"Does Pakistan still have polio cases?": Exploring discussions on polio and polio vaccine in online news comments in Pakistan

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ABSTRACT

Introduction: Polio, which is caused by poliovirus, is a contagious, potentially crippling, and deadly disease. Pakistan is one of the countries in which polio is still endemic in the 21st century. In 2019, 146 polio cases were reported across the country with some resulting in deaths. Following the spread of rumors insinuating that children were falling sick after receiving an anti-polio vaccine, a mob attacked and set fire to a small hospital in the Peshawar district in April 2019. The present study investigates readers' discussions that emerged from *Dawn's* online readers' comments on polio-related news stories in Pakistan.
Methods: Using thematic analysis, we analyzed (*N* = 2216) comments made by readers in the polio-related news stories published on Dawn.com from January 1, 2012, to March 1, 2020.
Results: Seven major themes emerged from the analysis of the comments: 1) reasons for and challenges resulting in the failure to eradicate polio; 2) proposed solutions and policy changes to eradicate polio; 3) misinformation; 4) criticism, frustration, and shame; 5) comparison of Pakistan to other countries; 6) the internet as a public sphere; 7) suffering, empathy, and appreciation. Overall, our findings suggested that commenters are knowledgeable about polio vaccines and consider polio a serious threat to public health in Pakistan.
Conclusion: Our study not only validated previous study findings such as reasons, challenges, and issues related to polio vaccination, but also found new challenges in online news sites concerning misinformation on polio and polio vaccination in Pakistan.

1. Introduction

Polio or poliomyelitis is a life-threatening acute paralytic disease that causes nerve damage and paralysis [5], which still remains endemic in Pakistan and Afghanistan. WHO, UNICEF, and local governments have faced several barriers to eradicate polio such as resistance on the basis of religion, especially from clergymen in Pakistan and Afghanistan [37]. Other challenges include parental refusal of polio vaccination, conspiracy theories, and misinformation which have rendered the polio eradication initiatives futile [11,13,14,18,34]. Polio vaccine hesitancy and resistance remain high in some areas of Pakistan. For example, following the rumors spread through social media claiming that polio vaccine had resulted in the death and sickness of school children

[35], a mob attacked and set on fire a hospital in Peshawar, a high-risk district for polio which occurred. This misinformation resulted in 25,000 children being rushed to hospitals in the district. As a response to this incident, the Emergency Operations Center Khyber Pakhtunkhwa (KPK) launched a campaign with the help of medical experts, parents, and polio health workers to counter rumors that polio vaccines cause sickness in children [18]. This news got media attention. Online readers started discussions on Web 2.0 to engage with this news story and reflect on the current state of polio and fake content surrounding polio-related issues in Pakistan.

Online platforms such as comments sections play an important role in creating discourses about health issues. This study is important for two reasons: firstly, internet discussion can impact readers' decision-making processes regarding vaccine administration and the type of measures they will take in the future [2,20,33]; secondly, online comments produce and distribute information among readers, are a source of information for many people, and are considered as an alternative to traditional media when it comes

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to seeking health-related information [12]. The comment section allows individuals to voice their thoughts and discuss diverse ideas and opinions related to any issue in a new form of public space on the internet [16,27]. Commenters might not be demographically representative, but they hold diverse socio-cultural views — e.g., regarding a particular health issue [28]. Previous literature also argues that these online spaces are a "wealth of information" that provide more authentic and diverse opinions than letters to the editors [7]. Meyer et al. [19] study found that online news comments are not only a space to engage with like-minded people but also aid in correcting misinformation and demanding proof of opinions.

Our study aims to understand how readers of *Dawn* discuss and view polio in Pakistan. Specifically, we intend to find major public themes discussed in online news comments under *Dawn* news stories related to polio and polio vaccination. Furthermore, Pakistan's online newspaper commenters' perceptions toward polio and polio vaccines are studied. To accomplish this goal, we employed a thematic analysis approach to understand users' comments in *Dawn* news stories published between January 2012 and March 2020. To the best of our knowledge, no study has been conducted to understand polio and polio vaccination in online news stories' comments in Pakistan.

