percent
I have an emergency and disaster kit.	Yes	139	35.8
	No	249	64.2
Total		383	100.0
I have experienced a disaster.	Yes	88	22.7
	No	300	77.3
Total		388	100.0
Safety measures are available in my home.	Yes	140	36.1
	No	248	63.9
Total		388	100.0
I own a fire extinguisher at home.	Yes	78	20.1
	No	310	79.9
Total		388	100.0

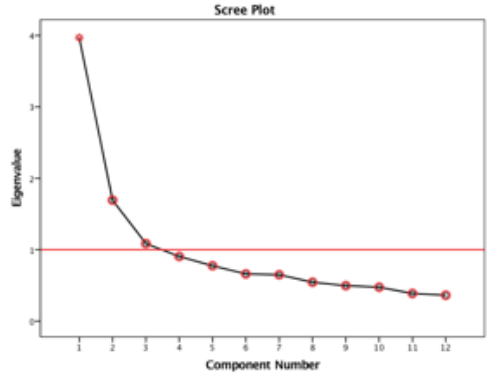
The overall score for community members' level of preparedness was below the cut-off point (2.5), which indicates a low level of preparedness, as shown in Table 3.

Table 3: Safety measures at Home for Disaster Preparedness

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Level of Preparedness	384	2.8693	.70	-.09	.12	-.39	.24

Figure 1 presents all the factors. Factors were extracted if they had eigenvalue plots above the elbow of a scree plot (those above the red line in Figure 1).

Figure 1: Scree plot showing all factors



Five iterations of PCA extracted three factors, which can be summarized as: (1) community awareness of the government's disaster preparedness efforts (2) individuals' readiness (3) knowledge regarding disasters. These factors have an explained variance of 56.24%, which is in the normal range of 50–100%. Table 4 indicates the accepted loading of items on factors, as the differences in these cases were greater than 0.40. The factor Rotation Achieve simple structure, which presented the items in three factors as follows:

Six items were loaded onto the first factor, which explained community awareness of the government's disaster preparedness efforts. The loading of these items ranged from 0.81 to 0.58. The item with the highest loading was "There are shelters in my community adapted and specialized to receive people affected by disasters," which had a mean score of 3.30 and a standard deviation of. The item with the second highest loading was "Competent authorities offer courses sufficient to educate the community about disasters," which had a mean score of and a standard deviation of. The item with the third highest loading was "Sufficient care is taken to provide safety facilities in roads, parks, schools, and other private facilities," which had a mean score of 3.42 and a standard deviation of 1.25.

The second factor explored in this study focused on individuals' plan in the event of a disaster, level of preparedness, and background in and information about disasters. Three items were loaded on this factor, with loading scores ranging from 0.85 to 0.51. The item with the highest loading was "I have a disaster plan at home," which had a mean of 3.06 and a standard deviation of 1.14. The third factor was related to participants' knowledge of disasters in general. Three items were loaded on this factor, with loading scores ranging from 0.76 to 0.65. The item with the highest loading score was "I have information on and a background in types of disasters". This factor focused on knowledge regarding disasters.

Table 4: Descriptive statistics showing the accepted loading of items on factors

Items	Factors			Descriptive Statistics		
	1	2	3	M	SD	h
There are shelters in my community adapted and specialized to receive people affected by disasters.	.81	.03	−.01	3.30	1.26	.66
Competent authorities offer courses sufficient to educate the community about disasters.	.78	.16	−.04	3.45	1.31	.64
Sufficient care is taken to provide safety facilities in roads, parks, schools, and other private facilities.	.72	.08	.11	3.42	1.25	.54
Society is knowledgeable about disasters.	.70	.17	.05	3.39	1.12	.52
I believe that competent authorities take precautions to reduce the risk of disaster risk in my community.	.65	.18	.08	2.50	1.20	.50
We have plans to secure dangerous items in the event of a disaster.	.58	.47	.11	3.36	1.22	.58

