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A Systematic Literature Review of Research From 2010 to 2020 Addressing User-Generated Online Comments Related to Health Issues and Recommendations for Future Research

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This systematic literature review was conducted to provide insights into how online readers' comments have been studied in the context of health over a 10-year span. About 593 studies published between 2010 and 2020; of these, 34 met the research criteria for inclusion. Our findings reveal that 60% of the studies focused on the United States, and a qualitative method was used in 74.3% of these studies. About 23.5% of the studies explored vaccine-related issues. Our results reveal that among the selected studies, 76.5% and 20.6% had female and male first authors, respectively. Textual analysis of abstracts shows that the top five keywords were news, HPV, vaccine, themes, and vaccination. However, 58.8% of the identified studies did not use any theoretical framework. In addition, nine health topics emerged: vaccines; health policies; nutritional and dietary choices; women's health issues; quality of life and well-being; smoking; engagement with health-related news content; COVID-19; and suicide and mental health.

Keywords: digital health, health issues, online user comments, research methods, systematic review, importance of theories

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People in rising numbers are turning to the Internet and social media to seek health-related information. More than 51% of Americans used the Internet in 2019 to seek health-related activities (Cao & Goldberg, 2020). Similarly, a report from Eurostat (2021) found that more than 55% of Europeans use the Internet to seek health-related information, and 20% reported using the Internet to make an appointment with a practitioner. In addition, residents of low- and middle-income countries are increasingly using social and mobile media to seek health information. For instance, Harris and associates' (2021) study suggested that people in these countries also use the Internet to search for health-care services. Studies also suggest that the global use of social and mobile media to seek health information has been increasing (Ejaz & Ittefaq, 2020; Ittefaq, Seo, Abwao, & Baines, 2022).

Within this line of inquiry, a growing body of research in health communication focuses on users' online comments (Laestadius & Caldwell, 2015; Lee & McElroy, 2019). Among such studies, some focus on investigating the effects of online commenters on one another (Anderson, Brossard, Scheufele, Xenos, & Ladwig, 2014; Lee & Jang, 2010; Shi, Messaris, & Cappella, 2014; Walter, DeAndrea, Kim, & Anthony, 2010), while others explore similarities and differences in readers' frames and media frames in online news comments (Coleman, Thorson, & Wilkins, 2011; Holton, Lee, & Coleman, 2014). Still others investigate the notion of positive participatory journalism between online commenters and health journalists through online interaction (Lee & McElroy, 2019). Hence, studies like these suggest that online comments are important to evaluate because they steer public discourses on issues of social importance (Loke, 2012; Toepfl & Piwoni, 2015) and influence not only one another but also those who just read these comments without participating in the discussion (Anderson et al., 2014).

Web 2.0 has empowered users to interact with the information they receive on digital media platforms through user-generated comments. This authentic and spontaneous public commentary on any issue of social importance is one of the ways to understand community perceptions of and opinions on certain issues. While user comments are not representative of the general public, they benefit scholarly research by identifying and exploring individuals' perspectives on certain issues, including health (Ittefaq, Baines, Abwao, Shah, & Ramzan, 2020).

This review focuses on previous research about user-generated comments concerning health-related matters while assuming that health issues are domains of high societal relevance and central to public debates in this politically and socially polarized environment (Reimer, Häring, Loosen, Maalej, & Merten, 2021). The transdisciplinary theoretical and methodological approaches of the prior research have produced diverse and varied findings concerning user comments related to health problems. We aim here to evaluate previous research and offer a compact and systematic review of existing scholarship related to communication, digital health, computer science, and public health to highlight any gaps and omissions in the published studies.

To our knowledge, this is the first systematic literature review of studies that investigated online user comments in a health context. Our systematic literature review contributes to the growing body of work in digital health, health communication, computer science, public health, and online user interactions with health-related content. In addition, this review identified existing research gaps in research into online user comments and their engagement with health information. Through this

investigation, researchers who study digital health, health communication, computer science, public health, and online user interactions will be able to make informed decisions about their research programs and identify gaps to further advance this growing transdisciplinary field. Moreover, this systematic literature review is helpful for health practitioners to understand the nature and quality of public interaction with health-related information on various social and mainstream media platforms.

Relevant Literature and Research Questions

User Comments in Health

Online user comments are an important area of research in mass communication scholarship (Lee & McElroy, 2019). Online user discussions are an additional source of data to understand public perceptions toward health-related information, particularly because news organizations such as *The New York Times*, social media platforms, and blog sites allow readers to provide opinions about such information in an anonymous environment (Pereira et al., 2013). Forums like these, by allowing users to interact with each other, play an important role in disseminating health information from a layman's (i.e., nontechnical) perspective, which often is more relatable to the general public. How readers respond to and interact with health information posted online can enable content providers to improve the reporting and dissemination of quality health messages (Lee & McElroy, 2019). For this study, we define a comment as a text-based communication from users under a social media post or news article. An online reader could be an individual who reads or skims a piece of information and leave feedback under health-related post or article.

As prior research into participatory websites suggests (Brossoie, Roberto, & Barrow, 2012; Loke, 2012), comments sections provide places for the generation of and engagement with public opinion. These sections are usually subsections under the online news stories or an option on social networking sites and other websites. Some comment sections function like letters to the editor in traditional newspapers. The comment section on any digital media platform is a forum of public discussions by Internet users to have a place to engage readers in discussions, participate, and interact with one another (Ittefaq et al., 2020). While only a minority of readers leave comments on news stories (and thus are not demographically representative of the entire population), these comments are read by a broad segment of the population (Lee & McElroy, 2019). This communication is more direct, spontaneous, and important to those readers (Henrich & Holmes, 2011). Online comment spaces offer a wealth of information that provides more authentic and diverse opinions, unlike letters to the editor (Henrich & Holmes, 2011; Ittefaq, Kamboh et al., 2022).

