Strategies to combat infodemics in public health

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Abstract

Background: Infodemic is an emerging concept in public health and effective strategies are required to combat it.

Aim: To identify documented strategies for combating infodemics in the health sector, particularly during the COVID-19 pandemic.

Methods: In November 2022, we reviewed 87 articles on the management of infodemics in public health on PubMed and Web of Science using the Preferred Reporting Items for Systematic Reviews and Meta-analyses Extension for Scoping Reviews.

Results: The number of articles on infodemic more than doubled from 18 in 2020 to 37 in 2021 and decreased to 32 in 2022, indicating efforts at different levels to combat infodemics especially during the COVID-19 pandemic. Strategies to combat infodemics included health literacy and education, use of more effective information resources, content control, social networking and communication, restrictive laws, use of electronic platforms, awareness campaigns, and health care provider involvement.

Conclusion: Findings from this review indicate that infodemic, especially during a pandemic, is a serious challenge in public health and a multifaceted approach involving education, technology, policy and community engagement is essential to combat it.

Keywords: infodemic, COVID-19, public health, pandemic, health emergency, health literacy, health worker

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Introduction

The term infodemic was initially used to refer to the hazards of misinformation during a pandemic, which could lead to negative responses from the public. During the COVID-19 pandemic, the Director-General of WHO stated, "we're not just fighting an epidemic; we're fighting an infodemic". We witnessed misinformation or false information shared among people without being aware that it was false. It was believed that such information was purposely circulated to mislead the community during the pandemic. An infodemic is a massive collection of information emerging during an epidemic, some of which is true, some of which is wrong, that spreads rapidly like a virus and complicates health system response (*1*). The word infodemic, a combination of information and epidemic, was first coined in 2003 during the severe acute respiratory syndrome (SARS) outbreak (*2*). Infodemic is the uncontrollable dissemination of information and misinformation about a health issue (*2*). Infodemics can cause confusion because of an abundance of misinformation and disinformation during the outbreak of a disease (*3*). During the COVID-19 pandemic, rumours were shared faster than verified information (*4*). In 2021, Zielinski addressed the primary characteristics of the infodemic as volume and velocity of information, and defined the components as location, capacity, quality, visibility, validity, assessment, gatekeeping, application, history and waste (*19*).

An infodemic is fake or false news that disseminates rapidly through social and mass media, causing inappropriate behaviour among users, endangering governments' policies and plans, or leading to panic or xenophobia in the general public. During the COVID-19 pandemic, infodemic was one of the factors that delayed vaccination caused speedy spread of the pandemic (*1*). There is no doubt that myths about COVID-19 formed a harmful infodemic that hindered efforts to stop the spread of the disease (*2*). Infodemics can cause distrust in governments, researchers and health policymakers, endangering people's lives and health, as well as causing psychological distress and panic among the public (*3*). In some cases, attacks on healthcare workers resulted from distrust caused by the infodemic (*4*). Depression, anxiety and stress disorders, caused by misinformation, have been observed (*4*). Conspiracy beliefs and mistrust largely determined the acceptance or not ofadvice from authorities, such as uptake of COVID-19 vaccines (*5*).

As infodemics spread via social and mass media during disease outbreaks, it becomes hard for people to distinguish between reliable and false information among the abundance of news. Thus, it is important to manage infodemics, as they cannot be totally eliminated because

of the widespread use of digital media (*6*). Access to timely and accurate information is crucial for promoting healthy behaviour during a disease outbreak; however, such information can be received negatively and threaten public health. This was observed during the COVID-19 pandemic when false news was disseminated rapidly (*7*). Provision of accurate and reliable information via information channels, officially related to a health issue, can be a measure taken to manage infodemics (*8*). To fight the infodemic during the COVID-19 pandemic, WHO launched a platform called WHO Information Network for Epidemics (EPI-WIN), which provided guidelines for health professionals. One hundred and thirty-two countries of the United Nations signed a statement to combat the COVID-19 infodemics, and the statement heightened the importance of reliable information in combating infodemics as well as epidemics (*9*).

