Impact of Social Media Disaster Awareness Campaigns of Punjab Disaster Management Authority on Flood-Affected Communities

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ABSTRACT

The present research evaluates the efficacy of disaster communication messages issued by the Punjab Disaster Management Authority (PDMA) on social media and evaluates how such messages affected the population impacted by floods. The study uses a mixed-methods design to evaluate the features of communication in PDMA and their influence on shaping users' awareness, engagement, information-seeking, perceptions, and behavior change. The survey involved exposure, engagement, perceived usefulness, awareness, self-reported preparedness, and response behaviours. The interviews conducted from disaster related authorities have addressed institutional strategies, communication priorities, operational constraints, and public perceptions regarding flood events. The quantitative outcomes revealed that the higher the exposure to PDMA's social media messaging and the deeper the engagement, the greater the awareness of the disaster, active information-seeking, and reported behavioural intentions and safety behaviours. People also used social media in different ways, which suggests that the more time people spent on it, the more they saw and were aware of disaster content. The study universe was the flood disaster, which had been warned about in the districts of Punjab by the Punjab Disaster Management Authority (PDMA) in 2023. The targeted population comprised young social media users at two government colleges in the eight flood-affected districts. Disaster communication campaigns were studied from January 2023 to December 2023, and SPSS-23 was used to analyze the results. The final results of the study provided a significant insight into the interconnection between social media usage, disaster communication and behavioural change. The Pearson correlation showed a moderate positive association (r = 0.260) between the time spent on social media and awareness of disaster communication. This implies that the more active people are on social media, the more they know about the risks of floods, preparedness, and response. The results are part of a broader concept for how social media can be used to enhance disaster communication and provide practical suggestions for future disaster campaigns on such floods.

Keywords: Disaster communication; PDMA; social media; floods; risk reduction; preparedness; mixed-methods

INTRODUCTION

Both natural and man-made disasters possess the capacity to inflict considerable damage upon human life, property, and the environment. The Punjab province of Pakistan is not immune to this susceptibility, since it encounters a diverse array of calamities including floods, earthquakes, environmental and industrial mishaps. The coordination of disaster management and response efforts is largely overseen by the

Provincial Disaster Management Authority (PDMA). The PDMA assumes a critical role in several aspects of disaster management, including preparation, mitigation, response, and recovery. The dissemination of critical information, instructions, and warnings to the public is a fundamental component of disaster management, as it facilitates informed decision-making and required action-taking. Therefore, effective communication plays a vital role in this process (Dehghani et al. 2022).

Communications is now widely recognized as an essential element in disaster management. The timely and correct broadcast of information to the general public, government authorities and the media is critical to the efficient management of disaster response and recovery operations. The dissemination of preparedness and mitigation knowledge encourages measures that lower the likelihood of future disasters. Addressing policies, goals, and priorities to employees, partners, and participants builds support and fosters a more effective disaster management operation. Establishing collaboration with the media and effectively engaging with social media are critical to creating a successful strategy when interacting with the public (Haddow & Haddow, 2014).

An Overview of Disaster Management

Disaster management is a process that involves preparation, response and recovery of disasters. It involves diverse activities that would reduce the effects of calamities on human life, property and environment. Natural disasters (earthquakes, floods, hurricanes, etc.), human-made ones (industrial accidents, terrorism, nuclear disasters, etc.) can be devastating. Thus, disaster management is the key to resilience creation and community safety (Kifle & Michael, 2006).

Disaster management is classified into four key parts namely; mitigation, preparedness, response and recovery. The phases are collaborative and help to minimize the effects of disasters and enhance the capacity of a community to recuperate and restore to normalcy after a crisis. All the phases have certain activities, stakeholders, and resources that are required to deal with the complexity of disaster management.

The very beginning of the disaster management is mitigation, which is prescribed in terms of reducing or removing the threats of possible disasters. This may involve structural solutions, which involve the construction of buildings that are resistant to disasters (through the building codes and regulations) and non-structural solutions, which involve the environmental conservation and the land-use planning. Mitigation measures are aimed at dealing with the underlying causes of disaster and avoiding their occurrence or reducing their effect on the communities (Bullock, et al., 2013).

Disaster Management and Social Media

Social media has become a very significant part of disaster management in recent years. Social media, including X, Facebook, and Instagram, have become crucial in spreading information, organizing the relief process, and mobilizing communities in disasters. Real-time updates are available on the social media and this can be invaluable when it comes to information about evacuation routes, shelters, and available resources.

Moreover, social media can serve to enable people, and institutions to exchange experiences, volunteer, and create awareness about disaster rescue. As an example, X was used to dispatch early warnings, inform affected communities, and organize volunteer workers during 2011 Tohoku earthquake and tsunami in Japan (Hughes et al., 2014). Through social media, communities are also able to give first-hand reports of what is going on, this may prove helpful to the responders as they evaluate the needs and allocate resources to most devastated areas.

Objectives of the Study

The study is organized to explore the following objectives;

- To find out the level of awareness of Facebook and X users regarding the disaster communication campaigns of PDMA.
- To evaluate the effectiveness of disaster communication action plans, attitude change, and action for disaster response.
- To analyze the authority's perception of disaster communication campaigns.

Research Questions

On evaluating the impact of disaster communication campaigns by the Provincial Disaster Management Authority (PDMA) on Facebook and X users in Punjab, the study will explore the following research questions to assess the effectiveness and outcomes of these campaigns:

RQ1: To what level of exposure to disaster communication campaigns have Facebook and X users in Punjab experienced?

RQ2: To what extent do disaster communication campaigns on Facebook and X impact the level of awareness, attitudes, behaviours, and collective action among the users?

Research Hypotheses

H1: The PDMA's disaster management campaigns are having significant impact on their Facebook and X users.

H3: Disaster communication campaigns on Facebook and X influence the attitude and behaviour to promote proactive disaster preparedness.

