

Social media for public health: Reaping the benefits, mitigating the harms

Zain Jafar¹, Jonathan D. Quick^{2*}, Heidi J. Larson^{3,4}, Verner Venegas-Vera⁵, Philip Napoli⁶, Godfrey Musuka⁷, Tafadzwa Dzinamarira⁸, Kolar Sridara Meena⁹, T. Raju Kanmani¹⁰, Eszter Rimányi¹¹

¹Trinity College of Arts and Sciences, Duke University, Durham, USA

²Duke Global Health Institute, Duke University, Durham, USA

³London School of Hygiene & Tropical Medicine, UK

⁴Institute for Health Metrics & Evaluation, University of Washington, Seattle, USA

⁵Division of Internal Medicine, Mexican Institute of Social Security, Mexico

⁶Sanford School of Public Policy, Duke University, Durham, USA

⁷International Initiative for Impact Evaluation (3ie), Harare, Zimbabwe

⁸School of Health Sciences & Public Health, University of Pretoria, South Africa

⁹Journal of Mental Health Education, Department of Mental Health Education, MIMHANS, India

¹⁰Department of Psychiatric Social Work, National Institute of Mental Health and Neurosciences, India

¹¹University of North Carolina at Chapel Hill, Chapel Hill, USA

ARTICLE INFO

Article History:

Received: Xx xx, 2022

Accepted: Xx xx, 2022

ePublished: Xx xx, 2023

Keywords:

Health communication,
Mental health, Pandemics,
Public health, Social media

*Corresponding Author:

Jonathan D. Quick,
Email: jonathan.d.quick@
duke.edu

Abstract

With more than 4.26 billion social media users worldwide, social media has become a primary source of health information, exchange, and influence. As its use has rapidly expanded, social media has proven to be a “doubled-edged sword,” with considerable benefits as well as notable harms. It can be used to encourage preventive behaviors, foster social connectivity for better mental health, enable health officials to deliver timely information, and connect individuals to reliable information. But social media also has contributed to public health crises by exacerbating a decline in public trust, deteriorating mental health (especially in young people), and spreading dangerous misinformation. These realities have profound implications for health professionals, social media companies, governments, and users. We discuss promising guidelines, digital safety practices, and regulations on which to build a comprehensive approach to healthy use of social media. Concerted efforts from social media companies, governments, users, public interest groups, and academia are essential to mitigate the harms and unlock the benefits of this powerful new technology.

Introduction

In the last two decades, social media has become increasingly prevalent in daily life. By the end of 2021, there were more than 4.26 billion social media users worldwide, a number that is expected to increase to nearly six billion by 2027.¹ As social media has grown more ubiquitous, it has intersected with public health — for both good and bad. While becoming a powerful communication tool for health officials and public health agencies, social media has also contributed to public health crises via the spread of misinformation and the erosion of mental health. This paper will explore this duality and propose recommendations to swing the balance between social media’s advantages and drawbacks more positively.

The growth and reach of social media for health

Social media use has exploded in the last twenty years. The number of active monthly users is in the billions for today’s

leading platforms: Facebook (2.9 billion), YouTube (2.6 billion), WhatsApp (2.0 billion), Instagram (1.5 billion), WeChat/Weixin (1.3 billion), and TikTok (1.0 billion).²

In recent years social media’s growth has stabilized in high-income nations, but in low- and middle-income countries, regular use of social media has increased sharply from just 34% of people in 2013 to 53% in 2018.³ As of January 2022, social media usage has spread to every region of the world, with an estimated 58% of the world’s population being regular users (Figure 1).

Benefits and harms of social media

As global access to social media has increased, it has produced both significant benefits and substantial harms to individual and population health. While this duality of social media was highlighted during the COVID-19 pandemic,⁵ accumulating evidence demonstrates it can be seen across the spectrum of other health emergencies,

