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ORIGINAL RESEARCH

Knowledge, Perceptions, and Practices on Risks and Disasters Among Medical Students. A Multicenter Cross-Sectional Study in 9 Latin American and Caribbean Countries

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Purpose: The objective of this study was to describe the level of knowledge, perceptions, and practices in relation to risks and disasters in medical schools in Latin America and the Caribbean.

Participants and Methods: Multicenter, observational, analytical, non-probabilistic convenience sample study with 2546 medical students in 9 countries of Latin America and the Caribbean. An online survey was conducted between October 2020 and November 2020, using an instrument validated in each country to assess knowledge, perceptions, and practices regarding risk and disaster prevention measures. Frequencies, percentages, mean and standard deviation (SD) were used for descriptive analysis. Differences resulting from the relationship between the variables studied and the level of knowledge were obtained using the Chi-square test. P-value <0.05 was accepted as statistically significant for all analyses.

Results: The highest proportion of responses came from women, third-semester students, and those studying in public universities. Students from Colombia and Honduras had the highest percentage of high levels of knowledge about disasters, while Peruvian students had the highest percentage of low levels of knowledge. Women and students from public universities showed a higher proportion of high levels of knowledge. 52.7% considered that they live in a country with a medium risk of natural disasters, while 91.2% said that Latin American and Caribbean countries are not prepared to face natural disasters. Only 43.6% believe they are prepared to help in the event of a natural disaster.

Conclusion: Most of medical students from Latin America and Latin America and the Caribbean have high and medium level of knowledge in risks and disasters. However, the implementation of disaster training programs for medical students has the potential to improve the preparedness, knowledge, and skills that are important for medical personnel to improve their self-confidence, and their ability to respond, resulting in more effective systems.

Keywords: disaster medicine, knowledge, perceptions, practices, students, medical, Latin America, Caribbean

Introduction

Disasters are defined as phenomena that cause socioeconomic damage, infrastructure damage, loss of health services, health deterioration, and death.[1–3] The main catastrophes caused by natural disasters revolve around devastating forces such as earthquakes, volcanic eruptions, hurricanes, floods, fires, tornadoes, and extreme temperatures that directly and

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indirectly impact the population.[1,4] Countries that are exposed to natural and man-made disasters are increasingly alarming and threatening their inhabitants.[5]

Despite constant advances and updates in the field of meteorology and geology, disasters follow an irregular and unpredictable pattern, triggering crises and causing setbacks in different areas of development.[6] The effect of these phenomena among humans is based on immediate deaths, temporary and permanent disabilities, and probable outbreaks of diseases caused by ecological changes.[2,7] Likewise, catastrophes have been shown to especially affect populations characterized by high rates of poverty, unplanned settlements, and high rates of ignorance of risk and prevention issues.

The incidence and increase of these natural phenomena have increased worldwide where, at the beginning of the 21st century, three times more disasters were reported than in the 1980s.7 In addition, 97% of human losses have been recorded in developing countries, among which the vulnerability of Latin American countries is evident.[2,4,8] Between 1990 and 2011 the countries of Latin America and the Caribbean recorded a total of 83,000 disasters, with an average of 3772 events per year;[9] showing that catastrophe scenarios are intimately related to health personnel.

It is estimated that after these events, the survival of the seriously injured decreases considerably, and the actions together with the prompt response of the health system are vital during the first 12 to 24 hours.7 In addition, there is a close relationship between the success of health personnel interventions and their preparedness for disasters, highlighting that training measures that can be acquired during undergraduate or postgraduate studies as indispensable prerequisites to mitigate the impact and devastation that disasters can cause.[10–12] In this context, the available research that has sought to evaluate the knowledge, attitudes and practices of medical students is limited, in countries like India the findings show that although the predisposition towards disaster practice is positive, the levels of knowledge are deficient;[13,14] while in the region of Latin America and the Caribbean, despite being exposed to various disasters, only 1 report is available that also showed deficient knowledge in medical students.[11] For these reasons, this investigation was carried out to determine the level of knowledge that medical students in Latin America have about risks and disasters, evaluating the practice of prevention and immediate response measures that occur in emergent situations, with the purpose of knowing the deficiencies of knowledge in medical students who are preparing themselves in areas of high risk of disasters.