LITERATURE REVIEW

Natural or man-made disasters have the potential to inflict major disruption, loss of life, and economic ruin. Effective communication and management are critical during such incidents to reduce the effect and promote a coordinated reaction. This study of the literature gives a thorough overview of the fundamental principles, problems, and developments in disaster communication and management. The goal is to comprehend the changing environment of this crucial sector and to find best practices that might improve catastrophe resilience and response.

An Overview of the Disaster Communication Strategies

Communication strategies are defined as "a purposive attempt to inform or influence behaviours in large audiences within a specified period using an organized set of communication activities and featuring an array of mediated messages in multiple channels generally to produce non-commercial benefits to individuals and society" (Atkin & Rice, 2012). Disaster communication strategies are often discussed in the contexts of disaster and crisis.

The effectiveness of disaster communication strategies can be estimated by measuring that how much it has improved the quality of life and to what extent the adverse effects of a disaster have been eliminated among the individuals (Coppola & Maloney, 2009). Moreover, there are various attributes that need to be considered to increase effectiveness and success of disaster communication strategies. When launching a disaster communication plan, organizations should consider how they want to inform, influence and motivate individuals. The results of campaigns vary in term of its influence, which can be moderate to

strong influences considering the cognitive outcomes, less influence on attitudinal outcomes, and less influence on behavioral outcomes (Atkin, 2001).

Impact of Flood Disaster Communication Campaigns

Flooding is among the frequently occurring and disastrous natural disasters that affect numerous places across the globe in a given year. Residents of developing nations are usually the most affected by high losses due to floods (Parker et al, 2009). Dissemination of flood risks, and suitable response measures is nowadays very relevant in flood disasters and improving the capacities of these communities through communication campaigns (Perry, 2012). Research has demonstrated that incorporating of communication campaign designed in the right way would enhance knowledge, change attitude, and promote desired actions during disasters (Lindell, 2012). This essay sought to also measure the potential of flood disaster communication campaigns organize in bringing out the best in vulnerable communities living near floods, in as much as event preparation, response and recovery is concerned.

Enhancing Post Flood disaster Communication

Flood affected communities' ability to bounce back and return to performing their functions is only based on adequate response to their needs, and communication in disaster (Reacher et al, 2004). Communication is part of recognizing issues that require intervention, the call for resources, support and assistance based on the severity and control of recovery processes for optimal gains. According to Oktari et al (2014), the communicated roadmap for helping villages level to come up with a recovery plan that responding to the input of the communities and progress check through consultations were carried out effectively enabled the Indonesian communities to regain their hurtling through floods 51% compared to normal top down approaches just to recover from floods that hit the country. Therefore, the effective communication involving all the groups that may be affected by the process of recovery can significantly enhance results.

THEORETICAL FRAMEWORK

This chapter gives the theoretical basis of considering the disaster communication campaigns of the Punjab Disaster Management Authority (PDMA) on the social media and its effects on the victims of floods. The present scenario of often and intense flooding in Punjab necessitates effective communication with the intention of information dissemination, mitigation of risks, and resilience in the community. The theoretical framework, based on the existing theories of communications and disaster management, will provide a systemic perspective through which the approaches to social media used by PDMA contribute to the creation of awareness, preparedness, and response among the affected communities of the flood.

Disaster Risk Reduction (DRR) Theory

Disaster Risk Reduction (DRR) as a theoretical framework has evolved significantly over time as the scholars, policymakers and practitioners have come to realize the complex interplay between hazards, vulnerabilities, capacities and socio-political systems. DRR theory gives a systematic approach in which disasters may be perceived not as natural acts in isolation, but rather as the product of converging social, environmental, economic, and political actions (Wisner et al., 2004). This theoretical background determines the risk assessment, policy formulation, and execution of the strategies to reduce the effects of disasters and enhance the resilience of the communities. The necessity of a strong and multidimensional DRR theoretical framework is even more urgent as the world continues to face challenges related to global issues like climate change, urbanization, displacement and environmental destruction (UNDRR, 2015).

Situational Crisis Communication Theory

Situational Crisis Communication Theory (SCCT) is one of the most recognized models that work to decode the strategies that organisations can take in order to ensure appropriate communication throughout the crisis. W. Timothy Coombs created SCCT in mid 1995 to offer practical details indicating how organisations could respond to a given crisis in relation to the type of and specifics involved in the particular crisis (Coombs, 1995).

In the following discussion, the reader will learn that SCCT posits that stakeholders apportion different amounts of blame towards the organization concerning the occurrence of a given crisis, and these different degrees of blame should determine the organization's corresponding responses during the crisis. If stakeholders perceive the organisation as being very much at fault for the occurrence or with the crisis through reckless behaviour or omission, then the organisation is seen as having to correct the wrongs and accept responsibility. However, if the crisis is perceived as less endogenous, then the response strategy tends to be protection-oriented and essentially concerned with victim outcomes rather than taking the blame (Coombs, 2007).

METHODOLOGY

The research methodology is used to achieve the targeted objective of the study. It refers to the approaches and procedures used to explore a research problem. The study of ways to address a research problem is called 'Research Methodology' (Kapoor, et al., 2022). The research methodology includes strategies used by researchers to comprehend and analyze phenomena in their study (Sileyew, 2020).

Rationale for the Selection of Social Media

The justification for choosing social media as the principal platform for assessment is rooted in its extensive reach and capacity to collect instantaneous feedback. Furthermore, its capacity to instantly disseminate information to a vast audience makes social media an effective instrument for raising awareness in the event of a catastrophe.

Rationale for the Selection of Facebook and X

The provincial disaster management authority chose Facebook and X for disaster mitigation strategies because they are widely used social media platforms. Facebook and X have emerged as influential platforms for the distribution of information pertaining to disasters, enabling provincial disaster management authorities to interact with the public in real-time throughout emergency situations.