2. Methods

2.1. Data collection

We started looking at the comments section from the English version of the Pakistani Dawn media group (Dawn.com) to investigate people's discussions on and perceptions of polio. *Dawn,* an English-language newspaper, is Pakistan's highly reputable, widely circulated, trusted, more mature, and less sensationalized publication when it comes to reporting on national and international issues [20,30]. With the help of key word like "polio" we searched news stories related to polio on NexisUni. Then, we used the same keyword on the official news website Dawn.com to find stories which had more than three comments per article to collect the data. In total, we excluded five articles that included token words such as "yes," "good," and "good luck" by following Jenkins and Moreno's [12] approach to exclude stories which have less than three comments. Those comments did not make semantic sense or could not be used to generate any meaning. In total, (N = 2216) comments in (N = 111) published news articles, opinion pieces, letters to editors, editorials, features, and long reports between January 1, 2012, and March 1, 2020, were gathered. The number of comments under news articles varied considerably; we had stories ranging from 4 to 170 comments. The average

number of comments generated per news story was 20.33. The following section provides the results from the dataset based on themes and sub-themes. Table 1 provides information on yearly published comments under polio-related stories in *Dawn.*

2.2. Sampling

We manually collected all the comments under polio-related news stories. Stories that had less than three comments or were not related to Pakistan, such as "Two polio cases reported in Africa" (published May 29, 2019), were excluded.

2.3. Ethical issues

To meet the ethical standards of this study, there was no need to acquire consent from commenters because the selected comments are publicly available [19]. Scholars who have studied online news comments in the past argued that when commenters voiced their opinion online, they are aware that their comment will be read by the public [6,8,28]. Therefore, Institutional Review Board approval was not needed for this study. However, to protect the anonymity and traceability of the commenters and replaced names with the date of the comment [6,28].

2.4. Data analysis

Methodologically, we adopted an inductive, data-driven approach to investigate the data [3]. After data was collected and organized in an Excel sheet, the first three authors familiarized themselves with the complete dataset. Then, the first three authors used an open-coding approach to code 33% of the data individually by reading each comment line by line [4]. During the first phase, the researchers remained open to all possible themes. The coding sheet was continually updated as each researcher continued coding the comments for themes. In the second phase, the authors used a focused coding approach to understand the most frequently occurring themes. During this phase, 14 themes were generated, and narrower categories were developed. In the final phase, the themes were further refined, modified, and merged following further discussion and agreement among the research team. After coding and discussing among the research team, seven major themes emerged from the readers' comments. Illustrative names (e.g., criticism, frustration, and shame) and sub-themes were used to provide definitions and conceptualization of the themes [28]. We considered each comment as a unit of analysis regardless of the number of words. Table 2 provides an overview of major themes and sub-themes in the comment section of *Dawn*'s polio-related news stories.

Table 1
Summary of published news stories and comments related to polio in *Dawn* newspaper 2012–2020.

Year	Number of reported polio cases	Number of articles/years	Sum of number of comments	Average number of comments per article	Comparison of average number of comments
2012	58	8	204	25.5	14.2%
2013	93	7	55	7.9	4.4%
2014	306	4	133	33.3	18.6%
2015	54	10	215	21.5	12.0%
2016	20	12	329	27.4	15.3%
2017	8	9	222	24.7	13.8%
2018	12	3	21	7.0	3.9%
2019	147	41	844	20.6	11.5%
2020	82	17	193	11.4	6.3%
Grand Total	**780**	**111**	**2216**		**100%**

*Number of polio cases are updated as of December 06, 2020.

Table 2
Themes and sub-themes in *Dawn* newspaper's online news comments.