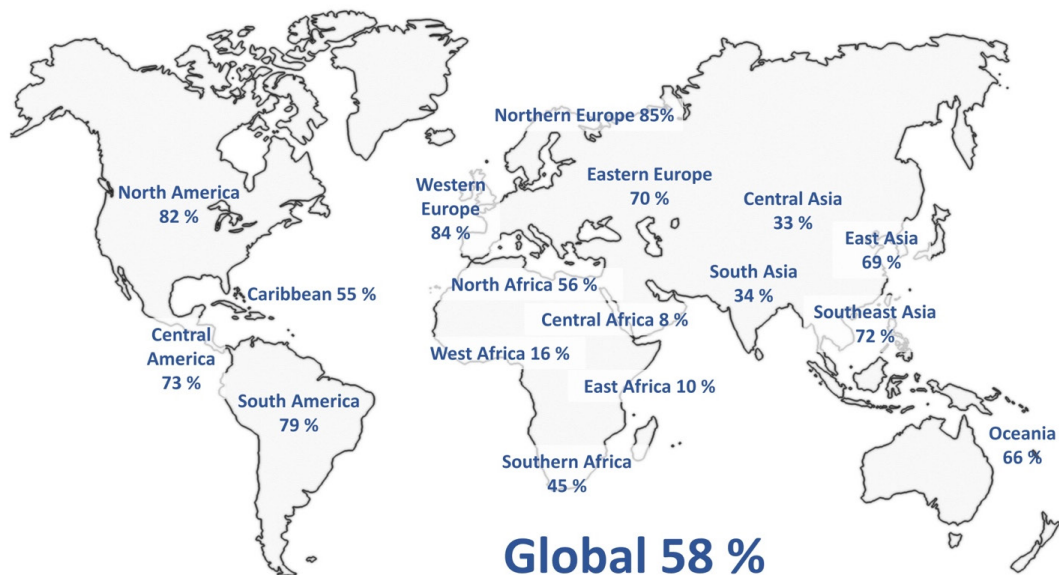


Figure 1. Social media users by region as a percent of total population (January 2022). Visualization: Authors. Data source: Digital 2022: Global digital overview, page 90.⁴

health promotion and prevention, healthcare provision, and mental health (Table 1).

Benefits for improved global health

Social media has become a significant source of public health information as it has grown more common in daily life. This was seen during the COVID-19 pandemic, according to a Pew Research study that found almost half of Americans have been getting a lot or some information regarding COVID-19 vaccines from social media.¹⁰ By acting as an information resource, social media has often encouraged preventive behaviors. A study conducted in Bangladesh, for example, found that social media users were about three times more likely than non-users to follow health rules established in response to the pandemic.¹¹ And a study from NYU School of Global Health found that informal sources like social media had the greatest potential to sway individuals towards preventive behaviors against the virus.¹²

Social media, therefore, offers a new tool for health officials to improve health literacy, raise awareness, and reach a larger audience with timely truths ahead of fatal fictions.¹³ This was the case with Ebola¹⁴ as well as with COVID-19 in West Africa, for which a study that found the number of social media accounts an individual owned was a significant predictor of their awareness of methods to stop the spread of the COVID-19 virus.¹⁵ Social media is particularly effective during times of crisis because it allows valuable information to be spread widely and rapidly,⁵ enhancing awareness and prevention strategies among the public.⁶ A 2020 systematic review highlighted the growing importance of social media in rapid detection of health-related rumors during outbreaks.¹⁶

Positive mental health benefits also have been associated with social media usage. One study from 2019 found that routine social media use was positively related to mental health, self-rated health, social well-

being, and resilience.¹⁷ The authors of this study believe social media can be beneficial by offering meaningful social interactions and opportunities to maintain existing social networks. A survey of American teens echoed this sentiment, with 81% saying social media makes them feel more connected to their friends' lives and 68% saying social media makes them feel that they have a support network when they encounter hardships.¹⁸ Social media can also help to decrease feelings of loneliness, especially among those with underlying mental health issues.¹⁹ Social media offers new opportunities to disseminate mental health information, connect individuals to mental health services, and create support networks between individuals and their caregivers.²⁰

Unintended harms

Despite significant health benefits, social media has been associated with substantial negative health impacts as well. While preventive behaviors may have been encouraged via social media usage, vaccine hesitancy has also been fueled by such sites,²¹ largely through unrestrained forms of misinformation that abound on these platforms.²² One study attempting to establish a causal relationship between exposure to social media misinformation and vaccine hesitancy found a 6.4-percentage point decrease in the number of individuals who would "definitely" receive a COVID-19 vaccine relative to individuals who did not receive any misinformation exposure in the United States, and a 6.2-percentage point decrease in the United Kingdom.²³ A review of the 100 most popular YouTube videos on autism spectrum disorder found that all but one were posted by non-professionals and 16% promoted the disproven vaccine-autism link.²⁴ Another study found a 2-percentage drop in mean vaccination coverage each year with every 1-point increase on a 5-point disinformation scale.²⁵ In Japan, social media was weaponized by anti-HPV vaccine groups to spread misinformation so