Prior research on user-generated comments on health-related issues offers a large variety of perspectives and insights. For instance, research by Prematunge and colleagues (2012) indicates that online comments related to polio vaccines influence readers' perceptions and attitudes toward vaccines. Similarly, an experimental study conducted by Zhang and Wang (2019) concluded that online comments influence people's perceived risk of human papillomavirus (HPV) and their intentions to get vaccinated. Internet information impacts individuals' decision-making processes regarding vaccines. Other studies have investigated attitudes and beliefs about influenza vaccines (Meyer et al., 2019), public sentiment

on Facebook toward autism vaccines (Hoffman et al., 2019), and public perception of HPV (Feinberg et al., 2015). Previous scholars have also engaged in a comparative content analysis of online comments related to a measles outbreak (Pereira et al., 2013), and an evaluation of parents' discussions on parenting blogs about pediatric vaccination (Jenkins & Moreno, 2020).

Thus, in light of the reviewed literature, the increasing scholarly attention on users' health-related comments has yielded numerous insights. However, we believe this attention to user-generated comments and health issues, with its researchers' diverse foci and methodologies, warrants a systematic review. This review offers an exhaustive and fresh review of the field that aims to take stock both of its existing content as well as gaps. Therefore, our first research question is the following:

RQ1: What are the gaps and omissions in these published studies on this topic for future research?

Importance of Theories, Diverse Methods, and Health Topics in Health Communication

Prior research suggests that studies in the health communication field lacked theories, less diverse methodological approaches, and examined only a limited number of health topics (Kim, Park, Yoo, & Shen, 2010; McCulloch, Hildenbrand, Schmitz, & Perrault, 2021). However, it is important to note that these systematic reviews were conducted in the communication and health communication fields. In our study, we focus solely on user comments related to health, a transdisciplinary field that includes digital technologies, public health, health communication, and computer science. As we believe ours is the first such systematic review, we do not know what theories, methods, and health topics will emerge.

The overall paucity of diverse methodological approaches (McCulloch et al., 2021) in health communication research is a hindrance to this growing multi- and transdisciplinary field. This lack of diversity limits the field's growth and fails to adequately produce and use methodological approaches that may be used to advance research in the future (McCulloch et al., 2021). By reexamining what methods are being used in this growing field, we hope to provide a better overview of the methods currently used in the field and to determine whether scholars of health communication, public health, digital technologies, and computer science favor particular research methods.

Recently, scholars have argued that studying a variety of health topics has become increasingly important since we are seeing more emergent health problems and pandemics such as COVID-19 (McCulloch et al., 2021). As health topics studied within the existing literature influence how future researchers' agendas address and solve current and emergent health issues, it is critical to investigate what health topics are studied frequently among scholars from different fields in the context of users' comments and health. By identifying under-researched health topics, we hope that future researchers better address health issues that may otherwise be overlooked.

The use of theories and models to understand social problems has gained scholarly attention over the last few decades, particularly in the health field. Scholars have expressed concerns over the lack of theoretically grounded work in this field. The use of theories can contribute to the maturity of the field both in theory and practice (Freimuth, Massett, & Meltzer, 2006; Hannawa, García-Jiménez,

Candrian, Rossmann, & Schulz, 2015; Kim et al., 2010; Shoemaker, Tankard, & Lasorsa, 2004). Theories allow researchers and practitioners to perform a systematic examination of a health issue and to provide greater insight into factors that may lead to healthy or unhealthy behaviors. The high amount of atheoretical research could be due to a variety of factors, including the applied nature of a certain field of research, the methods employed, and/or target populations. The theories or models may seem less useful to make sense of the particular phenomena under investigation (Shoemaker et al., 2004). However, situating research in theories or models can further advance the rigor of research in health communication, public health, and user interactions online (McCulloch et al., 2021). Our systematic literature review also aims to answer the following research questions:

RQ2: What is the focus of the studies on online commenting on health-related topics published between 2010 and 2020 in terms of geographical area, health issue, theoretical framework, method, and platform?

RQ3: What are the characteristics of the studies published between 2010 and 2020 in terms of the first author's gender, their country of affiliation, and the number of authors?

Methods

Data Collection Strategy

To answer the proposed research questions, the present review follows the PRISMA guidelines for data collection (Moher, Liberati, Tetzlaff, Altman, & Prisma Group, 2009). The data for this study were drawn from PubMed, Scopus, and Web of Science (WoS) records for research published between January 2010 and December 2020, using the following search terms in the title and abstract fields: "user-generated comments," "social media comments," "health news comments," "online health comments," "comments on health stories," "user comments," "online reader comments," "online newspaper comments," "online news comments." These terms yielded 81 studies from PubMed, 79 studies from Scopus, and 432 studies from WoS. We identified and removed duplicates, which resulted in 34 studies that were initially screened based on title and abstract. In cases where there was insufficient information from the title and abstract, the full publication was screened to determine whether it should be included (Hashmi, Rashid, & Ahmad, 2020; Wang, McKee, Torbica, & Stuckler, 2019). This procedure revealed whether the study's content was fully or partially connected to online comments and health. To ensure the eligibility of references, we uploaded them into the reference management software Mendeley.

Screening Criteria and Eligibility

We initially screened 593 studies based on the title and abstract, excluded those that did not involve online comments, were not related to health, and were not in English. Two coders, both trained in health communication, independently examined the studies for their relevance. First, we applied strict inclusion and exclusion criteria. We excluded review studies, commentaries, editorials, extended abstracts, conference proceedings, dissertations, encyclopedia entries, letters to the editor, podiums, perspective pieces, viewpoints, defining moments, short communications, and introductions. Second,

we also removed all duplicates. Finally, with regard to content, studies that explicitly studied user-generated comments related to health issues were retained. This process resulted in 34 potentially eligible articles, which underwent full-text analysis under the following prespecified eligibility criteria. The PRISMA (Figure 1) shows the results of these exclusions. Table 1 presents the inter-coder reliability scores of each variable coded in this study.