Materials and Methods

Design

A descriptive, cross-sectional, multicenter study was performed using an online questionnaire.

Population, Setting and Sample

Online data were collected from students officially enrolled in medical school at public or private universities in nine Latin American and Caribbean countries (Bolivia, Chile, Colombia, Ecuador, Honduras, Panama, Paraguay, and Dominican Republic) during October 2020 and November 2020.

A non-probabilistic convenience sample was used to collect data. Participants over 16 years of age, of both sexes, who agreed to participate voluntarily in the survey by means of an electronic informed consent form prior to filling out the questionnaire were included; data were excluded from those who stated that they did not agree to participate voluntarily in the study, as well as from those who did not complete the questionnaire.

Data Measurement and Questionnaire

A survey-type questionnaire was used, based on the questions developed by Abad et al,[11] which was carried out on a sample of medical students in Ecuador and adapted by the authors. The tool was validated in each participating country, where it was reviewed by a specialist in emergencies with ample experience from whom comments and rectifications were accepted; subsequently, the questionnaire was pilot tested among 10 participants in each country to assess the relevance and comprehension of the questions in the nine countries, and after the relevant corrections, a uniform questionnaire consisting of 22 questions was obtained. Finally, Cronbach's Alpha test was used on the responses collected, obtaining a coefficient of 0.495.

The online questionnaire consisted of five sections: 1) Informed consent; 2) Sociodemographic data made up of 5 questions that evaluated variables such as country of residence, semester of study, type of university, sex and age; 3) Level of knowledge about natural disasters made up of 8 questions; 4) Perceptions presented by the students regarding natural disasters made up of 6 questions; 5) Questions to measure practice made up of 3 questions regarding the activities that medical students have developed to act in the face of natural disasters.

Data collection was carried out through an online survey-type questionnaire, designed using the freely available tool "Google Forms". The questionnaire was distributed by the researchers in the participating countries through a unique link that was disseminated through the social networks Facebook and Instagram, and WhatsApp groups.

Data Management

The type of university was classified as public and private according to the university's source of funding.

To evaluate the level of knowledge, a value of 1 point was assigned for each correct answer and 0 points for incorrect answers. This allowed obtaining a maximum score of 8 points and a minimum score of 0 points for participants who answered incorrectly all the questions of the knowledge test. Thus, three categories were defined to measure the participant's level of knowledge of risks and disasters as follows: high level of knowledge (for questionnaires that scored between 6 and 8 correct answers), medium level of knowledge (for questionnaires that scored between 3 and 5 correct answers) and low level of knowledge (for questionnaires that scored between 0 and 2 correct answers).

Perceptions focused on determining vulnerability, preparedness, and the importance of risk and disaster preparedness.

The practice assessment questions focused on tangible actions that participants can take to train for disaster scenarios. Practices in natural disasters were evaluated in two categories, those who have the training and those who do not.

Statistical Analysis

A single digital database was obtained in Microsoft Excel 2016 with all participating countries, with quality control by the principal investigator of the study. Data analysis, calculations and graphs were performed with SPSS 25.0 software (IBM Corporation, Chicago, USA) AND GraphPad Prism version 8 software (GraphPad Software, California, USA).

Descriptive statistics such as frequencies and percentages were used for the description of qualitative variables, mean ± standard deviation (SD) for continuous variables. Differences resulting from the relationship between the characteristics of the variables studied (qualitative) and the level of knowledge were obtained using the Chi-square test (Chi2). For all statistical analyses, a p-value <0.05 was accepted as statistically significant.

Ethical Considerations

This research was approved by the Research Ethics Committee of the Faculty of Health Sciences of the Universidad Católica Nuestra Señora de la Asunción, Paraguay (Act N° 20/2020).

Results

A total of 2541 responses were obtained, distributed very similarly from the 9 participating countries. The highest proportion of responses (64.0%) came from women, third semester students (20.1%) and those studying in public universities (55.0%) (Table 1).

The distribution of demographic characteristics of the Latin American and Caribbean medical students who participated in the study is described in Table 1.