Table 1. Benefits and harms of social media for health

	Benefits	Harms
All uses	<ul style="list-style-type: none"> • Direct access to latest information, data, evidence, and expert opinion from local, national, international sources • Photos, videos, and graphics provide visual information and instruction that can be more effective and impactful • SMP algorithms for searches, recommendations, and popups can facilitate access to relevant information • Builds community and reduces both personal and professional isolation. 	<ul style="list-style-type: none"> • Fast spread of falsified content, fake news, manipulated information, or uninformed opinion • Unsourced or fictitiously sourced information makes it hard to distinguish the reliable from unreliable data • Information overload (“cognitive overload”) can lead to decline in memory, critical thinking and creativity • Polarization due to SMP algorithms that funnel users into preference bubbles (“echo chambers”) • Compulsive social media use (“technology addiction”) that undermines school and work performance
Health promotion and prevention	<ul style="list-style-type: none"> • Evidence-based information and recommendations on nutrition, fitness, and other healthy habits. • Access to wellness groups, chats, and other sources of peer support • Assessment of pros and cons of new developments in health living and disease prevention 	<ul style="list-style-type: none"> • Aggressive marketing of tobacco products, e-cigarettes, alcohol – often targeting minors • Misleading and unsafe marketing of pharmaceutical or herbal medicines, infant formula, and other products • Paid influencers and sponsored content disguised as independent assessments deceive consumers
Healthcare provision	<ul style="list-style-type: none"> • Provides direct access to current diagnosis and treatment information for users, including those in remote areas • Facilitates relationships between patients and providers, and among providers and healthcare organizations • Helps professional and lay groups exchange views the validity and implications of new healthcare developments 	<ul style="list-style-type: none"> • Testimonials and unverified claims encourage unproven, ineffective, costly or dangerous alternative treatments • Self-diagnosis based on unreliable information or anecdotal experience can delay effective, life-saving treatment • Time-consuming for providers
Pandemics and other health emergencies	<ul style="list-style-type: none"> • Rapid local to global alerts on disease outbreaks and other health emergencies • Facilitates open exchanges on benefits, costs, and alternative response options • Direct access to government recommendations, requirements, protocols, and resources • Identification of rumors, misinformation, conspiracy theories to adapt communication strategies 	<ul style="list-style-type: none"> • Rapid spread of misinformation and disinformation undermines trust in public health responses • Active promotion of ineffective, unproven, or unsafe responses diverts attention and resources • Threats, intimidation or violence against public officials or healthcare providers • Panic or riots due to rumors or conspiracy theories • Panic or paranoia when magnitude of earthquakes, pandemics and other natural or manmade disasters is exaggerated
Mental health	<ul style="list-style-type: none"> • Increased positive mental health and well-being when SM interactions are encouraging and supportive • Support through need-specific groups (eg, suicide prevention, Alzheimer’s support, addiction support) • Access to mental health resources, professionals and other sources for help-seeking and support • Increased mental health literacy and reduced stigma from information and educational campaigns • Builds social connection, community preparedness and resilience for psychological and social adversities • Builds connections for global perspectives on specific targeted interventions in the area of mental health 	<ul style="list-style-type: none"> • Negativity in thoughts, self-esteem or body image leading to social isolation and withdrawal • Depression, anxiety disorders, self-harm and suicide, especially among girls, women, and youth • Pro-suicide and suicide pact sites, message boards, chat rooms • Cyberbullying and cyberstalking with resulting psychological or physical harms • Anorexia nervosa, bulimia, and obesity with associated body-shaming • Behavioral contagion through deadly challenge contests such as eating laundry detergent pods • Disrupted sleep patterns and sleep-related disorders from excessive use of social media

Notes: SM, social media; SMP, Social media platform (eg, Facebook, YouTube, WhatsApp, Instagram, TikTok).

Source: Adapted by authors from Venegas-Vera⁵, Banerjee⁶, Madziva⁷, Karim⁸, Carrion-Alvarez.⁹

drastically that it pushed the government to redact its proactive recommendation for receiving the HPV vaccine. This policy change is estimated to have resulted in about 25 000 additional cervical cancer cases and 5000 to 5700 preventable deaths.²⁶

Another consequence of this unbridled misinformation is the use of social media to attack scientists and healthcare providers. One survey found that at least a quarter of US physicians have experienced attacks or harassment on social media during the COVID-19 era.²⁷ Health officials and doctors frequently are the target of posts containing misinformation that undermines their authority. They often face severe vitriol when discussing research or issuing recommendations on social media, which may discourage future communication of crucial information.