Table 1. Variables and Krippendorff's Alpha Values.

Construct	Krippendorff's α
Publication year	1.0
Geographical area of focus in the research	1.0
First-author affiliation at the time of publication	1.0
Gender of the first author	0.98
Number of authors	1.0
Country of focus	0.90
Methodological approach	0.95
Type of analysis	0.89
Theory or conceptual framework	0.91
Name of health issues/problem	0.85
Sampling	1.0
Name of the platform	0.92

The data were primarily coded by the first two authors. Overall, they coded 25% of the studies to reach the obtained inter-coder reliability score. The agreement among authors ranged between 85% and 90% for all themes for qualitative analysis. The final decision was carried out by all authors. The coders held eight meetings to address disagreements through discussions regarding the coding process and had several sessions with the co-authors to maintain rigor in the coding process. Finally, two experts in the field of health communication and user-generated comments were consulted on the results of the coding procedure and studies. For inclusion and exclusion criteria, see Figure 1.

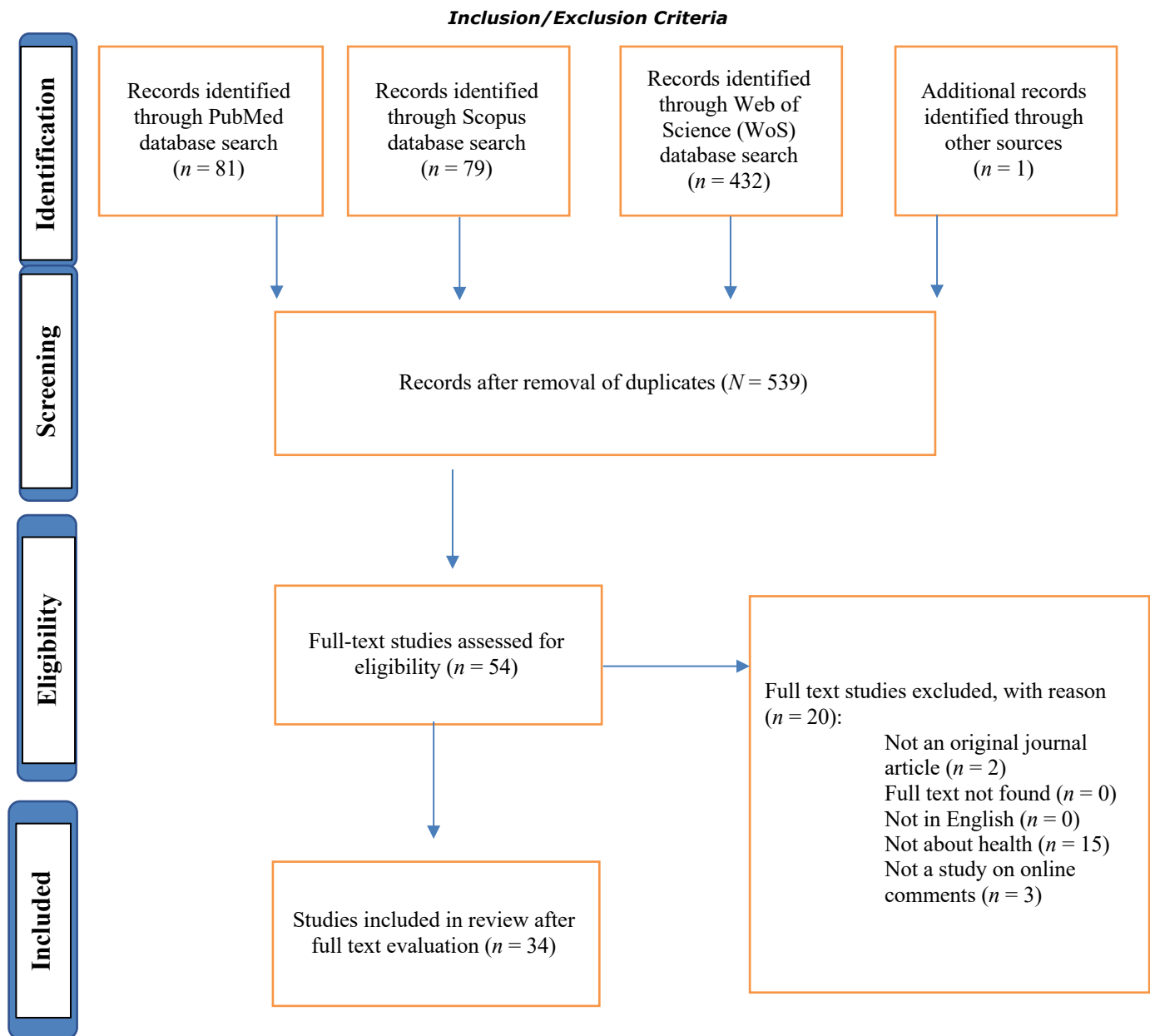


Figure 1. PRISMA flow diagram.