Mix Methodology Sequential exploratory design

Sequential exploratory design is a research design that is frequently employed in research particularly in researches that involve the application of mixed methods. Such methodological approach is quite useful because it makes the investigations deeper and more comprehensive. The study design is sequential that includes a qualitative and a quantitative phase of research where the former phase frequently follows the latter.

Method-1: In-Depth Interviews

In depth interviews, a method which could be used qualitatively or quantitatively for systematically analyzing written, verbal, or visual documentation, goes back to the 1950s and the study of mass communication (White & Marsh, 2006, p. 22). Furthermore, a series of extensive interviews were conducted to gather insights from key individuals in provincial disaster management authority, including the Director of PDMA/PIO, PIO of Rescue 1122, Relief Commissioner of Punjab/PIO, and DG of Meteorology/Public Relations Officers.

Method-2: Survey (Social Media Users)

This research was used a combination of survey methods to investigate the issue under examination. The study was used a survey methodology to assess the influence of disaster communication initiatives conducted via social media on the participants.

Universe of the Study

A study universe can be made of people, groups, institutions, or objects (Lavrakas, 2008). In this study, the universe is a totality of all the districts that are an object of disasters in Punjab. The Punjab Disaster Management Authority (PDMA) suggests that the floods, droughts, monsoons, heatstroke, and pollution are the key natural disasters in the area. Most of the districts in Punjab experience floods every year. In 2023, PDMA officially declared eight districts, including Kasur, Okara, Pakpattan, Vehari, Multan, Lodhran, Bahawalnagar and Bahawalpur, to be affected by flood disasters.

Population of the Study for Survey

All the youth of public sector colleges of selected eight district of Punjab was the population of the study. The survey was included respondents from the age group of 18 to 25. Both male and female participants from these selected public sectors district colleges were studied in this research. The education levels included in this study was to include intermediate, graduation and post-graduation. The locations under investigation were based on major disaster affected district.

DATA ANALYSIS AND RESULTS

In this section, a description of the results of the quantitative analysis of data is presented in detail. It entails an analysis of social media campaign programs at the Punjab Disaster Management Authority (PDMA), which involves the analysis of the reach, engagement, and the effectiveness of the content.

Demographic Characteristics of Respondents

Table 1: Demographic Characteristics of Respondents

Demographics	Categories	Frequency	Percent
Age	18-25	1600	100%
Gender	Male	800	50%
	Female	800	50%
Location	Urban	157	9.8%
	Rural	1443	90.2%
Marital Status	Married	177	11.1%
	Unmarried	1423	88.9%
Education Level	Intermediate	1156	72.3%
	B.A/B.SC (14 years)	333	20.8%
	BS/M.A/M.Sc. (16 years)	111	6.9%
District	Okara	200	12.5%
	Bahawalnager	200	12.5%
	Pakpattan	200	12.5%
	Bahawalpur	200	12.5%
	Kasur	200	12.5%
	Lodhran	200	12.5%
	Multan	200	12.5%
	Vehari	200	12.5%

Table 5 demonstrates the demographic traits of the respondents. The outcomes are all people of the 18-25 age group as shown by the prevalence of 1,600 that constitutes 100% of the numbers. This implies that the research or survey is specifically about the youth or adults, probably an age bracket to make it applicable in the research, marketing, or demographics study. The sex ratio is almost equal with 800 males (50.3) and 800 females (50) being considered in the sample. This balance shows that the data collection process was so constructed that the representation of both sexes will be equal, which could be the reason behind a gender-neutral result or analysis. Most of them (90.2) live in rural regions, with 1443 people, whereas a smaller percentage (9.8) lives in urban regions, and the number of these people is 157. This indicates that there is a high skewness of the sample towards the rural population, and this may be due to the tendency to study or survey rural areas. Unmarried (88.9) persons constitute a substantial majority of the respondents with 1, 423 persons under this category and those under (11.1) persons constitute the other married individuals. It means that the target group is mainly composed of young adults who are at the onset of adulthood or still in their educational years where one would be less likely to marry. The distribution of the education level indicates that the large part of the participants have an intermediate level of education (72.3%), and 1,156 members of this group. A lower number of respondents have the B.A./B.Sc. (14 years of education) at 20.8% (333 people) and the number of people with higher education level (BS/M.A./M.Sc. with 16 years of education) is very low at 6.9% (111 people). This implies the presence of a relatively middle gains education population with not many people going into the higher educational population. These data are also evenly spread out in eight districts with 200 members of each district making it 1,600 respondents in total. The districts mentioned consist of Okara, Bahawalnagar, Pakpattan, Bahawalpur, Kasur, Lodhran, Multan and Vehari which contributed 12.5 each to the total sample. This implies a balanced regional representation, which is probably likely to make the sample geographically varied and give it a wider outlook to analyze it.

A. QUALITATIVE ANALYSIS

Data Collection through Interviews

These methods come in handy especially during gathering of meaningful views and opinions of the senior officials, including the Director of the Punjab Disaster Management Authority (PDMA) the Public Information Officer (PIO) Punjab Emergency Services (PES), the Public Information Officer (PIO) Relief Commissioner of Punjab, and the Public Relations Officer of Meteorology department. These qualitative research methods permit understanding more deeply their perspectives, experiences, and knowledge about disaster management and communication methods.

Findings from PIO PDMA

The PIO (PDMA) stressed the need to integrate automated warning systems and social media sites so that the information related to the disaster could be shared in time. Findings of the study confirm this strategy with moderate positive correlation ($r = 0.260$) existing between time spent on social media and disaster communication awareness. This correlation shows that the more the individuals become active on social media, the more knowledgeable they are on disaster hazards, disaster preparedness, and disaster response measures. Another recommendation of the PDMA is that disaster communication campaigns should be addressed to particular groups of people particularly those living in flood-prone areas. The obtained results of the study on community engagement ($r = 0.927$) comply with this recommendation. It demonstrates that more enlightened users with disaster communication campaigns are more inclined to access the materials.