General understanding of what an infodemic is and how it works is still limited (*10*). Therefore, more studies should be conducted to determine the main dimensions of infodemics. The objective of this scoping review was to determine the strategies, solutions and methods used to combat infodemics during pandemics, with the goal of helping policymakers to manage infodemics more effectively. The following research questions were addressed. What are the main dimensions of infodemics during epidemics and pandemics? What strategies, solutions and methods have been used to tackle infodemics, particularly from 2019 to 2022? How can these strategies be made acceptable and effective for the public? How can the lessons learned from infodemics during the COVID-19 pandemic be applied to manage future epidemics?

Literature review

A review of the literature on combating infodemics revealed that this issue has gained considerable attention of researchers. Several studies have cited the speech of the Director-General of WHO, emphasizing that combating infodemics was crucial for controlling the COVID-19 pandemic (*11*, *12*). The following is a summary of the results from some of the studies conducted on the subject.

Eysenbach (2020) identified 4 key pillars of infodemic management during epidemics: information monitoring, building eHealth literacy, encouraging knowledge refinement, and accurate knowledge translation (*13*). Dash et al. proposed a 3-level approach for low- and middle-income countries to combat the COVID-19 infodemic (*14*). The approach emphasized the importance of tailored strategies for different socioeconomic contexts. Sharma et al. highlighted how infodemics during the COVID-19 pandemic exacerbated the spread of misinformation and hindered vaccine uptake (*15*). They proposed control measures such as social media guidelines, the use of artificial intelligence (AI), and active community participation to mitigate these effects. Kulkarni et al. emphasized that combating the COVID-19 infodemic required the active involvement of various stakeholders to identify and prevent the spread of misinformation, particularly through coordinated efforts at different societal levels (*16*). Corinti et al. emphasized the critical role social media played in spreading COVID-19-related misinformation (*17*). They proposed that using mobile technologies to provide targeted information, based on citizens' technological and health literacy, could serve as an effective countermeasure.

Scott discussed strategies for clinicians and researchers to limit the spread of misinformation on social media (*18*). They suggested that healthcare professionals play a crucial role in promoting accurate information and countering misinformation. Zielinski argued that combating infodemics during pandemics requires improvements in technology, changes to social and regulatory frameworks, and the establishment of trusted top-level domains for disseminating reliable health information (*19*). Hua and Shaw proposed that managing the COVID-19 infodemic called for a combination of strong governance, regulatory frameworks, community vigilance, and the strategic use of digital technologies to monitor and counter misinformation (*20*). Calleja et al. recommended a public health research agenda to manage infodemics during health emergencies, which involved measuring, detecting, responding to, and evaluating infodemics while promoting effective interventions (*21*).

Patil et al. emphasized that addressing infodemics requires the active involvement of experts and the timely dissemination of scientifically backed information to control the spread of misinformation (*22*). Jin et al. argued for a holistic approach to combating infodemics, focusing on building trust, addressing stigma, and enhancing scientific literacy in local communities, rather than merely combating misinformation itself (*23*). Abuhaloob et al. discussed various interventions applied by health authorities and organizations, such as media campaigns and digital tools, to mitigate the harmful effects of the COVID-19 infodemic (*24*). However, they noted that further research is needed to assess the effectiveness of these measures.

Overall, research on managing the COVID-19 infodemic has highlighted key strategies such as information monitoring, building eHealth literacy and using digital technologies. Community involvement, social media guidelines and AI-driven solutions are critical for combating misinformation. A holistic approach involving expert input, regulatory frameworks and improved health communication is essential for long-term infodemic management.

Methods

This study was a scoping review using the PRISMA-ScR (Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews) checklist. The search was conducted in PubMed and Web of Science databases in November 2022, without any time limitation. We limited our scoping review to

these databases because of their comprehensive coverage of high-quality scientific literature and their relevance to health-related research. This focused approach allowed us to ensure that our findings were based on robust and reliable sources, facilitating a more in-depth analysis of the infodemic phenomenon within the context of public health. These databases provided access to a wide range of interdisciplinary studies, enhancing the breadth of our review. The following keywords were used: "Infodemic AND Covid-19", "Infodemic AND Corona virus", and "Infodemic AND Corona".