Data Analysis

We used Hashmi and colleagues' (2020) procedure to produce a detailed quantitative analysis that allows research trends and comparisons to be made during the selected period, which in this case produced the answers to our research questions. We also performed a textual analysis of the abstracts by using natural language processing techniques through R programming language to determine the most frequently used words and relationships between terms. In the first step of this analytical procedure, all the eligible studies were coded into the following categories: publication year, name of the journal, geographical area of focus in the research, first-author affiliation at the time of publication, gender of the first author, number of authors, country of focus, and methodological approach used in the study (quantitative, qualitative, or mixed method). Quantitative method was recorded if the data collection approach was online or in-person surveys, experiments, and content analyses. Qualitative method was recorded if the researcher used interviews or thematic, textual, or discourse analyses. Mixed-methods studies were coded under both headings (Hashmi et al., 2020). We also coded the type of analysis (e.g., thematic, discourse, or content analysis) and recorded the name of the theory or conceptual framework each study used. If a study used more than one conceptual framework or theoretical basis, we coded them as well. If there was no theory employed, we coded that as "no theory." The name of the health issue(s)/problem(s) was also recorded. To understand the sample size, we used the actual number of online comments each study evaluated or the exact number of participants in the study. The name of the platform (e.g., comments under news stories, social media comments, or comments on blog sites or YouTube) was also coded. We used R programming language to perform a textual analysis of abstracts. We divided geographical locations into six broad regions (Hashmi et al., 2020), then we also performed a country-level analysis to examine the country of first-author affiliation to understand scholarly knowledge production in this domain.

Results

Journal Publication Distribution (2010–2020)

An overall mean of 3.4 research studies produced per year seems low over a span of 10 years. However, a changing trend can be seen in Figure 2. The first half of the selected period indicates low interest in research focusing on user comments and health, while after 2018 there was an increase, with 2019 having the most publications ($n = 11$), followed by ($n = 2$) in 2018, and ($n = 4$) in 2017. The increase in research related to user comments and health suggests an optimistic trend: Public health and health communication scholars are increasingly becoming more interested in understanding users' comments related to various health issues. Prior research suggests that user comments did not receive much attention during the early 2000s, but this area has recently received considerable scholarly attention; perhaps user comments provide a unique opportunity to explore perceptions and attitudes toward certain health issues (Reimer et al., 2021).

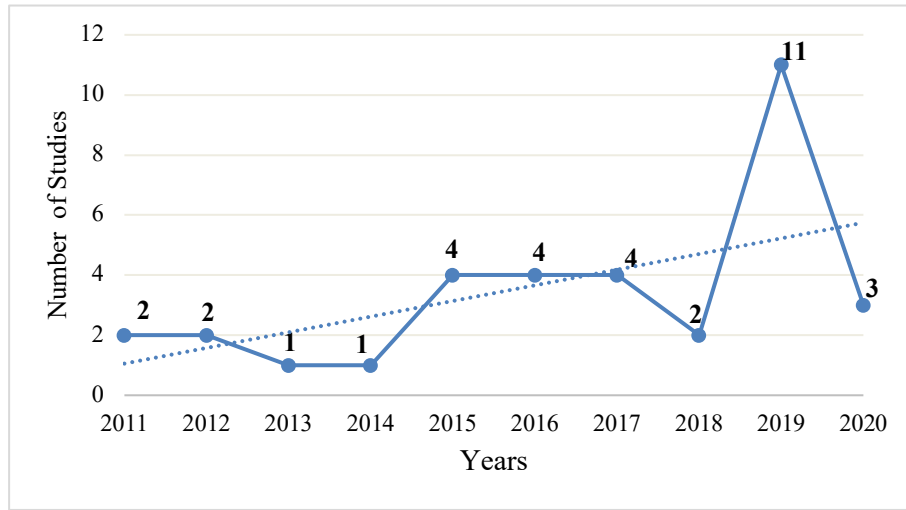


Figure 2. Number of publications per year between 2010 and 2020.

The Geographical Areas of Research Focus

The geographical areas on which these studies focused can be divided into six categories: Southeast Asia, Europe/United Kingdom, Australia/New Zealand, the Middle East, North America, and Worldwide. As Figure 3 shows, more than half (62%) of the published studies were from North America. This is followed by Europe/United Kingdom at 11% and Australia/New Zealand at 9%; followed by Southeast Asia, Worldwide, and the Middle East, which received less than 9%. The geographical distribution of the studies suggests a gap in research from regions such as Africa, South Asia, and the Middle East. Some countries such as South Africa, Afghanistan, and Saudi Arabia could be key in understanding online discussions on health issues. These countries host diverse and vibrant media products, and Internet penetration has also increased there over the last decade. Research focused on these regions and countries could enhance scholarly understanding of online health communication there, particularly in conditions that continue to plague those areas (such as polio, still endemic in Afghanistan and Pakistan).

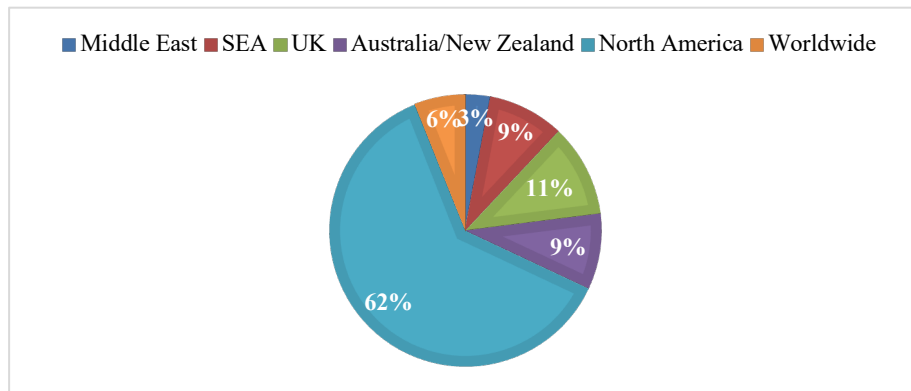


Figure 3. Regions of focus in the identified studies.

First Author's Country of Affiliation

Research production on this topic suggests the United States being in the lead with ($n = 12$) studies, followed by Canada ($n = 9$), the United Kingdom ($n = 5$), and Australia ($n = 2$). Figure 4 provides an important insight into the lack of research from many economically developed and developing countries such as France and India. However, these findings align with previous research from the top six communication journals that suggests that most first authors' country of affiliation during the research is the United States (Trepte & Loths, 2020). It is important to mention that in the cases of two or more authors, only first-author affiliation was considered. In addition, only the country itself was recorded; its internal geographical locations, such as states or provinces, were not considered.