Findings from PIO PES

Press Information Officer at Punjab Emergency Services (PES) insisted on posting comprehensive and factual rescue operations and safety information through social media on a timely basis. The results

of the study confirm it by revealing that there is a moderate positive relationship between social media use and community engagement (r = 0.244). Active social media users will be more willing to respond to the rescue related updates, which can make them behave in the right manner during a disaster. The situation of rescue efforts, the availability of shelters, and the closures of the roads will be constantly updated, which will make social media more active and will encourage people to follow the evacuation guidelines and implement safety measures.

The results of this study supported this recommendation as it was indicated that community engagement is significantly related to behavioral change (r = 0.773). Incorporating local influencers who are renowned people in the community can greatly increase the coverage of the disaster communication campaign. The fact they promote and are involved in spreading awareness is more credible, which motivates people to take the safety precautions and engage in relief efforts.

Findings given by PIO Flood Relief Commissioner

He proposed geo-tagging and location-based notifications to have more accurate communication. According to the findings of the study, the awareness (r = 0.927) and community engagement (r = 0.244) are closely interconnected. With geo-tagging, disaster related alerts can be sent to a particular area or neighborhood and only pertinent information will reach victims. This would also provide additional interest in the content because individuals in the impacted regions would be able to receive more personalized information which directly affects them and thus are better prepared against a response.

Another point made by the Commissioner was the enhancement of the public knowledge about the existing relief services and registration processes. This is supported by the findings of the study as it revealed that disaster communication awareness is a vital component when it comes to behavioural change. It would be better to give easy to understand and in brief information on the access to relief services, regarding the social media platforms, infographics, or videos, to make the people act in a better manner during the crisis. This transparency will minimize confusion and make people understand how to reach out to support throughout and after a disaster.

Public Relations Officers Meteorology Department

The Public Relations Officers underscored the need to supply early weather alerts and real-time weather alerts using social media. This is supported by the study because it indicates that awareness (r = 0.927) and involvement in community (r = 0.244) are highly related with successful disaster communication. Early and easily comprehensible weather forecasts on the social networking sites are bound to provide the populace with the necessary time to take the proper measures and the populace will be aware of the situation beforehand.

The recommendation of the application of social media in the process of clearing rumours and misinformation is of paramount importance, especially in disaster communication. The researchers concluded that community engagement is very essential in behavioural change (r = 0.773) and misinformation can disrupt the success of disaster campaigns. Through the official channels to offer the correct and reliable information and refute the false allegations, the authorities can keep the people trusting them and make them adhere to the right procedure during a disaster.

Conclusion

The suggestions made by the stakeholders, that is, Director PDMA, PIO PES, PIO Relief Commissioner Punjab, and PRO Meteorology are quite consistent with the results of the research. The Study emphasized that effective disaster communication requires the awareness, community involvement and behavioural

change to be critical elements. The good relationships between the use and the engagement of social media indicate that the best way to increase the preparedness and response in the population is through increased use of social media platforms in providing real-time, targeted, and interactive communication.

In order to make the campaigns related to disaster communication on social media more effective; the study findings imply the value of real-time updates, specific campaigns, and the engagement with local influencers. In addition, the fight against misinformation and the provision of clear and location-specific updates will be used to keep communities informed and take proactive actions in the case of a disaster. These results are a strong basis to enhance the disaster communication plan in the future floods and even later.

B. Quantitative Analysis

Time Spend on Social Media

The pie chart represents the amount of time spent by the respondents on social media across various time periods. The biggest segment of users, which is the green segment (B) uses between 1 to 2 hours on social media then there is the moderate portion represented by the yellow segment (C) who use between 2 to 3 hours. The purple segment (D) also includes a large number of people who fall into the 3-4 hours category. A smaller proportion of 4 to 5 hours (beige, E) and the even smaller proportion, pointed by the red portion (F) spend between 5 to 6 hours. The lightest part of the chart, the blue segment (A), refers to users that spend approximately half an hour on social media.

Kind of Disaster Communication

The pie chart shows the nature of disaster communication that the respondents received. The biggest part, which is represented by the green segment, demonstrates that the majority of people (47.9) were informed about disaster communication in the form of posts on social media. The second segment, which is the biggest segment, painted in beige, demonstrates messages of public service and which were passed by 48.1% of the respondents. The percentage that was communicated by the automated calling system was small (2.9), as indicated by the blue segment. Finally, the lowest volume that is highlighted by the colour purple indicates that the disaster communications were received by the respondents as 1.0 percent of the people through mobile applications (PDMA). This distribution shows the significance of social media and public service messages in providing disaster communication in the period that was observed.

Disaster Communication Campaign on Social Media

The pie chart shows how different types of disaster communication campaigns have been witnessed in social media with the respondents choosing the most appropriate disaster communication type to be applied. The highest percentage, which is depicted by the blue segment, shows that the majority of respondents are subjected to flood disaster communication campaigns the most. The second biggest segment, which is green, is to show earthquake disaster campaigns. Smaller sections are observed in drought (yellow) and smog (purple), but both types of campaign receive a lot less support on social media than flood and earthquake-related campaigns. This spread indicates that campaigns about the floods are dominant in the social media communication.

Measurement: Analysis of Descriptive Statistics

Table 2: Measurement: Analysis of Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Awareness	1600	1	5	3.5999	0.78865	-1.166	0.061	2.304	0.122
Community Engagement	1600	1	5	3.6386	0.82764	-1.151	0.061	2.237	0.122
User Behavioural Change	1600	1	5	3.6415	0.84681	-0.945	0.061	1.517	0.122

The descriptive statistics of the control variables are very important in terms of the characteristics of the data set. The average score of all variables is between 3.5999 and 3.6415 , which indicates a positive trend in all measures of disaster awareness, communication, engagement, and preparedness. The findings have coefficients of variation of between 0.78865 and 0.89565; thus demonstrating medium changes in the levels of response and forming a sense of homogeneity of response among the respondents.