Theme	Sub-Theme	Example from the data
Reasons and Challenges for Failure to Eradicate Polio	- Stating reasons why polio still exists in Pakistan Providing reasons for failed polio campaigns Describing challenges to eradicate polio from Pakistan	I will not allow my children to take polio drops if it is not manufactured in Pakistan (April 24, 2019).
Solutions to Eradicate Polio and Change Policies	- Suggesting various solutions to eradicate polio and how to make polio vaccination campaigns successful Recommending changes in health policies regarding polio	Proper education about vaccination along with sewer drainage, collection and proper treatment are the only way to solve this problem (February 17, 2020).
Misinformation	- Spreading misinformation in online news comments Countering and offering solutions to eradicate misinformation by suggesting reliable/factual sources	We should ban YouTube, Facebook, Twitter, WhatsApp etc. like Chinese government did (April 19, 2019).
Criticism, Frustration, and Shame	- Criticizing Pakistan's government policies Releasing frustration regarding polio cases Talking about the image of Pakistan	There is no limit to violence and stupid behavior in Pakistan. These workers had come to help you and your family and how did you reward them? Shame on such culture (January 29, 2020).
Comparison of Pakistan to Other Countries	- Comparing Pakistan's polio case situation with other countries around the world Commenting on polio vaccines, polio vaccination, polio eradication, and government policies of other countries	India has done an exemplary job in polio eradication. Pakistan needs to learn (January 11, 2020).
Internet as a Public Sphere	- Discussing research on polio and polio vaccines/vaccination Suggesting facts on science related to polio Sharing ideas, thoughts, and personal opinions on polio	According to the WHO there were around 400 people affected with the virus; it kills 1 in 200 cases. Question: Why is it so important to vaccinate the Pakistanis, the Syrians, the Nigerians and the afghans ????? not only that but hundreds of millions is spent to force populations to take this vaccine!!!! (May 5, 2014).
Suffering, Empathy, and Appreciation	Highlighting people's suffering from polio Empathizing and showing compassion for polio health care workers, their families, and children Appreciating polio health care workers	I salute all you Polio workers. You risk your life to save the next generation from becoming disabled. You are courageous, you are the true Mujahideen. May Allah protect you and your families (December 21, 2013).

3. Findings

3.1. Reasons for and challenges resulting in the failure to eradicate polio

Reasons and challenges to eradicate polio was one the most discussed themes in online news comments. The most common reasons were lack of education, religious opposition to polio vaccine, polio health workers' security issues, doubts about the efficacy of the vaccine among parents and general public, conspiracy theories including the involvement of Central Intelligence Agency (CIA), Research Analysis Wing (RAW), and Jews to sterilize Muslims, lack of media's active role to create awareness on polio eradication, government corruption issues, ignorance among rural communities about vaccination, and mistrust against government and its public health institutions. Comments in this theme reflect a plethora of reasons and challenges for Pakistani government to eradicate polio successfully. It also shows the diversity of challenges which Pakistan continues to face regarding vaccination. Examples:

Corruption is the main reason for the failure in Pakistan, most of the aid money went to officials' private bank accounts (July 20, 2019).

Ignorance and illiteracy are your biggest enemy. Educate yourself (June 14, 2015).

Terrorists are responsible (December 21, 2013).

We are not polio free because of the intrigues of our so-called religious scholars (July 20, 2019).

If this is what the extremists are doing resisting vaccinations and killing the NGO (May 5, 2014).

If the Taliban stopped killing the people trying to help and give out the vaccine, it would not spread (March 25, 2013).

Several individuals described the challenges of successful polio campaigns, challenges faced by polio health workers, and reasons why the government has failed with polio campaigns, especially in rural areas. One of the major reasons commenters mentioned was indoctrination from religious extremists who spread misinformation through religious teachings and social media.