Items	Factors			Descriptive Statistics		
	1	2	3	M	SD	h
I have a disaster plan at home.	.14	.85	.02	3.06	1.14	.74
I am adequately prepared to face a disaster.	.10	.82	.18	2.69	1.09	.72
I have a background in emergencies and disasters.	.28	.51	.23	2.55	1.16	40.
I have information on and a background i n types of disasters.	.04	.15	.76	1.34	.47	.71
I know the difference between natural and man-made disasters.	−.03	.04	.71	1.11	.31	.51
I have sufficient knowledge to communicate with competent authorities in the event of a disaster.	.11	.12	.65	1.25	.43	.50
Explained variance for each factor	26.23	16.70	13.31	----	------	---
Total	56.24			2.61	0. 99	0.60

All three factors have normal distribution values within the normal range of skewness and kurtosis (+2.0 to -2.0). There was a significant difference between the two groups for items loaded on factor two, including whether they had an emergency and disaster kit (M = 2.94, SD = 0.87) and emergency bags and equipment (M = 2.48, SD = 0.81; t [384] = −5.08, p = 0.01 two-tailed) at home. The magnitude of the differences in means (mean difference = 0.50, 95% CI: −0.64 to .28) was very high (eta squared = 0.06). For items loaded on factor three, there were differences between male (M = 1.20, SD = 0.28) and female (M = 1.31, SD = 0.31; t (380) = −3.46, p = 0.01 two-tailed) groups. The magnitude of the differences in means (mean difference = 0.50, 95% CI: −0.17 to .05) was very small (eta squared = 0.03). Details are given in Tables 5 and 6.

Table 5: Independent samples test comparing extracted factors between subgroups of those who did and did not have emergency and disaster kits

F		Levine's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper	
Factor 1	Equal variances assumed	.40	.52	-1.60	384	.108	-.15499	.09632	-.34436	.03439

F		Levine's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper	
Factor 1	Equal variances not assumed			-1.61	281.123	.108	-.15499	.09622	-.34439	.03441
Factor 2	Equal variances assumed	.93	.33	-5.01	384	.000	-.46020	.09065	-.63843	-.28197
	Equal variances not assumed			-5.190	298.809	.000	-.46020	.08867	-.63469	-.28570
Factor 3	Equal variances assumed	1.78	.18	-1.81	385	.065	-.05788	.03125	-.11933	.00356
	Equal variances not assumed			-1.900	304.559	.058	-.05788	.03047	-.11784	.00207

Table 6: Independent Samples Test comparing extracted factors between male and female subgroups

F		Levine's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Factor 1	Equal variances assumed	.15	.69	.39	379	.69	.03	.09	-.15	.23
	Equal variances not assumed			.390	257.78	.69	.03	.09	-.15	.23
Factor 2	Equal variances assumed	.73	.39	-1.13	379	.25	-.10	.09	-.29	.07
	Equal variances not assumed			-1.16	279.44	.24	-.10	.09	-.29	.07
Factor 3	Equal variances assumed	1.51	.20	-3.46	380	.01	-.10	.03	-.17	-.04
	Equal variances not assumed			-3.34	235.75	.01	-.10	.03	-.17	-.04

Discussion

Community members play an important part in disaster preparedness and response, which increases their community's resilience to disaster. This study explored community members' perceptions of disaster preparedness in Taif city, Saudi Arabia. The findings of this study indicated that (A) most community members did not have an emergency and disaster kit, (B) most community members had no experience with disasters, (C) safety measures were lacking, (D) not all community members had fire extinguishers, (E) awareness of preparedness is essential, (F) individuals' readiness in terms of having a plan for community members is important, and (E) general knowledge about disasters is one of the most important components of disaster awareness in a community.