The mean of the variable awareness with respect to disaster communication is 3.59999, and the standard deviation is 0.78865. These findings reflect a considerable negative skew of -1.166 and the kurtosis of 2.304, meaning that the responses are concentrated at the high end and have a more acute peak. Likewise, in the mean of Community Engagement, we have 3.6386, and the standard deviation is 0.82764. This has negative skewness -1.151 and kurtosis 2.237, meaning most respondents have a positive perception, and there is clustering of scores at the higher level.

For "User Behavioural Change", the mean = 3.6415, which is the highest among all the variables, and standard deviation = 0.84681, which also indicates positive behavioural change and is further corroborated by the negative skewness at -0.945 and kurtosis of 1.517.

In this case, therefore, the findings indicate that the mean average for all the variables presents a positive perception and positive behavioural intentions. This is a confirmation of the fact that a large number of respondents have a positive perception towards disaster communication, preparedness, and response, as depicted by the negative skewness values that correspond. The moderate variability across standard deviations adds to the reliability of the responses received. Therefore, interpreting the awareness and engagement levels of stakeholders towards disaster management activities is well supported by these results.

Awareness Regarding DC

Table 3: Descriptive Statistics Awareness Regarding Disaster Communication

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
1. I am familiar with the disaster communication awareness campaigns on PDMA's social media accounts.	1600	1	5	3.56	0.879
2. In my area, PDMA's social media channels are an effective	1600	1	5	3.85	0.965

tool for disseminating flood risk information.					
3. The PDMA disaster awareness campaigns helped me understand the importance of unblocking the flow of water in the river.	1600	1	5	3.63	0.991
4. The PDMA's social media postings have made me more aware of the possible effects of floods in my community.	1600	1	5	3.61	0.964
5. I have learned regarding flood emergency preparedness measures through PDMA's social media accounts.	1600	1	5	3.74	0.895
6. The PDMA's posts have inspired me to create a family emergency plan for flood situations.	1600	1	5	3.45	0.94
7. The PDMA's social media updates provide clear instructions on how to respond to flood warnings.	1600	1	5	3.56	0.894
8. I am aware of local evacuation routes and shelters because of information shared by the PDMA.	1600	1	5	3.56	0.953
9. The visual aids (such as info graphics and videos) used by the PDMA on social media help me understand the pre flood arrangements.	1600	1	5	3.46	0.895

The findings are described along with recommendations. Standard deviations of the outcomes of the nine items measuring awareness concerning disaster communication help in understanding individual responses and the spread of outcomes. All items were scored from 1 to 5, and the mean and standard deviation analyses depict participants' response directionality. The mean values for the items vary between 3.45 and 3.85, which shows the overall moderately positive response towards the awareness of disaster communication. Regarding issues that received the highest mean, responders were most positive about awareness regarding disaster communication two, which has a mean of 3.85. Conversely, awareness regarding disaster communication 6 has the least mean of 3.45, showing that respondents had a relatively low level of agreement or awareness with this particular item. The standard deviations stand between 0.879 and 0.991, interpreted as a moderate dispersion of the responses given. Concerning awareness of disaster communication 3, the scale has the largest standard deviation of 0.991, an implication of slightly more dispersed responses as compared to other items.

This relative variability suggests variations in perceptions or encounters of participants on this particular question. On the other hand, awareness regarding disaster communication 1 means that there is a lower standard deviation of 0.879, hence implying that these findings are more consistent. Awareness regarding

disaster communication, Items Awareness regarding disaster communication 5, and awareness regarding disaster communication 2 have moderate variability and mean values of 3.74 and 3.8,5, respectively, indicating a higher level of consensus among the participants. Overall Summary: The findings showed that participants' mean scores for the items are above the midpoint, suggesting that participants' awareness of disaster communication is mildly positive. However, the variability (standard deviations) shows that, although respondents are clear on the concept of awareness, they may not attend to or comprehend the same items to the same degree. Consequently, this means that although there is a relatively high level of awareness in all areas of disaster communication practices, specific subgroups may require special studies or programs to be implemented to achieve a more unified perception and understanding of the practices in question.

Community Engagement Regarding Disaster Communication

Table 4: Community Engagement Regarding Disaster Communication

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
1. I regularly "like" and follow the posts from the PDMA on social media.	1600	1	5	3.43	0.982
2. The PDMA's posts frequently receive my positive reactions (e.g., love, wow).	1600	1	5	3.6	0.921
3. I often share the PDMA's posts about flood disaster management on my social media.	1600	1	5	3.7	0.95
4. I encourage others to share the PDMA's content by using the share button on their posts.	1600	1	5	3.69	0.95
5. I frequently comment on the PDMA's social media posts related to flood disaster management.	1600	1	5	3.73	0.984
6. I actively participate in discussions about flood disaster management on the PDMA's social media pages.	1600	1	5	3.59	0.937
7. The discussions on the PDMA's posts often lead me to learn new information about flood preparedness.	1600	1	5	3.72	0.945
8. I feel more prepared for floods due to my engagement with the	1600	1	5	3.63	0.962

PDMA's social media content.					
9. The PDMA's social media contents are informative and useful.	1600	1	5	3.73	0.943
10. The PDMA's social media accounts are a reliable source of information on flood disaster management.	1600	1	5	3.57	0.877

It is important, however, to interpret descriptive statistics in a bid to determine the accomplishment in engaging the community.

The means concerning the Community Engagement variable that has been estimated based on 10 items provide meaningful patterns of participants' responses. All of them were measured, ranging from 1 to 5, and the means as well as standard deviations were determined in relation to the level of agreement and the dispersion.