A wealth of evidence has found that social media is associated with significant adverse mental health effects – especially among young adults. A review of social media and adolescent well-being in the Global South showed

that, despite some benefits, social media brings numerous harms to mental health.²⁸ Another study concluded that social media use is a common driver of mental health issues among youth in India.²⁹ A study from Cape Town, South Africa found associations between social media use and both sleep difficulties and depressive symptoms.³⁰ Studies from Iran observed that individuals who did not use social networks like Instagram and Facebook had significantly lower levels of anxiety and depression³¹ and that social media use by adolescents was correlated with lower life satisfaction as well as lower family social capital.³²

A *Lancet* report from the UK Millennium Cohort Study established a correlation between greater social media use and online harassment, poor sleep, low self-esteem, and poor body image, which ultimately were related to higher depressive symptom scores among teen users.³³ These findings were further supported by a recently published randomized controlled trial, which found significant differences in well-being, anxiety, and

depression between groups instructed to continue using social media (Facebook, Twitter, Instagram, and Tik Tok) for a week versus those instructed to cease social media usage for a week.³⁴

Social media companies have reached similar conclusions internally. In the last four years, Facebook has repeatedly determined that Instagram — used by roughly three-quarters of teens in the United States³⁵ — is harmful for many of these young users, and that teenage girls are particularly affected.³⁶ Approximately 40% of Instagram's global users are below the age of 24.³⁷

A trove of released company documents called the Facebook Papers revealed internal research that found one-third of teenage girls with body image issues have these issues made worse when they use Instagram, which is owned by Facebook. The company's own research also reported that “teens blame Instagram for increases in the rate of anxiety and depression.” Facebook studies found that 13% of suicidal teenagers in Britain and 6% in the United States attributed their suicidal ideation to Instagram. Finally, internal slide decks featured in the dossier showed that significant percentages of teen users reported that negative feelings — such as not feeling good enough (24% in the US, 29% in the UK), feeling alone or lonely (21% in the US, 18% in the UK), not feeling attractive (41% in the US and 43% in the UK), and feeling like they have to create the perfect image (39% in the US and 51% in the UK) — are traceable to Instagram.³⁶

How does social media cause harm?

Social media is not inherently good or bad, but the roots of its harms may lie in the algorithms and decisions made by social media companies. Facebook's algorithm, for example, is based on “engagement,” meaning that posts which get more likes and comments are amplified. These posts tend to be controversial or strongly resonate with users.³⁸ Consequently, the algorithm has polarized users and generated networks of like-minded people, according to a study from the University of Denmark.³⁹ The effect of such echo-chambers was documented by this study, which found that a person's vaccine stance resulted in seeing “highly dissimilar sources of vaccine information.” Because of polarization based on engagement, vaccine-hesitant or anti-vaccine individuals are likely to see content that confirms their biases, causing them to engage in risky, counterproductive behaviors.

Social media's harm to health also stems from its addictive nature. Addiction is at the core of many social media companies' business models: these apps feature hallmark ingredients of behavioral addictions, and social media algorithms capitalize on neurochemical responses to keep users returning.⁴⁰ Some teens, aware of Instagram's harms, have tried to distance themselves from the app, but researchers have found the app has triggered addiction.³⁸ A recent report found that 31% of social media use is caused by self-control problems,⁴¹ indicating a real connection between addiction and social media use. The

addictive nature of social media algorithms leaves young brains continually vulnerable.

The risks of social media have been intensified by social media companies' deliberate negligence in the face of such harms, as revealed by an October 2020 piece published in *The New Yorker*. The exposé suggests that Facebook's repeated inaction is a byproduct of a business model that prioritizes engagement and that its laissez-faire approach towards divisive content and hate speech is more lucrative.⁴² This apathy and its impact on public health were displayed in Facebook's response to misinformation during the pandemic. According to the Facebook Papers, when Facebook's employees devised strategies to suppress posts featuring misinformation and promote factual content from public health agencies during the vaccine rollout, company leadership balked at these proposals.⁴³ The Facebook Papers also show that when the company initiated a pilot program that reduced debunked claims by 12% and boosted content from public health agencies by 8%, the company hesitated on wide-scale implementation. Critics have pointed to a fear of decreased profits due to lower engagement as the reason for this decision.

Strategies to promote the benefits and reduce the harms of social media

The many benefits of social media outlined in Table 1 are largely driven by the actions of its users engaging through the platforms provided by social media companies. The harms of social media, which are not inevitable, arise primarily from a combination of the social media business model and the behavior of its users. Strategies to maximize the benefits and minimize the harms will require action by social media companies, governments, users, and civil society.

Social media companies

Despite an overarching pattern of initial inaction, social media companies like Facebook have taken some steps to mitigate harm. In 2020, Facebook deployed a “viral circuit breaker” — a tool that does not take down a controversial post but instead limits its amplification. Applauded by advocates, this new feature deviated from the company's previous strategy of issuing fact-checks days after baseless posts became widely circulated. Facebook also released a new feature in July 2022 that allows users to view posts chronologically, rather than in an algorithm-dictated feed.⁴⁴ These are two promising measures critical to mitigating social media's negative effects. Viral circuit breakers and chronological feeds offer a chance to disrupt algorithms and lessen the viral spread of misinformation, risks of social media addiction, and problematic usage of social media.⁴⁵

The flag-and-fact-check feature is another viable tool social media companies could deploy more widely to reduce the spread of misinformation. This tool denotes posts with misinformation and directs users to credible sources for accurate information. During the pandemic,

many social media sites, including Facebook, Instagram, and Twitter, implemented this system, which has made people less inclined to share misinformation.⁴⁶ One study found that flagging misleading tweets prompted users to lower their opinion on the usefulness, trustworthiness, helpfulness, and accuracy of these tweets.⁴⁷ Such mechanisms need to be consistently in place and not come and go with the ebb and flow of world events.