A total 1369 (53.9%) participants showed a high level of knowledge (between 6 and 8 points), while the average score for the participants was 5.6/8.0 (±1.4) points. The questions that showed to be of greater difficulty were those in charge of evaluating the consequences of disasters, the concept of mitigation and the classification of disasters, which obtained 95.1%, 74.9% and 73.4% of incorrect answers, respectively (Table 2).

The aspects of knowledge about risks and disasters evaluated, and the general level of knowledge of the participants are shown in Table 2.

More than half (52.7%) of respondents considered that they live in a country with a medium risk of suffering natural disasters, while 91.2% said that Latin American and Caribbean countries are not prepared to face natural disasters. While

Table 1 Demographic Characteristics of the Participants

Features		n	(%)
Country	Bolivia	311	12.2
	Chile	300	11.8
	Colombia	261	10.3
	Ecuador	300	11.8
	Honduras	278	10.9
	Panamá	232	9.1
	Paraguay	301	11.8
	Perú	330	13.0
	Dominican Republic	228	9.0
	Total	2541	100.0
University	Private	1143	45.0
	Public	1398	55.0
	Total	2541	100.0
Semester	First	284	11.2
	Second	423	16.6
	Third	511	20.1
	Fourth	454	17.9
	Fifth	423	16.6
	Sixth	232	9.1
	Seventh	214	8.4
	Total	2541	100.0
Sex	Female	1627	64.0
	Male	914	36.0
	Total	2541	100.0
Age (years)	≤ 23	1865	73.4
	> 23	676	26.6
	Total	2541	100.0

Table 2 Level of Knowledge About Risks and Disasters Among Participants

Knowledge		n	(%)
Q1. On the concept of disasters	Correct	1105	43.5
	Incorrect	1436	56.5
	Total	2541	100.0
Q2. On the classification of disasters	Correct	675	26.6
	Incorrect	1866	73.4
	Total	2541	100.0
Q3. On the concept of disaster risk	Correct	940	37.0
	Incorrect	1601	63.0
	Total	2541	100.0
Q4. On the consequences of disasters	Correct	125	4.9
	Incorrect	2416	95.1
	Total	2541	100.0
Q5. On the actions necessary for successful mobilization in emergencies and disasters	Correct	948	37.3
	Incorrect	1593	62.7
	Total	2541	100.0
Q6. On the concept of mitigation	Correct	639	25.1
	Incorrect	1902	74.9
	Total	2541	100.0

(*Continued*)

Table 2 (Continued).

Knowledge		n	(%)
Q7. On the most common causes of accidents in earthquakes	Correct	926	36.4
	Incorrect	1615	63.6
	Total	2541	100.0
Q8. About the concept of Triage in emergency situations	Correct	878	34.6
	Incorrect	1663	65.4
	Total	2541	100.0
Knowledge level	Low	58	2.3
	Medium	1114	43.8
	High	1369	53.9
	Total	2541	100.0
Knowledge qualification*		5.6	1.4

Note: *Mean and standard deviation (SD).

95.1% respondents (n=2417) said that disaster preparedness is an important subject for university education, however, only 43.6% believe they are prepared to help in the event of a natural disaster (Table 3).

Table 3 summarizes the personal perceptions about risks and disasters of the evaluated medical students.

Regarding practices, most of the participants stated that they had not taken a course on disasters (71.2%), nor had they participated in workshops on the subject (71.2%) (Table 4).

Table 3 Perceptions About Risks and Disasters Among Participants

Perceptions		n	(%)
How vulnerable is the country in which you live to disasters?	Low	668	26.3
	Medium	1340	52.7
	Elevated	533	21.0
	Total	2541	100.0
Latin America and the Caribbean countries are prepared to face disasters	No	2317	91.2
	Yes	224	8.8
	Total	2541	100.0
You live in a country vulnerable to hurricanes	No	2057	81.0
	Yes	484	19.0
	Total	2541	100.0
You live in a country vulnerable to fires.	No	1217	47.9
	Yes	1324	52.1
	Total	2541	100.0
You live in a country vulnerable to floods.	No	1050	41.3
	Yes	1491	58.7
	Total	2541	100.0
You live in a country vulnerable to drought	No	1906	75.0
	Yes	635	25.0
	Total	2541	100.0
You live in a country vulnerable to earthquakes.	No	1109	43.6
	Yes	1432	56.4
	Total	2541	100.0
Consider being prepared for a disaster scenario.	No	1728	68.0

(*Continued*)

Table 3 (Continued).