The results for the 10 items are as follows: item 4 has a mean = 3.43, item 4 has mean = 3.48, item 6 has mean = 3.73, item 7 has mean = 3.67, item 8 has mean = 3.53, item 9 has mean = 3.7, item 10 has mean = 3.58, item Concerning the level of agreement, mean values revealed that Community Engagement 1 has the lowest agreement mean at 3.43 and the highest standard deviation at 0.982 therefore varying greatly from the rest of the items. This was, however, accompanied by relatively fewer means, with participants showing less agreement and favourable perceptions of the aspect, as captured in Community Engagement 5 and Community Engagement 9, with a mean of 3.73.

The standard deviations of items range from 0.877 to 0.984, which represents a moderate fluctuation. Among all the developed items, Community Engagement 10 received the lowest standard deviation of 0.877, meaning that the students provided a more consistent response regarding this item than to others. On the other hand, Community Engagement 1 and Community Engagement 5 have relatively higher coefficients of variability at 0.982 and 0.984, respectively, suggesting a relatively wider spread of respondents in their answers to these questions.

In conclusion, the results paint a picture of participants' relatively positive behaviour towards their community, for items 5,7&9 had high means. That said, the comparatively smaller mean scores have been obtained for items 1 and 10, which suggests that it may be possible to strengthen the outreach with communities. The specified concerns might be improved by fatiguing or rectifying such particularities with a view to augmenting community participation and cooperation in relation to disaster measures. Moderate standard deviations also substantiate divergence in opinions, implying the existence of a difference in experiences or level of participation of the respondents.

User Behavioral Change

According to the descriptive statistics, 10 items that evaluate a User Behavioural Change assess the behavioral change of respondents who make changes in disaster management and disaster awareness. Each item was rated on a one-to-five scale, and the outcome obtained can be viewed as the mean and the standard deviation scores, that is, the mean and dispersion of data.

Table 5: User Behavioral Change

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
1. I always follow evacuation orders posted by the PDMA on social media during an emergency.	1600	1	5	3.7	0.936
2. The evacuation information provided by the PDMA on social media influences my decision to evacuate during a disaster.	1600	1	5	3.65	1.016
3. I have prepared an emergency kit for family securing as recommended by the PDMA on social media.	1600	1	5	3.71	0.978
4. The PDMA's social media posts have prompted me to update my emergency kit regularly.	1600	1	5	3.55	0.984
5. I follow safety protocols shared by the PDMA on social media.	1600	1	5	3.66	0.975
6. The PDMA's social media content has improved my adherence to recommended safety measures during emergencies.	1600	1	5	3.71	0.964
7. My behaviour regarding disaster preparedness has changed positively due to information from the PDMA on social media.	1600	1	5	3.63	0.904
8. I discuss the PDMA's social media updates with my family and friends to encourage them to take appropriate actions.	1600	1	5	3.65	0.945
9. I trust the information provided by the PDMA on social media.	1600	1	5	3.71	0.934
10. The credibility of the PDMA's social media posts influences my willingness to take recommended actions.	1600	1	5	3.46	0.971

The findings below show positive behavioural change among the participants, with mean values of the 10 items ranging from 3.46 to 3.71. LBL User Behavioural Change 3, 6, and 9 had the highest mean value of 3.71, which means these areas of behavioural change were scored positively more frequently. On the other hand, the least mean score of 3.46 shown in the Table depicts slightly less agreement in terms of weak behaviour change regarding User Behavioural Change 10.

The standard deviations vary from 0.904 to 1.016, which can be viewed as an intermediate level of response variability. In the patterns of the respondents, User Behavioural Change 2 has the highest standard deviation (1.016), which means the interviewees' answers differ greatly, meaning that the participants encountered or have a different perception about different kinds of experiences. At the same time, User Behavioural Change 7 seems to be the least deviant from the mean, with a standard deviation of 0.904, suggesting that it had higher inter-response agreement.

In sum, the findings suggest that participants describe moderate to substantial descriptive behavioral changes when it comes to experiences or communications of disasters. Items 3, 6, and 9 are most salient with the highest mean scores, and this indicates a strong response among the respondents. But it reported that items 4 and 10 are somewhat less mean, which may be an indication of a place where the behaviour change is not as high. Standard deviation of moderate variation of responses indicates that the experiences or perceptions of the respondents may be different or would be diverse, particularly in the case of Item 2. These consequences result in a system of explaining behaviour transformations and finding what spheres should remain in focus and, therefore, develop further changes.

Comprehensive Analysis of Correlations

Table 6: Comprehensive Analysis of Correlations

**. Correlation is significant at the 0.01 level (2-tailed).

		Awareness regarding disaster communication	Community Engagement	User Behavioral Change
Awareness regarding disaster communication	Pearson Correlation	1	.927**	.760**
	Sig. (2-tailed)		.000	.000
	N	1600	1600	1600
Community Engagement	Pearson Correlation	.927**	1	.773**
	Sig. (2-tailed)	.000		.000
	N	1600	1600	1600
User Behavioral Change	Pearson Correlation	.760**	.773**	1
	Sig. (2-tailed)	.000	.000	
	N	1600	1600	1600

Pearson Correlation coefficients are in the table and they indicate the degree of linear association among various pairs of variables, and their statistical significance. It is time to deconstruct and decipher each of the major outcomes to understand it better. The Pearson correlation value is 0.260, which implies that there is the moderate positive correlation between the duration of social media time and enlightenment about disaster communication. This implies that the longer the time that people spend on social media, the more they are likely to be aware of disaster communication. The level of significance ($p = 0.000$) is lower than 0.01 by far, which implies that this is a statistically significant relationship.

The value of correlation is 0.244, which also implies a moderate positive correlation. This implies that the more people use social media, the more they tend to consume disaster related information or campaigns. The value of significance ($p = 0.000$) stands to show that such a relationship is statistically significant.