Research also indicates that changing health behaviors is more effective when social media users are exposed to accurate information before they encounter misinformation — an approach referred to as “pre-bunking.”⁴⁸ Conversely, behavior change becomes more challenging when fact-checks are displayed after a user has been exposed to misinformation. One American study demonstrated that users’ vaccination intentions only improved if they were shown truths before they encountered misinformation.⁴⁹ Recent research from Cambridge University and Google also shows that pre-bunking has a range of positive effects on how social media users process misinformation.⁵⁰ Therefore, social media companies should consider proactively incorporating informative posts into users’ feeds, too.

Governments

Maximizing social media’s benefits and mitigating its adverse impacts will also require systemic changes in how these platforms operate, which governments must enforce. Some experts recommend that the US government raise the minimum age for users in the Children’s Online Privacy Protection Act with more stringent age verification.⁵¹ Others advise breaking up social media conglomerates like Facebook, as this would make more user-friendly sites and protections against misinformation a source of competitive advantage, according to one comprehensive overview of experts’ recommendations.⁵²

Some pundits have also called for criminal penalties for executives, policy reforms, and the creation of regulatory administrations.⁵² Criminal liability would address the culture of impunity at companies like Facebook that has led these problems to spiral. Amendments to Section 230 — a landmark American law meant to uphold free speech that ultimately protects tech companies from the legal consequences of harmful content⁵³ — could include requirements for social media companies, many of which are based in the US, to be held responsible for the harmful effects of amplifying dangerous content. Regulatory bodies exist for other powerful industries but are scarce for social media. Being a relatively new technology, many aspects of these platforms fall between the cracks of the jurisdiction ascribed to existing regulatory agencies such as the U.S. Federal Trade Commission and the U.S. Federal Communications Commission.

The European Union has become a pioneer in social media regulation, to which other countries might look. The EU passed both the Digital Services Act and the Digital Markets Act in early 2022. The first of these two laws may

be especially consequential to public health, as it requires social media companies to more robustly police their platforms for inflammatory posts and disinformation, hone their unrestrained algorithms, and assume greater responsibility for social media’s harms.⁵⁴

Users and civil society

The business model, algorithms, content moderation practices, and other actions of social media companies clearly play a major role in determining balance between the beneficial and the harmful effects of social media. However, there is much that users themselves — supported by civil society — can do to tilt the balance to the positive side.

Professional associations, consumer groups, religious bodies, and others have developed guidelines for effective, safe, and ethical use of social media. Recognizing the value of social media for health professionals, students, and patients, the World Medical Association has provided practical guidance on professional and ethical use of social media.⁵⁵ U.S. nursing schools are beginning to introduce social media use and cybercivility guidelines.⁵⁶ A 2019 review of social media guidelines for health professionals and faculty members from five countries concludes with practical advice on training in social media skills.⁵⁷

A 2022 literature review identifies ways in which users can “rewire their social media habits” for their wellbeing.⁵⁸ For example, users can choose to use sites with explicit content guidelines and boycott those without them. They can flag harmful and misleading posts while sharing informative content related to health.

Civil society organizations also play a central role by promoting healthy social media use and pressuring lawmakers and social media companies. Concerted movements and organizations like the Organization for Social Media Safety and the Council for Responsible Social Media institutions help to raise awareness of social media’s harms, rally public support, and instigate meaningful change.

The Center for Human Technology (<http://www.humanetech.com>), founded by Google’s former Design Ethicist to “align technology with humanity’s best interests”, provides a wealth of resources on wise use of social media for individuals, organizations and policymakers. The Center’s 2020 docudrama, *The Social Dilemma* — with an estimated 100 million worldwide views — and its associated solutions and resource materials provide specific insights and tools for healthy use of this technology.⁵⁹

Conclusion

Social media is a “double-edged sword” that both greatly benefits and can seriously harm individual and collective health.¹³ Social media is a tool that can encourage preventive behaviors and raise awareness rapidly, but it also can be leveraged to spread misinformation and disparage healthcare workers. Social media has been shown to have negative associations with mental health,

while simultaneously providing resources and support for positive mental health.