We used these syntaxes for searching in PubMed: ("Infodemic"[Title/Abstract]) AND ("COVID-19"[Title/Abstract] OR "Coronavirus"[Title/Abstract] OR "Corona"[Title/Abstract]), "Infodemic*"[Mesh Terms] AND ("COVID-19" OR "Coronavirus" OR "Corona"), and "Infodemic"[Title] AND ("COVID-19"[Mesh Terms] OR "Coronavirus"[Mesh Terms] OR "Corona"[Mesh Terms]). Also, these syntaxes were used to search in WOS: Topic ("Infodemic" AND ("COVID-19" OR "Coronavirus" OR "Corona")), Topic ("Infodemic*" AND "COVID-19") OR Topic ("Infodemic*" AND "Coronavirus") OR Topic ("Infodemic*" AND "Corona"), ("Infodemic*") AND ("COVID-19") (All fields), and ("Infodemic*") AND ("Coronavirus") (All fields).

A total of 568 articles from PubMed and 287 from World of Science were retrieved after the initial search in November 2022. There were 27 duplicates from PubMed and 9 from World of Science, which were removed. In PubMed, among the 541 remaining articles, 5 did not have abstracts and were excluded. In World of Science, 46 articles were excluded because no abstract was available. Fifteen articles were excluded because the full texts were not available (5 from PubMed and 10 from World of Science). A total of 479 articles from PubMed and 232 from World of Science were eligible for further screening. We excluded 408 articles from PubMed due to irrelevant topics, insufficient information and not providing a specific solution, method or strategy to combat infodemics. We also excluded 179 articles from World of Science on the same basis as for PubMed. Twenty-seven articles were excluded because of overlap between the databases. Ultimately, 87 articles were included in the review.

A thematic analysis was used to identify the themes, specifically addressing methods for managing infodemics. This approach examined the article contents, which enabled researchers to identify accurately key sections dealing with infodemic management strategies. Each of the subthemes was then assigned a code, based on the concept conveying the meaning of that subtheme. Following this meticulous coding process, the subthemes were categorized on the basis of underlying connections and nature. Then researchers assigned a name to each theme by considering the context. This comprehensive process resulted in 8 distinct themes.

This analysis was conducted on quantitative, qualitative and mixed-methods articles. The inclusion criteria were articles: (1) discussing strategies, solutions and methods in dealing with infodemics; (2) highlighting technologies to combat infodemics; and (3) addressing infodemics as a serious issue and suggesting management strategies. The exclusion criteria for our scoping review were established to ensure a focused and relevant analysis of the infodemic phenomenon. We excluded articles related to theoretical discussions about infodemics, as we aimed to prioritize empirical studies that provided actionable insights and evidence-based findings rather than theoretical frameworks that did not directly contribute to understanding practical implications or interventions. We excluded articles that did not provide access to abstracts and full texts, deeming it essential to include only those studies that offered full access to their content. This requirement allowed for a comprehensive evaluation of the methodologies, results and conclusions, ensuring that our review was grounded in accessible and verifiable information. Overall, these criteria helped maintain the integrity and relevance of our review by focusing on studies that contributed to a practical understanding of infodemics and to inform future interventions. Figure 1 shows all the steps in the search strategy. Identification, screening, eligibility and inclusion of articles were conducted and verified by 2 professors in the departments of health information, medical library science and English language.

The study was approved by the Ethics Committee of Tabriz University of Medical Sciences. All methods were performed in accordance with the relevant guidelines and regulations. (IR.TBZMED.REC.1402.65167).