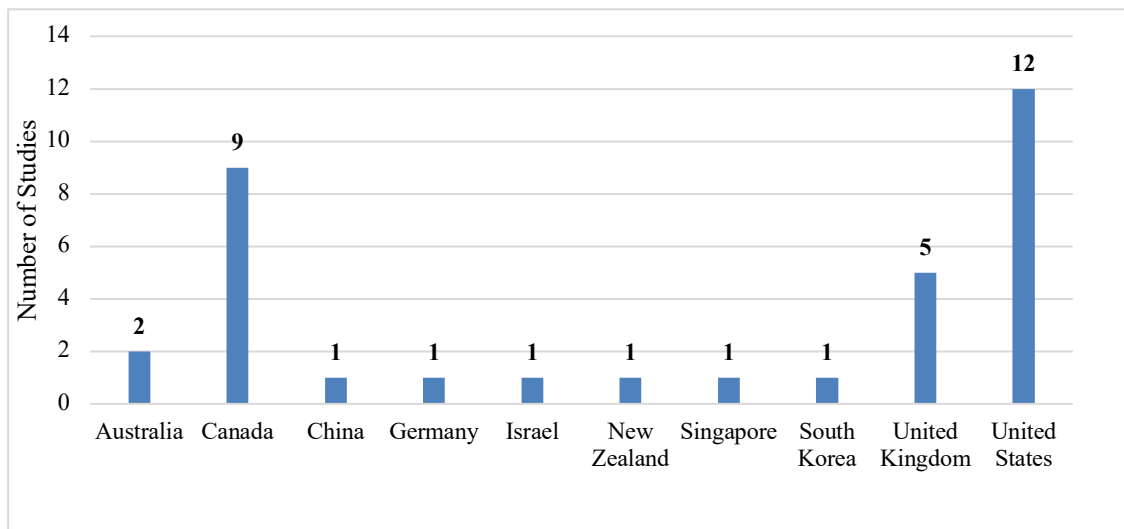


Figure 4. Country of first-author affiliation in the identified studies.

Method Used

Table 2 shows the frequencies and percentages of the methods used. Qualitative methods were dominant, adopted in 73.5% of the studies. Only one identified study (2.9%) reported using a mixed method as Table 2 reveals.

Table 2. Method Used in the Identified Studies.

Methods	Frequency	Percentage
Quantitative	8	23.5
Qualitative	25	73.5
Mixed method	1	2.9
Total	34	100.0

As Table 3 shows, the most frequently employed qualitative approach was thematic analysis ($n = 7$; 26.9%), followed by qualitative content analysis ($n = 5$; 20%). Quantitative methods were used in eight (23.5%) studies. Of these studies, three (37.5%) studies used experiments, and two (25%) used content analysis in studies. Table 3 further differentiates between quantitative and qualitative methods. It further differentiates among methods. Most of the studies used only one instrument.

Table 3. Instruments Employed in the Included Studies.

Method	Analysis	Frequency	Percentage
Quantitative	Computerized linguistic analysis	1	12.5
	Content analysis	2	25.0
	Experiment	3	37.5
	Latent semantic analysis and latent Dirichlet allocation	1	12.5
	Media content analysis	1	12.5
Qualitative	Content analysis	1	4.0
	Foucauldian discourse analysis and discursive psychology	1	4.0
	Grounded theory	2	8.0
	Modified grounded theory	1	4.0
	Netnography and thematic analysis	2	8.0
	Qualitative frame analytic approach	1	4.0
	Qualitative analysis	1	4.0
	Qualitative content analysis	5	20.0
	Qualitative descriptive analysis	1	4.0
	Thematic analysis	4	16.0
	Thematic analysis	2	8.0
	Thematic analysis and discourse analysis	1	4.0
	Thematic analysis and qualitative netnography	1	4.0
	Thematic and qualitative analysis	1	4.0
Thematic content analysis	1	4.0	
Mixed Methods	Content analysis	1	2.9
Total		34	100.0

Note. The name of the reported analysis is provided here verbatim.

Theoretical Lens

More than half ($n = 20$; 58.8%) of the identified studies did not employ any theoretical framework. Of those that did, three (8.7%) used framing theory. As Table 4 shows, other studies used theories such as attachment theory and social defense theory, elaboration likelihood model, and deliberative discourse. All theories employed in the studies (except framing) are very interdisciplinary; they have been used in journalism and mass communication, health communication, psychology, sociology, and public health. This

finding also suggests that health-related comments on digital platforms is a multidisciplinary field into which a variety of fields can provide insight.

Table 4. The Theoretical Lens Used in the Studies Investigated.

Theories	Frequency	Percentage
Attachment theory and social defense theory	1	2.9
Conceptual model of themes influencing stigmatic and sympathetic attitudes	1	2.9
Conceptual framework—crisis of trust	1	2.9
Deliberative discourse	1	2.9
Elaboration likelihood model	1	2.9
Framing theory	3	8.7
Health-promoting financial incentives	1	2.9
Linguistic analysis	1	2.9
Models of cognitive persuasion and learning	1	2.9
Neurotics framework	1	2.9
No theory	20	58.8
Notions of resistance and social change	1	2.9
Risk perception	1	2.9
Total	34	100.0

Health Topics

An analysis of the health topics of the 34 studies was carried out and classified according to the nine health topics, as shown in Table 5: (1) vaccines (i.e., polio, H1N1, HPV, influenza, general vaccination, and measles); (2) health policies; (3) nutritional and dietary choices; (4) women's health issues; (5) quality of life and well-being; (6) smoking; (7) engagement with health-related news content; (8) COVID-19; and (9) suicide and mental health. More details are provided in the studies' conclusions section. The list of studies we reviewed is available at the Open Science Framework: <https://osf.io/k6yppm/>.