3.2. Proposed solutions and policy changes to eradicate polio

Commenters discussed possible solutions to eradicate polio from Pakistan. This is the second-most-discussed theme among commenters. However, surprisingly, the solutions which appeared in these comments are stringent and difficult to implement. For instance, commenters suggested that there should be a punishment for those who refuse vaccination, media role is vital to create awareness about the polio and polio vaccine, government should put religious leaders in prison, health officials should dialogue with parents who have doubts about vaccinating their children, and the use of force through security departments was suggested. People also proposed changes in health-related policies, specifically those concerning the eradication of polio from Pakistan. Examples:

To eradicate polio, we need to take five steps: 1) All mobile phone and multinational companies etc. should buy TV time and place ads telling people about polio and its effects and sufferings. 2) Each MNA [Member of National Assembly] and MPA [Member of Provincial Assembly] should be held responsible for every case reported in his area. 3) Involve cricketers and other stars like Shahid Afridi, Waseem Akram, Saeed Ajmal and any other sports, TV and movie star who can volunteer time and effort for this cause. 4) Billboards should be erected with pictures not words in slum areas showing the misery of polio. 5) If these steps are taken, then make centers and let people come with the kids so that shooting of lady workers is avoided. (Ameen). (July 1, 2019).

Parents of polio virus affected children should be sent to jail at least for 10 years (April 27, 2019).

Agree that the military is the only solution (December 12, 2012).

The only long-term solution to focus upon is education (April 27, 2019).

Our religious leaders can play a big part positively in this campaign (April 24, 2019).

Under this theme regarding solutions to eradicate polio, commenters suggested the imprisonment of parents who refuse to vaccinate their children, the creation of awareness among Pakistani people, and the implementation of celebrity endorsement.

Regardless of the outcome, a group of commenters recommended the use of military force and the positive role of religious groups to eradicate polio. Commenters also construed polio as a threat to Pakistan's future, therefore justifying the use of force and severe punishment as the only solution.

3.3. Misinformation

We found that misinformation was the third-most-occurring theme in online news comments. A sizable proportion of commenters reflected on the ongoing misinformation and fake viral video related to polio content on social media sites. The most important theme we found in the comments focused on misinformation, particularly after a mob attacked a hospital on April 22, 2019. Commenters talked about the effects of "disinformation and misinformation" regarding vaccination acceptability. They viewed polio-related "fake videos, Facebook posts, YouTube content" as harmful to campaigns and as new challenges to make polio campaigns successful. Some of the commenters viewed fake information on vaccines as an amplification of new polio cases. Examples:

Polio is not a contagious disease (January 11, 2020).

Those vaccines are big time harmful. They are trying to make us take them in the United States too. Do not let them touch you or your children. Mercury, Formaldehyde, MSG, Aluminum, according to the American CDC!!! People get sick and die from vaccines. (March 6, 2015).

There is actually no polio in Pakistan, there is another disease which people mistake for polio (January 11, 2020).

No doubt, social media is the home of false, fraud and futile media outlets bent upon spreading fake news (May 11, 2019).

Please do not comment about the subject with so much authority that you do not know. You will add to the confusion. The risk of giving immunization with live attenuated virus certainly is not warranted in people with poor immune status such as those on chemotherapy or immune diseases etc. polio from polio vaccine?? (April 1, 2017).

The rumors quickly went viral among the netizens and we found some of the commenters spreading fake news, misinformation, and making false claims about the vaccination. As shown in the examples above, individuals also believe that there is "no polio in Pakistan." We noticed that misinformation was prominent in recent comments particularly between 2019 and 2020. Some commenters mentioned that social media is the "home of false," fraudulent information, and responsible for spreading fake news. In addition to that, some of the commenters also countered misinformation and false claims by providing factual information from reputable journals and news media outlets such as *Nature* and Google Scholar.

3.4. Criticism, frustration, and shame

In this theme, comments generally criticized Pakistan's government health policies, particularly polio-related actions. Most commenters expressed their frustration and anger due to various factors such as the "killing of polio health workers," "incompetencies of the government's various departments," and consider the polio disease as a "shame" for Pakistan. Many individuals stated that the government's lack of political will, people's lack of awareness regarding the effectiveness of polio vaccination, and the misplaced health priorities by Pakistan's government are responsible for placing Pakistan in a position where the country is not yet polio free. Commenters contended that polio is hurting Pakistan's image and that government policies are not geared toward viable solutions. The following comments are from the dataset:

Forget the economy. Polio resurgence is the biggest failure of the government (October 6, 2019).