The relationship between the duration of time spent on social media and the behavioural change in the user is 0.295, meaning of moderate positive relationship. This implies that the longer time spent using

social media, the more drastic the user behaviour change (through preparedness measures adoption, evacuation, or participation in disaster relief activities). Once again, the value of significance (p = 0.000) proves that this correlation is statistically significant.

Awareness: The participants were aware of disaster communication and other variables.

The value of correlation between the awareness on disaster communication and community engagement is 0.927, which is a positive correlation with a strong value. This implies that the increased disaster communication awareness correlates strongly with the increased community engagement, including the share, comment, or interaction with disaster-related posts. The level of significance (p = 0.000) is a confirmation that this is a statistically significant relationship.

The potential correlation between the awareness of disaster communication and change of behaviour of the user is 0.760 in which there is a strong positive relationship. This means that the more people get the message about disaster communication, the more they will be likely to respond to the campaigns by changing their behaviour (preparing to floods, staying on evacuation routes, or preventive measures). The strength and statistical significance of this relationship is supported by the value of the significance (p = 0.000).

The correlation in this case is 0.773 and this implies that there is strong positive correlation between community engagement and user behavioural change. It implies that the more people interact with disaster-related information (e.g., by liking, sharing, or commenting on it), the higher the likelihood of them modifying their behaviour, e.g., sticking to safety precautions and preparing emergency kits or participating in the relief operation. The value of statistical significance (p = 0.000) demonstrates that this correlation is very strong.

These correlations between user behavioural change and all other variables (time spent on social media, awareness on disaster communication, and community engagement) are all positive and significant. Community engagement has the highest correlation (0.773) with the other as the greater the engagement with disaster communication, the higher the behaviour change. The second-highest correlation (0.760) is with the awareness related to disaster communication which stresses the point that awareness is a crucial variable when it comes to triggering behaviour change. The correlation with the time spent on social media (0.295) is positive as well, which means that the more a person is engaged in social media, the greater impact it has on behaviour change, although the correlation is not so strong as with the other variables.

According to the correlations, awareness, community engagement, and user behavioural change are all correlated significantly with the time spent on social media and to each other. In particular, the longer people spend on social media, the more they get to know about the disaster communication, so, the more the community is engaged and the better the user behavioural change is achieved.

The highest relationships are seen between the awareness and community engagement (0.927), community engagement and user behavioural change (0.773), and the role of active participation and awareness is very important in influencing the behaviours. It indicates that disaster communication campaigns can be more fruitful in case they can raise the sense of knowledge of people as well as enhance their interests in information.

The correlation between the time spent on social media and change in user behaviour (0.295) indicates that although there is a positive relationship between social media use and behavioural change, it might be possible that other factors including the kind of content that individual consumes or previous disaster experience may be important with regard to behaviour change.

Conclusively, the findings imply that social media is a major factor that aids in creating awareness, community engagement and inducing behavioural change with awareness and community engagement serving as the strongest predictors of behavioural change. This means that any disaster communication campaign must target some measures that can increase awareness and participation towards effective promotion of preparedness and response behaviours among the population.

Discussion of Results

This study reveals that the disaster communication campaigns that were adopted by the Punjab Disaster Management Authority (PDMA) using the social media platforms generally positively impacted the younger generation in the state of Punjab who had been affected by the floods. The average values of main constructs such as awareness, community engagement and behavioral change were not less than the midpoint of the scale, which suggested positive reactions of the audience to the communication activities of PDMA.

The descriptive statistics show that the awareness of disaster communication had a mean score of 3.60 which implies that the respondents were moderately to highly aware of information about the disaster spread on social media. The negative skewness on the variables that are related to awareness shows that a high percentage of the respondents were oriented towards increased levels of agreement which is a sign of efficiency of the message penetration. These findings confirm the Disaster Risk Reduction (DRR) theory, which highlights the importance of information dissemination to decrease vulnerability and improve preparedness in the communities.

Community engagement was also showing positive results and the mean scores were between 3.43 to 3.73 on various indicators. This implies that the campaigns undertaken by PDMA not only hit the target audience but also provided interaction and participation. Nevertheless, comparatively lower average scores on some items on engagement indicate the lack of two-way communication, suggesting that the flow of information was not enhancing, but enhancing participatory engagement was possible. This partially coincides with the Situational Crisis Communication Theory (SCCT) that states that situational communication can increase trust and credibility of the message when in crisis. One of the best results of the study was found to be the change of the user behavior as several behavioral indicators showed the mean of 3.71. This implies that trauma induced by exposure to messages on disasters made respondents engage in precautionary and preparedness-based behaviors. These standard deviations indicate that there is a range of behavioral response to a moderate degree, probably because of the differences in the digital literacy, access to the internet and rural to urban differences that were also cited as obstacles in the study.

However, the use of social media seems to be not enough to access marginalized and rural communities, which confirms the recommendation of the study to integrate the use of Facebook and X as a communication channel. In general, both hypotheses were supported and the results provide evidence that social media campaigns by PDMA positively influence the awareness, engagement, and behavior change. Meanwhile, the results indicate structural and contextual shortcomings that restrict the effectiveness of disaster communication with social media to their full extent.

CONCLUSION

This paper concludes that disaster communication campaigns undertaken by the Punjab Disaster Management Authority through social media can create a great impact to change lives of the disaster affected youth in Punjab in terms of awareness and community mobilization and change of behavior. The results indicate that prompt, regular, and graphic content is achieving better understanding of the risk of a disaster and stimulates preparedness-related behaviors in various levels of disaster management rotation.