Table 5. Major Topics Related to Health Issues in Selected Studies.

Theme	(Number) Percentage
Vaccines	(8) 23.52
Health policies	(8) 23.52
Nutritional and dietary choices	(5) 14.70
Women's health issues	(4) 11.76
Quality of life and well-being	(3) 8.82
Smoking	(2) 5.88
Engagement with health-related news content	(2) 5.88
COVID-19	(1) 2.94
Suicide and mental health	(1) 2.94

Gender of the First Author

Gender diversity in research is one of the most debated issues currently and is widely acknowledged as important to ensure research quality, especially in the communication and public health fields (Campbell, Mehtani, Dozier, & Rinehart, 2013). Gender diversity further ameliorates gender bias in research studies and fosters fairness and representativeness in academia (Mayer, Press, Verhoeven, & Sterne, 2018; Walter, Cody, & Ball-Rokeach, 2018). Table 6 shows that the majority of the published research in this sample featured female first authors ($n = 26$; 76.5%). Male authors comprised most of the rest ($n = 7$; 20.6%), and the gender of one author was not established.

It is pertinent to mention the coding procedure of gender variables. We followed the two-step approach offered by Trepte and Loths (2020). First, the coders looked at a visual image of the first author. Second, we relied on the name as well. This method is not deemed to be the best approach; however, previous research argues for its suitability (Chakravarty, Kuo, Grubbs, & McIlwain, 2018). We conducted an online search of all 34 identified studies, and coders were instructed to code for male or female according to their personal impression of the first author's name and picture (Trepte & Loths, 2020). Furthermore, we also looked at author biographies to establish the genders of the first authors.

Table 6. Gender of the First Author in Selected Studies.

Gender	Frequency	Percentage
Male	7	20.6
Female	26	76.5
Unidentified	1	2.9
Total	34	100.0

Number of Authors

Our results show that majority of the studies in our feature more than one author. As Table 7 reveals, eight (23.5%) of the identified studies have two authors, seven (20.6%) studies have five authors, and only one (2.9%) study had 10 authors. These results suggest that, perhaps due to the interdisciplinary nature of research on user comments and health, scholars tend to engage in collaborative work on this topic.

Table 7. Number of Authors on Identified Studies.

Number of Authors	Frequency	Percentage
1	1	2.9
2	8	22.9
3	6	17.1
4	5	14.3
5	7	20.0
6	4	11.4
9	2	5.7
10	1	2.9
Total	34	100.0

Platforms Studied

In terms of platforms studied in the selected studies, our results show that the most commonly studied platform was mainstream news sites with, 24 (70.59%) studies, as shown in Table 8. Moreover, five (14.71%) studies analyzed more than one platform, such as comments from news sites and YouTube, or comments from news sites and health organizations' social media pages. Furthermore, only three (8.82%) studies used social media comments; one (2.94%) used blogs, YouTube and Reddit; and another one (2.94%) used comments from health organizations' social media pages. We see here that social media comments have received less attention from scholars compared with other platforms. More than two-thirds of all analyzed media are mainstream news sites, perhaps due to a strong focus on national-quality newspapers.

Table 8. Platforms Studied in Identified Studies.

Platform	Frequency	Percentage
Mainstream news sites	24	70.59
Social media	3	8.82
Blogs, YouTube, and Reddit	1	2.94
More than one platform	5	14.71
Health organizations' social media page	1	2.94
Total	34	100.0

Textual Analysis of Abstracts

We also performed a textual analysis of the selected 34 studies. Unnesting the abstracts into individual words revealed a total of 8,827 words (excluding the titles and the keywords), with an average of 252 words per abstract. Figure 5 illustrates the 15 most frequently used terms across the abstracts. While calculating the frequency of words, we excluded common words like "introduction," "background," "results," "health," "information," "social," and "media," which otherwise would have dominated. Figure 5 reveals that "news" is the most used word in the abstract, followed by health issues such as "HPV," "vaccine," and

methods terms such as “thematic analysis.” Moreover, it is interesting to see that the abstracts do not really mention which social media platform/s (e.g., Twitter and YouTube) they have analyzed.