People of Pakistan are not taking the country forward. It is ridiculous that something as simple and basic as polio drugs is not accepted. Let us all stand up and make Pakistan a polio free nation (April 24, 2019).

Shame Shame Shame! Another humiliating news for Pakistani's Oh! wait is American behind this? or maybe India? Wake Up nation the world is moving on (May 5, 2014).

Shame on us that we can't manufacture vaccines, but we can build atomic weapons (January 14, 2015).

Readers framed the existence of polio in Pakistan as the government's "biggest failure" and expressed their anger at the failure of the government of Pakistan to eradicate polio from the country. Some commenters who expressed their anger, also mentioned that they are "healthcare professionals or public health scholars" and are doubtful that the incumbent or any other subsequent government would make Pakistan a polio-free country. It was also noted that people used strong words to express their feelings about polio and polio vaccination in Pakistan. Additionally, people were fed up and pessimistic about the non-eradication of polio from Pakistan. For instance, people were angered that Pakistan has atomic weapons but cannot manufacture polio vaccines. Some individuals went as far as stating that polio is "humiliating" to Pakistan and that it is a shame that the government is unable to control and eradicate polio from the country.

3.5. Comparison of Pakistan to other countries

This theme refers to the comparison of Pakistan's current state of polio not only to neighboring countries such as Afghanistan, Bangladesh, China, and India but also European and African countries (Nigeria, Somalia, & Sudan), as well as the United States. Commenters compared Pakistan with others in terms of eradicating polio through drops, vaccination effectiveness, successful polio campaigns, and government health priorities. These online readers of *Dawn* provided examples from other countries and suggested that Pakistan can learn from them. Many commenters referenced other Muslim majority countries, like Bangladesh, that had similar challenges but have successfully eradicated polio. Below are a few examples of comments:

When the same vaccine has eradicated polio from the entire world leaving a handful of cases in Pakistan, Nigeria and Afghanistan due to the unfounded doubts of the stubborn militants calling it Satanic-drops that exposed Osama, what else is required to prove its efficacy in the wildest of imagination? (March 6, 2015).

India eradicated polio a long time ago. India has a robust polio vaccination drive frequently at each village level (January 31, 2020).

Neighbor countries India, Sri Lanka, Bangladesh already achieved zero polio. When will Pakistan do it? (July 5, 2017).

Commenters talked about other countries' policies in successfully eradicating polio while comparing Pakistan's challenges and opportunities to those other countries have had. For instance, other countries of similar economic standing as Pakistan have similar problems like "extremism, poverty, resistance, and lack of awareness." Commenters suggested that Pakistan can be successful if it implements similar strategies to eradicate polio and asks for help regardless of "political and diplomatic relationships."

3.6. The internet as a public sphere

The conversations about polio and polio vaccination evolved into an online discussion forum. The commenters viewed online commenting as a "public sphere" to express their opinions, share scientific studies, and pose critical questions to journalists, government health officials, and one another. In this theme, we found that people held an online dialogue on polio in Pakistan. Some of them

asserted their expertise on the topic and shared resources for other people to check facts and statistics about the disease. Examples:

As a medical professional, what I would like to emphasize is that a significant portion of the population is not vaccinated in Pakistan. If you see the age group that is vaccinated, it's only under 5 years children which is more vulnerable. In an endemic country like in Pakistan any age group can carry or transmit a communicable disease (November 26, 2019).

Why burn the hospital and break hospital windows? Our people have to learn to control their emotions. Everybody in my country blames someone else for their problems. What an immature reaction towards a problem. Read mass hysteria in educational institutes on Google (April 22, 2019).

Number of reported Poliovirus cases in the World in 2015 (WHO): Pakistan-54 (73%), Afghanistan-20 (27%) (October 23, 2016).