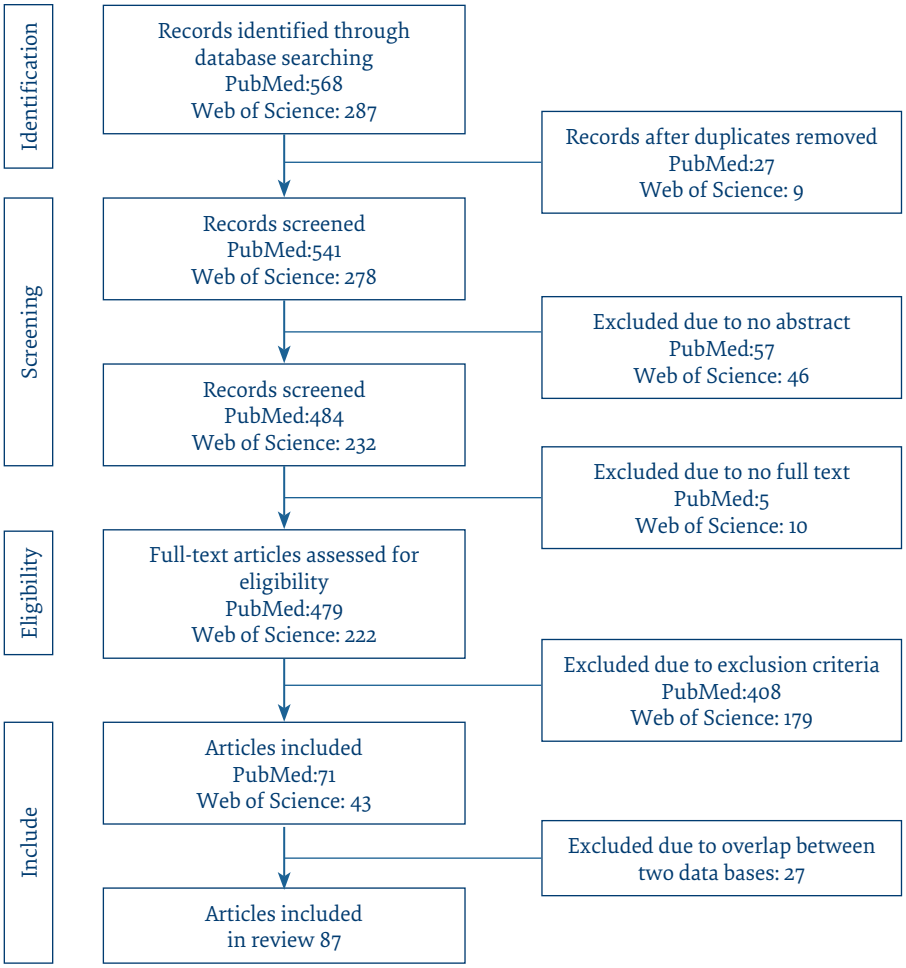
Results

In 2020, there were 18 articles about infodemics, which doubled to 37 in 2021, and then decreased again to 32 in 2022. Figure 2 shows the countries where the studies for these articles were conducted. Articles were published in 46 countries, including United States of America (21 articles), China (14 articles), United Kingdom of Great Britain and Northern Ireland (10 articles), India (8 articles), Pakistan (6 articles), Switzerland and Japan (5 articles), Italy and Spain (4 articles), France, Canada and Australia (3 articles); and other countries (2 or 1 articles).

Based on the latest classification of the World Bank in 2019–2020, 55 studies were conducted in high-income countries, 16 in average-to-high income countries, and 16 in average-to-low income countries. These findings suggest that there has been an intention to investigate solutions to deal with infodemics in high-income countries. Other findings show that among 87 articles, 28 were conducted as part of international collaborations.

The strategies, solutions and methods for tackling infodemics can be categorized into 8 themes: (1) education and promotion of health literacy; (2) using effective information resources; (3) applying content control; (4) using social network and communication strategies; (5) establishing restrictive laws; (6) applying computers and computing systems; (7) launching awareness campaigns; and (8) using health care providers' potential.