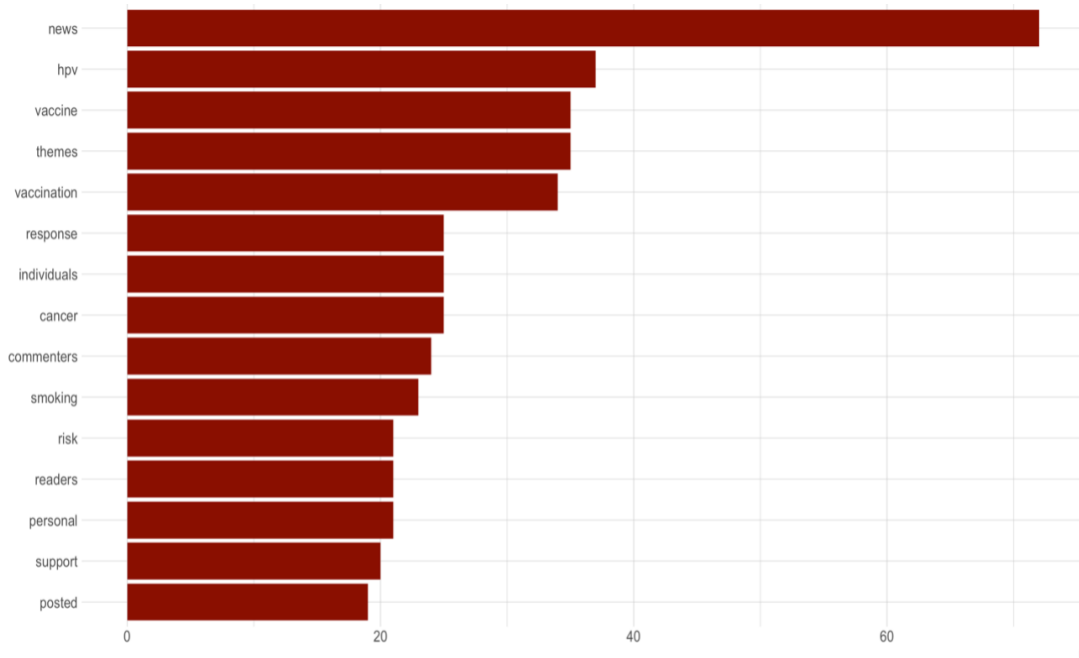


Figure 5. Top 15 most frequently used words in the abstracts of selected studies.

We also examined the relationships between words in the abstracts using R Studio. The relationship between the terms is based on the percentage of co-occurrence of these terms. To do that, we first unnested the words into bigrams (two words that appear together). After unnesting, we separated the words and removed any stopwords (common English language words like “a,” “an,” and “the”). Once we removed the stopwords, we then visualized the network of words (Figure 6). Each word is a *node*; the edge is the relationship between nodes connected by a numeric value associated with each edge, called *weight*.

Figure 6 illustrates different clusters of words that frequently co-occur in the corpus. The most pronounced is the cluster in which terms like “news,” “social,” “media,” “information,” “websites,” and “public” are connected, indicating their prevalence in the data. The terms in the second most pronounced cluster suggests different types of diseases, together showing the variety of health-related issues explored across 34 abstracts. However, a lot of words do not share an edge between them, indicating a diversity of key terms used in the abstracts.

Gender Diversity in Studying Online Health-Related Comments

Gender diversity in different fields including health and STEM (science, technology, engineering, and math) disciplines remains a key issue in practice and academia (González-Álvarez & Cervera-Crespo, 2019; Vanderbroeck & Wasserfallen, 2017). This is true for the communication and public health fields. Furthermore, researchers' gender diversity is a critical component in ensuring representation of diverse perspectives. Trepte and Loths (2020) analyzed six communication journals and revealed a more balanced gender distribution among the U.S. authors versus the non-U.S. authors. While gender diversity remains a critical issue in communication and public health fields (Campbell et al., 2013) our results indicate that in the context of research focused on user comments and health, the majority of the analyzed studies featured female first authors (see Table 6). On one hand, this is cause for optimism given the prominent role of first-author women within this subfield or research compared with other areas, where, for example, women accounted for only a third of the authors, while women made up more than half the graduates in medical sciences. On the other hand, the results still indicate a gender imbalance and seem to mirror other studies that found an overrepresentation of women as first authors (González-Álvarez & Cervera-Crespo, 2019). However, in certain fields being the last author is more important than being the first author, and that same study found an underrepresentation of women as last or senior authors. There is a need for more research in this area and an improved analysis framework. Future studies should also look at the connection between gender balance beyond authorship order, into the impact of the journals, citations, and editorial boards.

Need to Focus on New Geographical Regions

The limited geographical distribution of the analyzed studies reveals gaps in terms of understanding and knowledge of health-related online user comments. More research is needed from and on regions such as South Asia, the Middle East, and Africa to better understand online commenters' perceptions of various important health issues as well as the possible effects comments have on individuals looking for online health information. Possible countries to further explore include Afghanistan, Saudi Arabia, and South Africa, countries with diverse and vibrant media and high Internet use.

The issue of studies heavily focusing on Western countries is not new to public health and health communication scholarship. For example, Guenther, Gaertner, and Zeitz's (2021) systematic review of framing as a concept for health communication and Kubb and Foran's (2020) systematic review of online health information seeking by parents for their children found the same lack of non-Western countries and argue for the need to widen research areas beyond the West. This type of research would cater to an international and non-Western audience, thus enhancing our understanding of the issue on a global scale. Beyond the theoretical implications, widening the number of regions researched would have practical implications for current health issues such as outbreaks, endemics, and epidemics that are playing out online as much as offline. In addition, public health and communication officials who work in health-care settings might find practical insights in studies focused on online discourse related to different health issues. Against this backdrop, more diverse scholarly research may provide both researchers and practitioners more tools to enhance understandings of, and perspectives on, public discourse in the form of users' comments on the digital platforms related to health that exist globally.

We recommend that future studies should explore non-Western regions that are historically underrepresented in the health communication and digital health fields.

Need for Cross-National Comparative Work

This systematic review on how online readers' comments have been studied in the context of health in different geographical regions provides a window of opportunity for scholars to conduct cross-national comparative studies. These findings suggest a strong need for researchers in different parts of the world to start replicating earlier studies on issues studied only from a specific geographical region, or perhaps conduct comparative research on these health issues and regions. Prior research has shown that cross-national comparative research can make great contributions to theory development (Brislin, 1976; Esser & Hanitzsch, 2012) and advancement in examining users' attitudes toward health issues to test and extend existing theoretical frameworks. A cross-national comparative study that includes two or more countries can aid researchers in determining the strength of relationships between quantitative variables, for example, or increase the chances of identifying factors that help to understand differences in how people interact with health issues online.

Need to Focus on Theories

We found that the majority of the studies did not employ a theoretical framework to interpret their results. These findings illustrate that scholars of health communication, public health, and computer science need to include theories in their work related to user-generated comments and health. Prior research suggests that the inclusion of theories or models is important because theorizing a concept is vital to understand the chosen phenomenon in reality (Kim et al., 2010). Furthermore, theories can help scholars to predict a phenomenon under investigation. Many peer-reviewed scholarly journals, particularly in health communication, prefer theoretically grounded papers for publication, and journals expect that scholars' work should contribute new knowledge to the existing literature with the help of theories or add to theory building and extend the findings.