Oral polio vaccine (OPV) and injectable (IPV) have different mechanisms of action. OPV induces intestinal immunity whereas IPV blood immunity. but the downside of OPV is that it causes polio in one out of 750,000 cases. So, a country like ours with a population of 180 million mounting a massive campaign of OPV immunization is bound to get dozens of new polio cases. it may thus never be declared polio free (April 1, 2017).

In this public space, people shared their stories and experiences with polio. Commenters discussed polio cases under these news stories and shared facts and figures on the number of polio cases. Commenters saw the comment section under the news stories as a place to share statistics, opinions, clarify, and discuss health issues with other readers/commenters.

3.7. Suffering, empathy, and appreciation

Commenters in this theme highlighted the suffering of children due to polio. They expressed their empathy with polio workers who face difficulties and sometimes get killed during anti-polio campaigns by militant groups who are against polio vaccination. Many commenters applauded polio healthcare workers for performing a "noble job." People were also saddened that the majority of the attacked victims were female polio healthcare workers. The position of these commenters was that killing polio health workers is inhumane because they are saving "our children." Examples:

Humanity always comes first. Children especially should never suffer because of politics (December 25, 2019).

I salute all polio workers. You risk your life to save the next generation from becoming disabled. You are courageous, you are the true Mujahideen. May Allah protect you and your families (December 21, 2013).

Hats off to the workers and security forces working to vaccine every child and make Pakistan a polio free country. They deserve the Nobel peace prize. Wish the Government supports them in the fight against polio (April 25, 2019).

This is really sad, its heart wrenching to see children suffer due to negligence of people in charge. Pakistan rulers, seen and unseen must really show will to put a stop to this suffering! (March 15, 2020).

Within this theme, a considerable number of commenters expressed empathy toward polio health workers and deemed any violent acts against them as acts of terrorism. These commenters believed that "killing" polio health workers is "sad" and "heart wrenching," because children suffer from being susceptible to the polio disease due to non-availability of polio health workers. Furthermore, appreciation as a subtheme was found in regard to polio healthcare workers in improving the current polio situation.

4. Discussion

The aim of the present study was to understand *Dawn* readers' online discussions related to polio and polio vaccination in Pakistan. Thematic analysis allowed us to explore insights regarding the increasing importance of users' comments in online newspapers as indicators of public opinions around polio vaccination. As per previous research findings, the comment section on newspaper websites provides a wealth of information, which allows researchers to "explore individual opinions and to identify the extent to which consumers engage with one another to 'assemble' the knowledge base that informs their vaccination decisions" [19]. 1773).

One of the novel findings in our study is the discussion of misinformation regarding polio vaccination in online news comments. Since the April 2019 mob attack, the spread of misinformation has reignited the debate around this issue and has emerged as a bigger threat and problem in the eradication of the polio disease [18]. Indeed, misinformation was a leading cause even prior to this incident, but the Pakistani government has diverted its attention and resources to combat this problem. For instance, Pakistan has launched the Perception Management Initiative (PMI) and blocked more than 700 social media pages related to anti-vaccination propaganda [25].

Our findings suggest that people spread misinformation and make false claims regarding polio in the online comments section of *Dawn* news website. However, we also found that some of the commenters identified the misleading content and pointed out the false claims about polio and polio vaccination to other commenters. A major challenge Pakistan is currently facing is how the government can combat the spread of misinformation on the internet. In 2019, the government of Pakistan urged Facebook and YouTube to remove harmful and false information regarding polio vaccination [26] .

Previous research documented that security was one of the major challenges to eradicating polio from Pakistan in 2012 [29]. Similarly, our comments reveal that security issues were more prevalent in the early years of our analysis. For instance, commenters mentioned polio health workers security problems between 2012 and 2015. Although there is recent improvement in the security situation in some parts of Pakistan, however, other areas of the country such as FATA and KPK still have security problems. In addition, increased accessibility to social networking sites and the internet have added a further challenge to the spread of misinformation about polio-related issues. Recently, misinformation emerged as a major problem in Pakistan regarding polio and polio vaccines [1] which also reflected in our findings from the online comments. Social networking sites spread rumors and misinformation about the effects of polio vaccines [36]. The government of Pakistan is gradually trying to implement concrete and effective plans to tackle this new and emerging problem. For instance, some attempts have been made through Facebook and Google to counter misinformation on the internet [25].