Perceptions		n	(%)
	Yes	813	32.0
	Total	2541	100.0
Consider being prepared to help in disaster scenarios.	No	1432	56.4
	Yes	1109	43.6
	Total	2541	100.0
Considers that a subject on risks and disasters is important in medical training.	No	124	4.9
	Yes	2417	95.1
	Total	2541	100.0

Table 4 Risk and Disaster Preparedness Practices Among Participants

Practices		n	(%)
Has participated in workshops on risks and disasters	No	1808	71.2
	Yes	733	28.8
	Total	2541	100.0
Participated in drills on risk and disaster scenarios	No	1266	49.8
	Yes	1275	50.2
	Total	2541	100.0
Within its university training it has the subject of risks and disasters	No	1808	71.2
	Yes	733	28.8
	Total	2541	100.0

Participants' risk and disaster preparedness practices are summarized in Table 4.

Students from Colombia and Honduras had the highest percentage of high level of knowledge about disasters, while Peruvian students had the highest percentage of low level of knowledge ($p < 0.00\ 1$). Women and students from public universities showed a higher proportion of high levels of knowledge ($p < 0.05$) (Table 5).

Table 5 shows the relationship between demographic characteristics, perceptions, and practices with the level of risk and disaster knowledge of the surveyed medical students.

The perception of the participants showed that those who considered that the subject on risks and disasters is important obtained higher levels of knowledge ($p = 0.002$), on the other hand, curiously, the students who assured that the countries of Latin America and the Caribbean are not prepared to face disasters as well as those who did not consider themselves prepared to help in disaster scenarios had higher levels of knowledge compared to those who considered themselves to be prepared ($p < 0.001$) (Table 5). Similarly, within the practices of the respondents, those who claimed to have a subject on disasters during their training obtained lower levels of knowledge compared to the group of students who did not have the subject ($p < 0.001$) (Table 5).

Discussion

Human action is creating a greater risk, pushing the planet towards existential and ecosystem limits, making disasters inevitable, and placing the transformation of systems and their adaptability as the best defense against the systemic risk to which we are exposed.[15] Health personnel in training are an important part of the healthcare area; consequently, training and knowledge about risks and disasters strengthen the response capacity and the reduction of morbidity and mortality in the face of such events.

Table 5 Relationship Between Demographic Characteristics, Perceptions, and Practices with the Level of Knowledge About Risks and Disasters Among Medical Students