These realities have profound implications for social media companies, governments, health professionals, users, and civil society. The strategies to promote the benefits and reduce the harms of social media described in this perspective provide promising approaches by which these stakeholders increase the benefits and reduce the risks of social media.

A significant issue, however, is the dearth of evidence surrounding the effectiveness of such interventions.⁶⁰ The evaluations that do exist are predominantly from Western nations — even though nine of the ten countries with the highest number of Facebook users are in the Global South.⁶¹ Great investment and data-sharing is needed to generate studies on the impact of these and other interventions. One initiative that has been recently launched in this direction is the Alliance for Advancing Health Online (AAHO). Concrete indications of what works and what does not will allow for more effective, evidence-based interventions.

Under Hippocrates' principle of "first do no harm," it is incumbent on the global health community, national authorities, users, and social media companies themselves to take steps to continue to mitigate social media's harms. Social media companies need to reform policies and implement stronger control measures while strengthening the positive assets of their technology. Concurrently, governments, health organizations, NGOs, and academic and research institutions must work together for a common goal of improving mental and physical health.

Acknowledgments

The researchers thank Michael Penn for providing valuable insight on the benefits of social media and support throughout the duration of the project. We are also appreciative of the editorial advice provided by Karl Leif Bates.

Authors' Contribution

Conceptualization: Zain Jafar, Jonathan D. Quick.

Investigation: All authors.

Methodology: Jonathan D. Quick.

Project administration: Jonathan D. Quick.

Supervision: Jonathan D. Quick.

Visualization: Jonathan D. Quick.

Writing—original draft: Zain Jafar.

Writing—review & editing: All Authors.

Ethical Approval

Not applicable.

Competing Interests

In the past 36 months, HLJ has received a GSK research grant in conjunction with UK NIHR, a Merck research grant in conjunction with the MacArthur Foundation, and a J&J research grant in conjunction with the Gates Foundation.

Funding

No designated funding was received for the preparation of this paper.

References

- Dixon S. Number of Worldwide Social Network Users 2027. Statista. Available from: <https://www.statista.com/statistics/278414/number-of-worldwide-social-network-users/>. Accessed September 21, 2022.
- Statista. Biggest Social Media Platforms 2022. Available from: <https://www.statista.com/statistics/272014/global-social-networks-ranked-by-number-of-users/>. Accessed November 11, 2022.
- Poushter J, Bishop C, Chwe H. Social Media Use Continues to Rise in Developing Countries but Plateaus Across Developed Ones. Pew Research Center; 2018. Available from: <https://www.pewresearch.org/global/2018/06/19/social-media-use-continues-to-rise-in-developing-countries-but-plateaus-across-developed-ones/>. Accessed November 4, 2022.
- DataReportal. Digital 2022: Global Overview Report. <https://datareportal.com/reports/digital-2022-global-overview-report>. Available from: Accessed September 21, 2022.
- Venegas-Vera AV, Colbert GB, Lerma EV. Positive and negative impact of social media in the COVID-19 era. *Rev Cardiovasc Med.* 2020;21(4):561-4. doi: 10.31083/j.rcm.2020.04.195.
- Banerjee D, Meena KS. COVID-19 as an "infodemic" in public health: critical role of the social media. *Front Public Health.* 2021;9:610623. doi: 10.3389/fpubh.2021.610623.
- Madziva R, Nachipo B, Musuka G, Chitungo I, Murewanhema G, Phiri B, et al. The role of social media during the COVID-19 pandemic: salvaging its 'power' for positive social behaviour change in Africa. *Health Promot Perspect.* 2022;12(1):22-7. doi: 10.34172/hpp.2022.03.
- Karim F, Oyewande AA, Abdalla LF, Chaudhry Ehsanullah R, Khan S. Social media use and its connection to mental health: a systematic review. *Cureus.* 2020;12(6):e8627. doi: 10.7759/cureus.8627.
- Carrion-Alvarez D, Tijerina-Salina PX. Fake news in COVID-19: a perspective. *Health Promot Perspect.* 2020;10(4):290-1. doi: 10.34172/hpp.2020.44.
- Mitchell A, Liedke J. About Four-in-Ten Americans Say Social Media is an Important Way of Following COVID-19 Vaccine News. Pew Research Center. Available from: <https://www.pewresearch.org/fact-tank/2021/08/24/about-four-in-ten-americans-say-social-media-is-an-important-way-of-following-covid-19-vaccine-news/>. Accessed July 19, 2022.
- Sharif N, Opu RR, Alzahrani KJ, Ahmed SN, Islam S, Mim SS, et al. The positive impact of social media on health behavior towards the COVID-19 pandemic in Bangladesh: a web-based cross-sectional study. *Diabetes Metab Syndr.* 2021;15(5):102206. doi: 10.1016/j.dsx.2021.102206.
- Kim S, Capasso A, Cook SH, Ali SH, Jones AM, Foreman J, et al. Impact of COVID-19-related knowledge on protective behaviors: the moderating role of primary sources of information. *PLoS One.* 2021;16(11):e0260643. doi: 10.1371/journal.pone.0260643.
- Quick JD, Fryer B. Fatal fictions, timely truths. In: *The End of Epidemics: The Looming Threat to Humanity and How to Stop It*. St. Martin's Publishing Group; 2018.
- Walker BF, Adukwu EC. The 2013-2016 Ebola epidemic: evaluating communication strategies between two affected countries in West Africa. *Eur J Public Health.* 2020;30(1):118-24. doi: 10.1093/eurpub/ckz104.
- Okorie IE, Afuecheta E, Alaabo CG, Nadarajah S. Socio-economic and demographic impacts on the full awareness of the methods for controlling/preventing the spread of COVID-19 among social media users in some African countries at the onset of the pandemic. *BMC Res Notes.* 2021;14(1):331. doi: 10.1186/s13104-021-05736-z.
- Salehinejad S, Jangipour Afshar P, Borhaninejad V. Rumor surveillance methods in outbreaks: a systematic literature review. *Health Promot Perspect.* 2021;11(1):12-9. doi: 10.34172/hpp.2021.03.