Another novel finding of this study was that the internet acts as a public sphere where people ask one another questions and express their opinions online. Previous studies considered the online comment section in a newspaper as a public sphere [16], especially when people ask questions to health officials and journalists in online news comments. This provides an opportunity for public health officials not only to be aware of the commenters concerns and questions but also to understand the dynamics that may contribute to the affected and unaffected population's attitude and beliefs toward polio and polio vaccination.

Other emerging themes in the present study, such as reasons and challenges to eradicating polio from Pakistan are consistent with past literature and have been extensively discussed in those studies [9,15,17,21], Nishtar, 2010; [31,32].

Some commenters suggested that enhancing educational programs through the involvement of religious leaders and celebrities could be effective to create awareness regarding polio vaccination.

This solution has been suggested in the published research as well [23]. On the other hand, some of the solutions suggested by online commenters included excessive use of military force and imprisonment of parents, which are not practical. Our findings suggest that users' comments are reflective of previous government actions to find solutions for eradicating polio. For example, many commenters highlighted and suggested that parents who refuse to vaccinate their children should go to prison for 10 years [10]. In fact, the government had previously used this strategy in KP when they arrested 450 parents who refused to vaccinate their children, and later had the parents sign an agreement to cooperate with the administration [11].

Other themes that emerged, such as criticism, frustration and shame; comparison of Pakistan to other countries; and suffering, empathy and appreciation, are prevalent in existing studies [9,15,21,22,24] (Hussain at al., 2016; [15]; Murakami at al., 2014; [22,24]. Polio has been eradicated for a long time in many countries; however, Pakistan still has polio cases and readers in online comments are releasing their frustration and anger toward government policies for failure to eradicate the disease. This frustration also reflects that other countries that share similar economic situations and cultural values to Pakistan have eradicated polio (Bangladesh, Nigeria, & India), but Pakistan has yet to achieve this milestone.

Users perceive that polio is not a political but more of a societal issue. Polio workers are performing their duty to eradicate polio from Pakistan. Therefore, commenters empathize with polio workers, their families, and children. The commenters also applauded the polio workers for risking their lives to administer polio vaccines in conflict areas such as KPK and FATA.

5. Limitations and future research

As with any empirical research, our study has limitations. First, we only analyzed one newspaper's readers' comments. Second, *Dawn* attracts a readership that chooses to access news in an online format and can read, write, and understand English. Third, since *Dawn* has a very specific audience, these themes are not representative of the entire Pakistani population. *Dawn*'s readers might understand and interpret these public health issues differently than other social classes in Pakistan. Fourth, demographic information could enrich the findings of this study [19]. Scholars who have studied online news comments in the past suggested that generalizability to the entire population cannot be the scope of a study [28].

Future research should compare news articles with online comments to understand the relationship between the news story content and the types of comments generated by the readers. Framing of news and comments can be studied in the future. Also, a longitudinal study to understand media content could be helpful to design a comprehensive media and communication campaign to create awareness among rural communities. Future studies could also explore misinformation on social networking sites and investigate how it is being spread and how to counter that misinformation.

6. Conclusion

Our work adds to the growing literature on online news comments and vaccination in news stories [19]. It shows that online news comments are a place to understand people's reaction to a public health issue. *Dawn*'s readers view this as a problem of future generations, and see it is a very complex issue in Pakistan. Currently the biggest challenge to eradicate polio in Pakistan is misinformation on the internet. The government of Pakistan needs a

multi-systematic and comprehensive plan to counter misinformation from online platforms. Moreover, digital literacy campaigns need to ensure outreach among rural and tribal communities of Pakistan regarding polio. Future research needs to be done to understand the effects of online news comments on people's attitudes and beliefs toward polio vaccination.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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