Features		Knowledge Level						Total	p value
		High		Medium		Low			
		n	(%)	n	(%)	n	(%)	n	
Demographic characteristics									
Country	Bolivia	150	48.2	154	49.5	7	2.3	311	**< 0.001**
	Chile	167	55.7	129	43.0	4	1.3	300	
	Colombia	165	63.2	92	35.2	4	1.5	261	
	Ecuador	174	58.0	122	40.7	4	1.3	300	
	Honduras	168	60.4	104	37.4	6	2.2	278	
	Panama	133	57.3	98	42.2	1	0.4	232	
	Paraguay	179	59.5	118	39.2	4	1.3	301	
	Perú	125	37.9	179	54.2	26	7.9	330	
	Dominican Republic	108	47.4	118	51.8	2	0.9	228	
University	Private	572	50.0	534	46.7	37	3.2	1143	**< 0.001**
	Public	797	57.0	580	41.5	21	1.5	1398	
Semester	First	123	43.3	153	53.9	8	2.8	284	**< 0.001**
	Second	234	55.3	180	42.6	9	2.1	423	
	Third	306	59.9	196	38.4	9	1.8	511	
	Fourth	257	56.6	190	41.9	7	1.5	454	
	Fifth	237	56.0	178	42.1	8	1.9	423	
	Sixth	127	54.7	100	43.1	5	2.2	232	
	Seventh	85	39.7	117	54.7	12	5.6	214	
Sex	Female	898	55.2	701	43.1	28	1.7	1627	**0.016**
	Male	471	51.5	413	45.2	30	3.3	914	
Age (years)	≤ 23	1031	55.3	797	42.7	37	2.0	1865	**0.026**
	> 23	338	50.0	317	46.9	21	3.1	676	
Perceptions									
How vulnerable is the country in which you live to disasters?	Low	335	50.1	318	47.6	15	2.2	668	0.074
	Medium	754	56.3	559	41.7	27	2.0	1340	
	Elevated	280	52.5	237	44.5	16	3.0	533	
Latin America and the Caribbean countries are prepared to face disasters	No	1285	55.5	997	43.0	35	1.5	2317	**< 0.001**
	Yes	84	37.5	117	52.2	23	10.3	224	
You live in a country vulnerable to hurricanes	No	1101	53.5	907	44.1	49	2.4	2057	0.646
	Yes	268	55.4	207	42.8	9	1.9	484	
You live in a country vulnerable to fires.	No	663	54.5	531	43.6	23	1.9	1217	0.415
	Yes	706	53.3	583	44.0	35	2.6	1324	
You live in a country vulnerable to floods.	No	563	53.6	473	45.0	14	1.3	1050	**0.021**
	Yes	806	54.1	641	43.0	44	3.0	1491	
You live in a country vulnerable to drought	No	1040	54.6	831	43.6	35	1.8	1906	**0.024**
	Yes	329	51.8	283	44.6	23	3.6	635	
You live in a country vulnerable to earthquakes.	No	581	52.4	494	44.5	34	3.1	1109	**0.042**
	Yes	788	55.0	620	43.3	24	1.7	1432	
Consider being prepared for a disaster scenario.	No	947	54.8	742	42.9	39	2.3	1728	0.391
	Yes	422	51.9	372	45.8	19	2.3	813	
Consider being prepared to help in disaster scenarios.	No	820	57.3	591	41.3	21	1.5	1432	**< 0.001**
	Yes	549	49.5	523	47.2	37	3.3	1109	
Considers that a subject on risks and disasters is important in medical training.	No	49	39.5	69	55.6	6	4.8	124	**0.002**
	Yes	1320	54.6	1045	43.2	52	2.2	2417	

(*Continued*)

Table 5 (Continued).

Features		Knowledge Level						Total	p value
		High		Medium		Low			
		n	(%)	n	(%)	n	(%)	n	
Practices									
Has participated in workshops on risks and disasters	No	974	53.9	799	44.2	35	1.9	1808	0.176
	Yes	395	53.9	315	43.0	23	3.1	733	
Participated in drills on risk and disaster scenarios.	No	679	53.6	558	44.1	29	2.3	1266	0.97
	Yes	690	54.1	556	43.6	29	2.3	1275	
Within its preparation it has the subject of risks and disasters.	No	1020	56.4	757	41.9	31	1.7	1808	**< 0.001**
	Yes	349	47.6	357	48.7	27	3.7	733	

Notes: P-values were calculated from Chi-Square test. Bold p-values are statistically significant.

To the best of our knowledge, his study brings together for the first-time medical students from various countries in Latin America and the Caribbean in relation to medical students' knowledge, perceptions, and practices of risks and disasters. The findings of this study show that more than half (53.9%) of medical students have a high level of knowledge about disasters; however, the questions that represented the greatest difficulty for the participants were those that focused on evaluating the consequences of disasters, the concept of mitigation and the classification of disasters, in which up to 95.1% of answers were found to be incorrect. Studies conducted on Indian medical students and Iranian nursing students have also exposed significant limitations in knowledge of disaster situations, reinforcing the idea that undergraduate training on these topics is insufficient.[13,14,16]

In addition, we found that females showed higher proportions of high level of knowledge than males (p=0.016), in this framework, research conducted by Al-Ziftawi et al found that health students had moderate knowledge, however, these results did not show significant differences related to the sex of the students.[17] We believe that one of the possible reasons for the differences found among our participants is due to the fact that the highest percentage of respondents were female students (64.0%), an inclination that has been previously described in studies using self-report methodology as in this case.[18]

It is also important to analyze probable shortcomings in the teaching methods and/or curricula taught in private universities, since, in this study, students from public universities showed a higher proportion of a high level of knowledge ($p< 0.001$). It is possible that the lack of public policies at a global level, as well as the restructuring of the curricula in several medical schools, highlight the deficiencies in the response to natural disasters, making it necessary to develop innovative didactic strategies, rather than complementary courses or the addition of content.