Figure 1 Search strategy and inclusion process



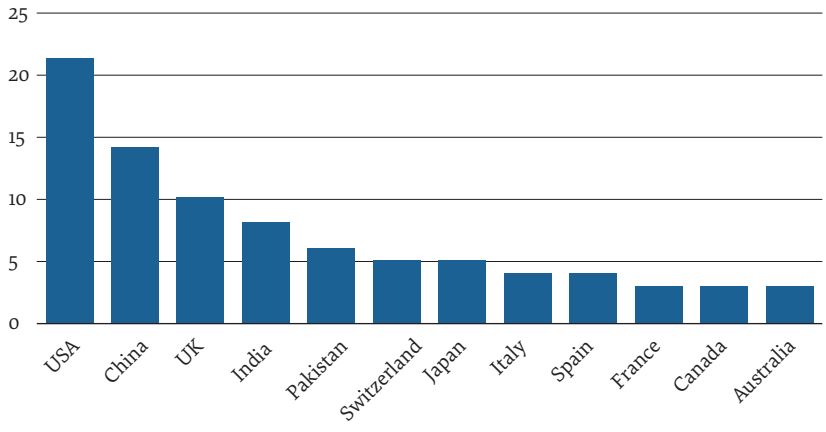
Discussion

Infodemics are characterized by excessive dissemination of inaccurate information and should be taken seriously during pandemics, such as COVID-19, because of the inevitable adverse outcomes and losses they cause. One of the best options to manage infodemics is identifying the lessons learned, experiences, and methods derived from the literature. This scoping review was conducted to determine the strategies, solutions and methods used to combat infodemics. Strategies, solutions and methods derived from eligible studies were categorized into 8 main themes.

Education and promotion of health literacy

Many studies addressed education and promotion of health literacy as a major solution to overcome infodem-

Figure 2 Number of publications on infodemics by country



ics. Developing a curriculum and competency framework for media and information literacy; online educational interventions; countermeasures for the low level of health/eHealth literacy; considering infodemiology as a scientific discipline; media literacy education; and e-Health and media literacies were some of the main subthemes identified in the studies to combat infodemics (*25–27*). Inoue et al. Abel and McQueen and Chong et al. reported that health literacy and knowledge about COVID-19 could be improved by using different information sources, and providing opportunities to make the best use of social media and face-to-face communication (*28–30*). Jin et al. advocated a holistic approach to combating infodemics by emphasizing the importance of building trust, addressing stigma and enhancing scientific literacy in local communities, rather than solely focusing on misinformation (*23*). Thus, to combat infodemics, education and promotion of health literary of the population should be considered as the main solution. Society should be ready to face infodemics during pandemics. We should establish policies and programmes and provide infrastructure and facilities for the development of health literacy before we experience new and possibly more destructive pandemics than COVID-19.

Using effective information resources

Several studies emphasized the use of graphic, illustrative, educational, entertaining, attractive, informed and evidence-based content to inform the public regarding infodemics (*31*). Other studies highlighted promotion of official websites such as "Infodemic 2019", Chinese infodemic dataset or EARS (*32–34*). Abdekhoda et al. conducted a study regarding the role of information resources in raising awareness, control and prevention of COVID-19 in Tabriz, Islamic Republic of Iran. They reported that a wide range of mass media became well known as information resources for COVID-19. They suggested that accurate and readily available information at low cost is essential, when there are multiple sources of information increasing the likelihood of misinformation and pseudo-information (*8*).

Applying content control

Many studies recommended content control as an effective and strategic method to prevent infodemics. Other studies suggested information management systems to control and collect misinformation, such as iHealthFacts.ie; CHECKED, the first Chinese dataset on COVID-19 misinformation; and CoVerifi, the system at scale for combating the COVID-19 infodemic (*35, 36*). Some studies recommended taking down contentious pandemic content; dispelling misinformation on social media platforms; debunking misinformation; and downgrading, blocking and counteracting claims about COVID-19 (*37–39*). One study suggested the flagging of content as an effective technique to control infodemics (*40*).

Another method of content control is the use of AI, which was increasingly used to combat infodemics, especially during the COVID-19 pandemic. While AI technologies can facilitate the spread of misinformation (*41*), they are also effective in detecting and countering false information. Large language models like ChatGPT present opportunities and challenges in this area, potentially worsening dissemination of misinformation (*42*). However, AI can be used to identify emerging infodemic threats and provide evidence-based responses, as seen in the Pan American Health Organization's Anti-Infodemic Virtual Center, which uses AI to analyse social media posts and recommend strategies (*43*). Social media platforms use AI to manage infodemics, in collaboration with global agencies, local authorities, healthcare professionals and community efforts (*15*).