17. Bekalu MA, McCloud RF, Viswanath K. Association of social media use with social well-being, positive mental health, and self-rated health: disentangling routine use from emotional connection to use. *Health Educ Behav*. 2019;46(2_ suppl):69-80. doi: 10.1177/1090198119863768.
18. Anderson M, Jiang J. Teens' Social Media Habits and Experiences. Pew Research Center. Available from: <https://www.pewresearch.org/internet/2018/11/28/teens-social-media-habits-and-experiences/>. Accessed August 11, 2022.
19. Gowen K, Deschaine M, Gruttadara D, Markey D. Young adults with mental health conditions and social networking websites: seeking tools to build community. *Psychiatr Rehabil J*. 2012;35(3):245-50. doi: 10.2975/35.3.2012.245.250.
20. Naslund JA, Bondre A, Torous J, Aschbrenner KA. Social media and mental health: benefits, risks, and opportunities for research and practice. *J Technol Behav Sci*. 2020;5(3):245-57. doi: 10.1007/s41347-020-00134-x.
21. Larson HJ, Gakidou E, Murray CJL. The vaccine-hesitant moment. *N Engl J Med*. 2022;387(1):58-65. doi: 10.1056/NEJMra2106441.
22. Wardle C, Singerman E. Too little, too late: social media companies' failure to tackle vaccine misinformation poses a real threat. *BMJ*. 2021;372:n26. doi: 10.1136/bmj.n26.
23. Loomba S, de Figueiredo A, Piatek SJ, de Graaf K, Larson HJ. Measuring the impact of COVID-19 vaccine misinformation on vaccination intent in the UK and USA. *Nat Hum Behav*. 2021;5(3):337-48. doi: 10.1038/s41562-021-01056-1.
24. Kollia B, Kamowski-Shakibai MT, Basch CH, Clark A. Sources and content of popular online videos about autism spectrum disorders. *Health Promot Perspect*. 2017;7(4):238-44. doi: 10.15171/hpp.2017.41.
25. Wilson SL, Wiysonge C. Social media and vaccine hesitancy. *BMJ Glob Health*. 2020;5(10):e004206. doi: 10.1136/bmjgh-2020-004206.
26. Larson HJ, Lin L, Goble R. Vaccines and the social amplification of risk. *Risk Anal*. 2022;42(7):1409-22. doi: 10.1111/risa.13942.
27. Harmon GE. Threats, Intimidation Against Doctors and Health Workers Must End. American Medical Association. Available from: <https://www.ama-assn.org/about/leadership/threats-intimidation-against-doctors-and-health-workers-must-end>. Accessed September 28, 2022.
28. Ghai S, Magis-Weinberg L, Stoilova M, Livingstone S, Orben A. Social media and adolescent well-being in the Global South. *Curr Opin Psychol*. 2022;46:101318. doi: 10.1016/j.copsyc.2022.101318.
29. Dhandapani VR, Chandrasekaran S, Singh S, Sood M, Chadda RK, Shah J, et al. Community stakeholders' perspectives on youth mental health in India: problems, challenges and recommendations. *Early Interv Psychiatry*. 2021;15(3):716-22. doi: 10.1111/eip.12984.
30. De Doncker K, McLean N. Social media, sleep difficulties and depressive symptoms: a case study of South African youth in Cape Town. *Technol Soc*. 2022;70:102038. doi: 10.1016/j.techsoc.2022.102038.
31. Khodarahimi S, Fathi R. The role of online social networking on emotional functioning in a sample of Iranian adolescents and young adults. *J Technol Hum Serv*. 2017;35(2):120-34. doi: 10.1080/15228835.2017.1293587.
32. Geraee N, Eslami AA, Soltani R. The relationship between family social capital, social media use and life satisfaction in adolescents. *Health Promot Perspect*. 2019;9(4):307-13. doi: 10.15171/hpp.2019.42.
33. Kelly Y, Zilanawala A, Booker C, Sacker A. Social media use and adolescent mental health: findings from the UK Millennium Cohort Study. *EclinicalMedicine*. 2018;6:59-68. doi: 10.1016/j.eclinm.2018.12.005.