Because of the transdisciplinary nature of this domain, the majority of the studies were published in public health and medical journals such as *Vaccine*. In health-care fields, medical journals focus on results and practical factual research and are not related to theory development (Alderson, 1998). However, we believe that theories are important in practice, planning, and research. In addition, scientifically and practically, recognition of implicit theories powerfully influences our understandings of health care (Alderson, 1998). Our findings suggest that future work should use theoretical frameworks to study online user comments related to health issues.

Our results suggest that there is a window of opportunities for scholars to use and adapt both communication and non-communication theories to enrich this field. Future scholars could consider using personal behavior theories such as Hofstede's theory of cultural difference, risk perception theory, technology acceptance model, theory of hostility, and social cognitive theory to understand user-generated comments on different social and mainstream media platforms related to health issues (Lewis & George, 2008). In addition, scholars could also use social behavior theories such as the social capital

theory, the social identity model of deindividuation effects, and the social interaction theory. Finally, future studies might focus on mass communication theories such as media richness theory, entertainment theory, and uses and gratifications theory to extend them in the context of digital media and health (Ngai, Tao, & Moon, 2015).

Need to Focus on New Methodological Approaches

Our study found that most selected studies in this review applied a qualitative method of analysis. Only 23.5% of the studies used the quantitative method, and only 2.9% used the mixed-method approach to study online comments and health issues. These findings suggest a potential methodological gap that could be filled. For instance, computational comment analysis, which is gaining attention in communication science (Reimer et al., 2021), is lacking in this field. Our findings also suggest that it is significantly less common in public health research to combine the analysis of user comments with other methods and data, such as surveys of users or the general public. In other words, public health and health communication scholars often look at user comments in isolation. The diversity of opinions expressed in comments is likely to vary in countries with different sociopolitical, cultural, and religious aspects. In addition, there are many automated methods developed for English, but few other languages probably add to this geographic research gap.

Finally, this field lacks mixed-method research. As it is becoming increasingly important in many fields to use mixed methods, scholars in this arena could consider mixed-method approaches in future work. These are significantly important research gaps in this field because we live in a hyper-technological environment. A particular shortcoming of comment analyses, so far, is the near-complete focus on user posts in comment sections of news organizations and the small number of studies investigating comments made on other sites, such as social media and health organizations' websites and social media pages. Also lacking are comparative analyses of comments from different platforms (i.e., Facebook, websites, or blog sites) and media brands that also attract different groups of users. Researchers could take advantage of this absence to create innovative ways to assess users' online comments across both various platforms and media environments.

Need to Focus on Prevailing and Emerging Health Issues

The findings of this study revealed that the selected studies examined a variety of health-related issues, including diseases, health behaviors, healthy lifestyle choices, health news, health interventions, environmental health issues, health policies and legislation, and health-related incentives (see Table 5). However, most of the analyzed studies were mainly centered on issues related to vaccines and influenza, which were ranked first and second, respectively.

In this systematic review, we found that certain health topics such as mental health issues, common chronic diseases such as diabetes, heart diseases, cancer, stroke (Wang et al., 2009), childhood infectious diseases, and tuberculosis were not featured in the selected studies. The present study further revealed that common diseases such as cystic fibrosis and multiple sclerosis were not studied (Melnikova, 2012). It would be worthwhile for future studies to examine other prevalent health issues

not featured in these previous studies as well as new emerging health issues such as COVID-19 and its multiple variants. We acknowledge that rare diseases affecting small numbers of people may have not received enough attention in the media to warrant user groups or comments focused on them. However, these diseases are not only important to study to create public awareness but also to study what the public understands about them and how to leverage those findings for other, more common, diseases and issues.

Conclusion

Overall, we believe that scholars and practitioners can draw several conclusions from our findings. For the reasons outlined above, we think that a stronger diversification of current research in terms of the countries and regions studied, methods and instruments used, inclusion (or not) of theories, and platforms and health topics explored is critical to advance the field, and far more comparative research is needed. This field is still wide open for both traditional and innovative studies. Studies on under-researched countries or health problems might have a better chance to provide new insights for the field and, therefore, to merit publication in high-ranking journals. Future studies could include other variables such as the valence of comments (i.e., negative, positive, and mixed) to add depth.

We also hope that our findings encourage researchers from countries where Internet access is penetrating rapidly, and people use digital platforms to do more work on their own national situations, to broaden the knowledge base of the health communication field. Furthermore, researchers from Western countries, which often have more resources at their disposal, should make a conscious effort to collaborate with colleagues from other countries and/or to select countries and health issues for their analyses that have been so far neglected. Moreover, they might consider making common, best-practice codebooks and methods available in open-access formats to enable global colleagues to analyze and, subsequently, compare international sentiments and opinions on health issues. The collaborative nature of this kind of research is evident even from this small sample; we hope to encourage even more cooperation and co-authorship across nations and health issues as researchers shape the foundation on which future scholars can build.

This study has limitations. First, there are only 34 studies that met the inclusion criteria. Therefore, conclusions drawn from this study are limited to English language literature in this domain. Future research could include non-English language literature to conduct systematic literature in this area. Second, we did not compare studies that examined news stories comments and social media comments; future studies could examine comments from mainstream social media and closed chat room comments. Third, we only included three databases; future studies could include more databases to provide more comprehensive overviews of online comment and health. Lastly, we analyzed studies from a 10-year period, therefore excluding previously published research that could bring more interesting insights into discussions related to health in chat rooms. Despite the limitations, this study serves as a springboard to future research recommendations in the area of public health, digital technologies, user-generated comments, and health communication.

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