But the success of such campaigns is limited due to lack of access to the internet, poor digital literacy, language barrier and misinformation especially in the rural regions. Although social media is a useful tool of communication, it cannot and must not work alone. Social media should be incorporated in the traditional and community-based communication channels to achieve inclusiveness and wider coverage. Although the study was limited in a methodological sense in that it used self-reported data and had a cross-sectional design, it offers empirical support to the strategic utilization of social media in disaster risk reduction and gives key indications on how disaster communication practices can be enhanced in the future.

All in all, the results show that the social-media-oriented disaster communication of PDMA is a positive aspect of forming the vision of audiences and facilitating more secure reactions to flood-related threats. The numerical findings indicated that there was overall positive awareness, involvement in disaster messages, and statistically significant connections between the central variables. Specifically, an increased exposure and active involvement are always linked to better awareness, more self-reported behavioral change. These trends contribute to the paper that social media is not just a broadcasting channel but a mechanism capable of affecting preparedness and response behaviors in the presence of visible, timely and trusted content.

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APPENDIX I
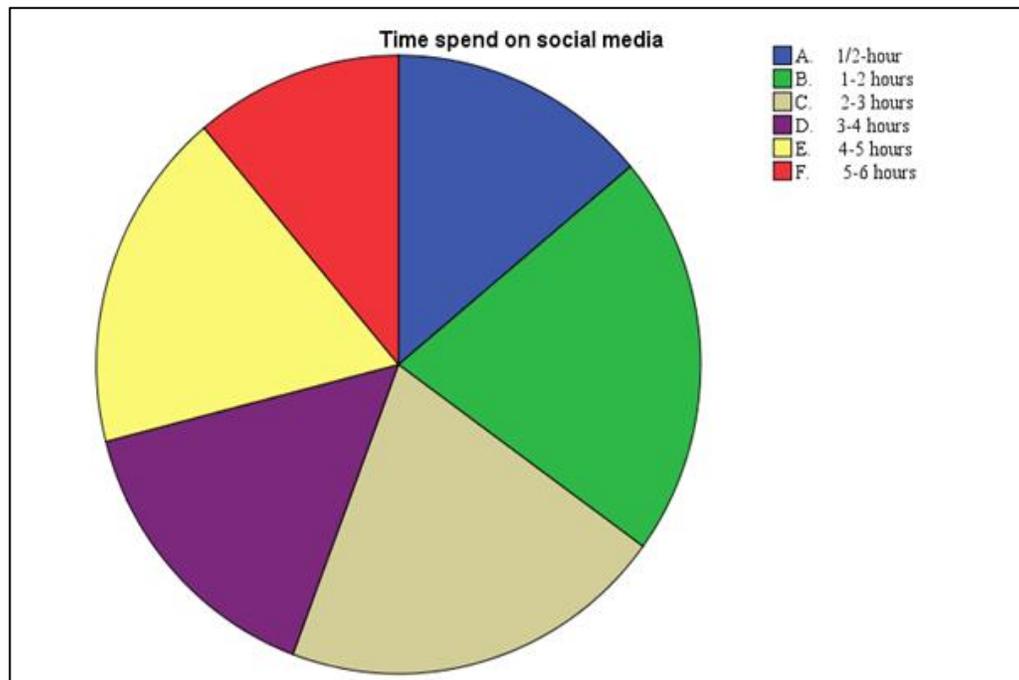
Figure 1: Time spend on social media
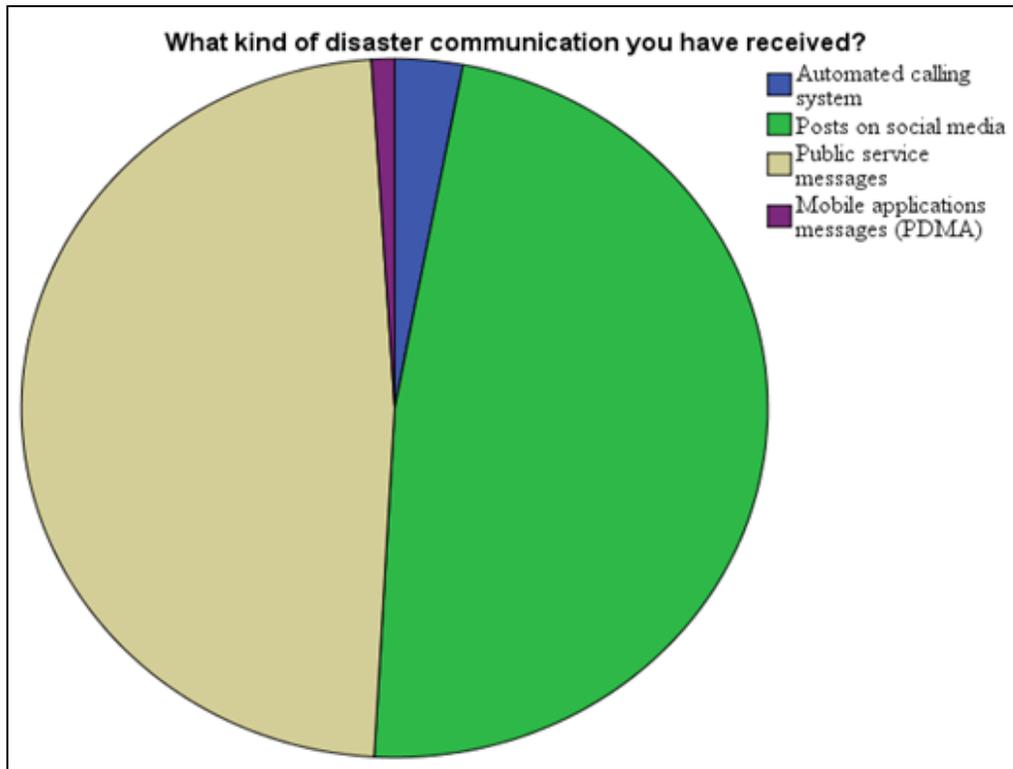
Figure 2: Time spend on social media

Figure 3: Disaster communication campaign on social media