Regarding perceptions, our research showed that most of the participants (56.4%), did not believe they were prepared to act in disaster scenarios, and up to 91.2% considered that Latin American countries are not prepared to face disasters; however, almost all participants (95.1%) stated that they considered it important to have a subject on risks and disasters during their undergraduate preparation. This contradiction between perceptions of low knowledge accompanied by a positive stance toward disaster training and preparedness is common and has also been observed in Indian medical students, and nursing students from Oman.[14,19] Likewise, Kaiser et al found in medical students in the US that 51.6% considered themselves sufficiently trained to respond to a natural disaster, but only 17.2% believed they were receiving adequate training for natural disasters.[20]

Only 52.7% of respondents considered living in a country with a medium risk of suffering natural disasters, a perception that is not in line with that described in the Regional Assessment Report on Disaster Risk in Latin America and the Caribbean, 2021 of the United Nations Office for Disaster Risk Reduction, which describes increasing levels of mortality, damage, economic losses, and people affected by disasters in recent decades. It also states that between 1998 and 2017, the region accounted for 53% of global economic losses due to climate-related disasters and 46% of global disaster losses in the last decade.[15]

Regarding practices, most participants have not had undergraduate or extracurricular training related to risks and disasters; in this context, unexpectedly the participants who claimed not to have a risk and disaster subject showed higher levels of knowledge compared to those who did ($p< 0.001$), we believe that the most likely reason for this finding is due to the fact that the group of participants who do not have the subject is much larger. We are confident that the positive effect that has been demonstrated between the training and increased levels of knowledge and humanitarian response to hazards and disasters has been amply demonstrated in previous research on both nursing and medical students.[16,21,22]

The results found in this research frame a problem that seems to affect a large part of countries in the Latin American and Caribbean region, characterized by education systems with deficiencies in training and knowledge about risks and disasters, which, however, is accompanied by a positive attitude of students towards acquiring preparation on the subject. Leading us to consider that risk and disaster preparedness exercises are indispensable to achieve optimal levels of knowledge among medical students, as well as the need to include this subject within the learning needs during undergraduate studies since these measures can bring growth effects both at a personal and professional level.[21,23–25]

This study has several limitations in its ability to form solid conclusions. An important limitation is of selection bias, as the delegates of each country were forced to opt for convenience sampling to obtain the necessary sample, contacting Universities that were within their reach to distribute the survey. Consequently, the results are not representative of the country's population. Nevertheless, the effects of selection bias were reduced by including students from both private and public universities. The self-report design also exposes the research to possible selection bias, as students interested in risks and disasters are more likely to be willing to fill out the questionnaire.

Likewise, within the collection process to avoid the collection of duplicate responses, using the properties of the "Google Forms" platform, the number of responses was limited to 1 per device.

Finally, to address the possibility of a social acceptance bias that might be due to students fearing the lack of anonymity of the responses, the investigators tried to reiterate to the students the strict anonymity of the data collected and the importance of honesty when completing the instrument.

Conclusions

Slightly more than half of the participants showed high levels of knowledge about risks and disasters, however, close to 100% of participants considered that knowledge and preparation for this subject is important. The implementation of disaster training programs for medical students has the potential to improve the preparedness, knowledge, and skills that are important for medical personnel to improve their self-confidence, and their ability to respond.

Leveraging existing knowledge and the readiness of trainees in disaster medicine training will facilitate the process of knowledge acquisition, leading to more effective response systems. In addition, recognizing the role of risk perceptions and biases of medical personnel in training to reduce the gap between intention and action when responding to disaster scenarios, as well as to reduce the consequences of these.

The results found in this research open the door to new research focused on evaluating the effects that intra- and extracurricular training activities can have on the knowledge and perceptions of risks and disasters in medical students in Latin America and the Caribbean.

Data Sharing Statement

The entire data set is available by written request to the lead or corresponding author.

Consent for Publication

Electronic informed consent was obtained, voluntarily accepted in a section of the questionnaire, by each of the participants prior to completing the online instrument of this research.

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Disclosure

The authors report no conflicts of interest in this work.

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