Using social network and communication strategies

Some studies suggested an understanding of how information is communicated and shared, and suitable communication strategies for combating infodemics (*44, 45*). The use of social media to prevent or minimize the spread of fake news and use it as a tool for public health surveillance and education was recommended by other studies (*46, 47*). Corinti et al. and Scott emphasized the crucial role of social media in spreading and countering COVID-19 misinformation, advocating targeted communication strategies and active involvement of healthcare professionals (*17, 18*). Zielinski added that effective management of infodemics requires improvements in social and regulatory frameworks to establish trusted platforms for disseminating accurate health information (*19*). Undoubtedly, the role of social media in circulating information and its power to influence people's attitude and behaviour is indisputable. To combat infodemics, policy- and decision-makers should consider communication strategies and not ignore the potential effect of social media and networks.

Establishing restrictive laws

Three studies recommended establishing pre-emptive restrictive laws that could help fight infodemics, such as: criminalizing malicious coronavirus falsehood; prison sentences for persons who created and shared fake news; and ethical and legal imperatives (*48, 49*). Hua and Shaw argued that effectively managing the COVID-19 infodemic required strong governance, regulatory frameworks, community vigilance and strategic use of digital technologies to combat misinformation (*50*). Calleja et al. recommended establishing a public health research agenda during health emergencies that focused on measuring, detecting, responding to and evaluating infodemics while promoting effective interventions. All these studies emphasized the need for a multifaceted approach to addressing misinformation during public health crises (*49*). It seems that preventive laws regarding the dissemination of false information could be useful, especially for social networks, because offenders know that they could be convicted and their social status could be endangered.

Applying computers and computing systems

Cyber technology, neural networks, deep learning algorithms, machine learning, plebeian algorithms, and spatial and temporal information features were recommended as effective methods for controlling infodemics (*20*, *51–55*). Each of these suggestions was based on practical experience or a conceptual model presented in one of the studies.

Launching awareness campaigns

Provision of accurate and timely information to the majority of people during pandemics is crucial. Awareness campaigns, in which accurate and reliable information is provided are effective ways to share and transfer information. Information specialists and healthcare staff should accurately and promptly share the necessary information with the public. Launching information campaigns is a smart strategy in combating infodemics, which was highlighted in several studies (*56–58*). Sharma et al. argued that during epidemics, timely, accurate and reliable information is crucial in shaping public opinion, whereas an infodemic can pose a serious threat and cause panic by spreading false information, as was widely seen during the COVID-19 pandemic (*7*). Dash et al. , Sharma et al. and Kulkarni et al. highlighted the importance of information campaigns in combating the COVID-19 infodemic. Dash et al. proposed a 3-level approach tailored to low- and middle-income countries, while Sharma et al. recommended measures such as social media guidelines and community participation to counter misinformation and enhance vaccine uptake. Kulkarni et al. emphasized coordinated efforts among stakeholders, indicating that active involvement is crucial for preventing the spread of misinformation (*14–16*).

Using health care providers' potential

Physicians, librarians, pharmacists and healthcare workers and professionals can play a major role in combating the spread of false information (*34*, *59–61*). Public health professionals and policymakers should ensure that accurate and evidence-based information is provided to the public to limit the spread of pandemics (*62*). They should constantly inform people and try to establish their role as the official and reliable sources of health information. They should be easily accessible to provide correct and timely information to the public. Otherwise, traders of false and incorrect information, mixed with ignorance and myth on health issues will flourish. Similarly, Patil et al. noted that effectively addressing the infodemic necessitates active engagement of experts and prompt sharing of scientifically backed information to curb the spread of misinformation (*22*).

Conclusion

This scoping review identified various strategies, solutions and methods that can be used effectively to combat the infodemic phenomenon, categorizing them into 8 main themes. The findings from this review suggest that a multifaceted approach involving education, technology, policy and community engagement is essential for managing infodemics. As we navigate future health crises, it is imperative that policymakers, healthcare professionals and the public collaborate to develop robust frameworks that promote accurate information and combat the detrimental effects of infodemics. Ultimately, the potential impact of AI in the future of infodemics is its ability to quickly analyse data, identify misinformation patterns and enable timely interventions for the dissemination of accurate information.