This study indicated that most of the population needed to improve its disaster preparedness. First, most did not have emergency and disaster kits at home. This was a disappointing finding; more effort is needed to ensure that homes have the basic equipment for responding to emergencies and saving lives. The existing literature has focused on the importance of an emergency and disaster kit with a first aid kit, a cell phone, a flashlight, and other materials that vary according to local risks and hazards[18]. Second, the population lacked experience in responding to disasters, as most had never experienced one. This might be related to the rarity of disasters in Saudi Arabian communities; however, as COVID-19 has caused a worldwide pandemic at the family and community level and at the level of health organizations, many families have begun to recognize the importance of disaster preparedness at home[19]. Third, this study confirmed the importance of implementing safety measures at home, in contrast to a study conducted in the United States, which found that only 17% of 314 participants had no functioning smoke detector [20]. Finally, it is important to have fire extinguishers in every home and workplace. This study confirmed that around 80% of participants had no fire extinguisher, similar to the finding in the United States that 50% of participants had no fire extinguisher in their home [20].

The first factor community members must be aware of is preparedness in terms of shelters, safety, and percussing. A study conducted in the United States found that less than half of participants perceived themselves to be prepared for disasters [13]. In this study, community members perceived themselves to be moderately prepared for disasters, which is inadequate. It is important to increase community aware-

ness of disasters in Taif City by creating strategies to strengthen the community's preparedness to deal with risks, especially approaches that use existing facilities. Participants perceived that adequate educational programs to increase community awareness of disasters and adequate shelters and measures were available.

Shelters house and provide medical care for people affected by disasters or those whose homes have been lost or damaged. Knowledge of where to access shelters enhances the effectiveness of disaster response and recovery. Participants perceived themselves to know where shelters were located in their communities, but a strong plan is needed to help shelters identify the community's needs. A Japanese study highlighted the need for electricity, accessible food, and the use of public and private facilities [5]. This finding suggests that more effort must be made to develop and improve the effectiveness of shelters and education on disasters and that further research must be done. In Saudi Arabia, community education on community awareness of disasters is new, but it has been incorporated into the disaster medicine curriculum [21], and its content is based on the principles and needs of communities. Short sessions at schools and other public facilities, such as shopping malls, are raising community awareness in parts of Saudi Arabia at risk of earthquakes, flooding, and pandemic outbreaks [21].

Planning is essential when responding to a disaster. Plans vary in terms of type and level and across institutional, regional, and family levels [6, 9, 10]. It has been confirmed that families' disaster preparedness is one of the most important issues related to planning community responses to disasters[6]. Encouraging community members to have a disaster plan at home will enhance their preparedness and response [22]. The literature shows that whether a family had a disaster plan influenced healthcare providers' willingness to respond to a disaster, as this affected their response to the disaster in hospitals [14, 23]. It is therefore very important for families to have a disaster plan in place and to help them develop such plans through instruction or short training courses.

Community members should have enough information and knowledge about disasters and be able to communicate with relevant organizations to enhance their level of preparedness, enabling effective responses and recovery. The findings of this study confirmed that community members must know about different types of disasters. In the literature, disasters have been categorized as natural, such as earthquakes, flooding, pandemics, and volcanic eruptions, or man-made, such as war and ter-

rorism. This finding was consistent with other studies conducted in Saudi Arabia and found that the population lacked information and knowledge about risks and disasters [4, 24]. It is therefore essential to build strategies that increase the population's knowledge of disasters and improve their disaster response. Much research on the topic of disasters in Saudi Arabia has been conducted in the fields of health, education, and technology [11, 12, 21, 25, 26], but research on disaster at the community level is sparse, so information and knowledge is limited.

Conclusions

The findings of this study show the importance of disaster preparedness in Saudi Arabia's population; increasing readiness for disasters will require much effort by the government and community members to enhance the country's resilience to disasters. More educational programs for families and community populations are needed to increase their awareness about disasters and their impact, to help them prepare an emergency and disaster kits, to ensure that families have safety measures in place and presence of fire extinguishers at home.

The study recommends that all families must have a well-established disaster plan. More effort from the government is needed to facilitate these measures and educate the community members as this area has received little attention in research and education.

Limitations

Limitations of this study include its design as a survey, which might affect the results' generatability. This study must therefore be replicated in other areas of Saudi Arabia. Some issues regarding the sampling technique must also be considered, as the subgroup of the population of Taif is not very well known.

Conflicts of interest

We declare no conflicts of interest. The study was not funded.

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