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Competing interests: None declared.

Stratégies de lutte contre l'infodémie dans le domaine de la santé publique

Résumé

Contexte : L'infodémie est un concept émergent en matière de santé publique, contre lequel il est nécessaire de mettre en place des stratégies de lutte efficaces.

Objectif : Identifier des stratégies documentées pour lutter contre l'infodémie dans le secteur de la santé, en particulier pendant la pandémie de COVID-19.

Méthodes : En novembre 2022, nous avons passé en revue 87 articles sur la gestion de l'infodémie en santé publique, issus de PubMed et de Web of Science en utilisant le protocole de l'extension PRISMA (éléments de rapport préférés pour les analyses systématiques et les méta-analyses) pour les revues exploratoires.

Résultats : Le nombre d'articles sur les infodémies a plus que doublé, passant de 18 en 2020 à 37 en 2021, avant de baisser à 32 en 2022, ce qui reflète les efforts déployés à différents niveaux pour lutter contre les infodémies, en particulier pendant la pandémie de COVID-19. Les stratégies de lutte contre l'infodémie comprenaient l'éducation et la littératie en santé, l'utilisation de ressources d'information plus efficaces, le contrôle du contenu, les réseaux sociaux et la communication, les lois restrictives, l'utilisation de plateformes électroniques, les campagnes de sensibilisation et la participation des prestataires de soins de santé.

Conclusion : Les conclusions de cette étude indiquent que l'infodémie, en particulier pendant une pandémie, représente un grave défi pour la santé publique. Pour la combattre, une approche multidimensionnelle faisant intervenir l'éducation, la technologie, les politiques et la participation communautaire est essentielle.

استراتيجيات مكافحة الوباء المعلوماتي في مجال الصحة العامة

محمدهيوا عبدخدا، أفسانه دهنية

الخلاصة

الخلفية: الوباءُ المعلوماتي مفهومٌ ناشئ في مجال الصحة العامة يتطلب استراتيجيات فعالة لمكافحته.

الأهداف: هدفت هذه الدراسة الى تحديد الاستراتيجيات الموثقة لمكافحة الوباء المعلوماتي في قطاع الصحة، ولا سيما في أثناء جائحة كوفيد-19.

طرق البحث: في نوفمبر/ تشرين الثاني 2022، استعرضنا 87 مقالاً عن إدارة أوبئة المعلومات في مجال الصحة العامة نُشرت في مجلتَي *Pub Med* و *World of* Science مستخدمين بنود الإبلاغ المفضلة في حالة الاستعراضات المنهجية وتوسيع نطاق التحليلات التلوية في استعراضات النطاق.

النتائج: زاد عدد المقالات عن الوباء المعلوماتي بأكثر من الضعف (من 18 مقالاً في عام 2020 إلى 37 مقالاً في عام 2021) ولكن انخفض إلى 32 مقالاً في عام 2022، مما يشير إلى الجهود المبذولة على عدة مستويات لمكافحة أوبئة المعلومات، ولا سيما في أثناء جائحة كوفيد-19. وأما الاستراتيجيات الرامية إلى مكافحة أوبئة المعلومات فشملت مثلاً محو الأمية الصحية والتثقيف الصحي، واستخدام موارد معلومات أكثر فعالية، ومراقبة المحتوى، والتواصل على الشبكات الاجتماعية، وسنَّ القوانين التي تحد من انتشار المعلومات المغلوطة، واستخدام المنصات الإلكترونية، وحملات التوعية، وإشراك مقدمي الرعاية الصحية.

الاستنتاجات: تشير النتائج المستخلصة من هذا الاستعراض إلى أن الوباء المعلوماتي، ولا سيما في أثناء الجائحة، يمثل تحديًا خطيرًا في مجال الصحة العامة، وأن مكافحته تتطلب بالضرورة اتباع نهج متعدد الأوجه يشمل التعليم والتكنولوجيا والسياسات والمشاركة المجتمعية.

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