34. Lambert J, Barnstable G, Minter E, Cooper J, McEwan D. Taking a one-week break from social media improves well-being, depression, and anxiety: a randomized controlled trial. *Cyberpsychol Behav Soc Netw*. 2022;25(5):287-93. doi: 10.1089/cyber.2021.0324.
35. Statista. Global Instagram User Age & Gender Distribution 2022. Available from: <https://www.statista.com/statistics/248769/age-distribution-of-worldwide-instagram-users/>. Accessed August 10, 2022.
36. Wells G, Horwitz J, Seetharaman D. Facebook Knows Instagram Is Toxic for Teen Girls, Company Documents Show. *Wall Street Journal*. Available from: <https://www.wsj.com/articles/facebook-knows-instagram-is-toxic-for-teen-girls-company-documents-show-11631620739>. Accessed July 21, 2022.
37. Schaeffer K. 7 Facts About Americans and Instagram. Pew Research Center. Available from: <https://www.pewresearch.org/fact-tank/2021/10/07/7-facts-about-americans-and-instagram/>. Accessed July 19, 2022.
38. Ghaffary S, Heath A. Facebook Gets a Facelift. (Land of the Giants). Available from: <https://www.vox.com/land-of-the-giants-podcast>. Accessed July 28, 2022.
39. Mønsted B, Lehmann S. Characterizing polarization in online vaccine discourse-a large-scale study. *PLoS One*. 2022;17(2):e0263746. doi: 10.1371/journal.pone.0263746.
40. Alter A. Irresistible: The Rise of Addictive Technology and the Business of Keeping Us Hooked. Penguin Books; 2017.
41. Allcott H, Gentzkow M, Song L. Digital Addiction. National Bureau of Economic Research. Available from: <https://www.nber.org/papers/w28936>. Accessed August 11, 2022.
42. Marantz A. Why Facebook Can't Fix Itself. *The New Yorker*. Available from: <https://www.newyorker.com/magazine/2020/10/19/why-facebook-cant-fix-itself>. Accessed July 21, 2022.
43. Klepper D, Seitz A. Facebook Froze as Anti-Vaccine Comments Swarmed Users. AP News. Available from: <https://apnews.com/article/the-facebook-papers-covid-vaccine-misinformation-c8bbc569be7cc2ca583dadb4236a0613>. Accessed July 19, 2022.
44. Notopoulos K. Facebook is Finally Giving People a Non-Algorithmic News Feed. *BuzzFeed News*. Available from: <https://www.buzzfeednews.com/article/katienotopoulos/facebook-chronological-home-feed>. Accessed July 21, 2022.
45. Simpson E, Conner A. Fighting Coronavirus Misinformation and Disinformation. Center for American Progress. Available from: <https://www.americanprogress.org/article/fighting-coronavirus-misinformation-disinformation/>. Accessed August 11, 2022.
46. Red-Flagging Misinformation Could Slow the Spread of Fake News on Social Media. NYU Tandon School of Engineering. Available from: <https://www.sciencedaily.com/releases/2020/04/200428112542.htm>. Accessed August 11, 2022.
47. Lanius C, Weber R, MacKenzie WI Jr. Use of bot and content flags to limit the spread of misinformation among social networks: a behavior and attitude survey. *Soc Netw Anal Min*. 2021;11(1):32. doi: 10.1007/s13278-021-00739-x.
48. Roozenbeek J, Traberg CS, van der Linden S. Technique-based inoculation against real-world misinformation. *R Soc Open Sci*. 2022;9(5):211719. doi: 10.1098/rsos.211719.
49. Full Fact. Health Misinformation in Africa, Latin America and the UK: Impacts and Possible Solutions. Available from: <https://fullfact.org/media/uploads/en-tackling-health-misinfo.pdf>. Accessed August 12, 2022.
50. Roozenbeek J, van der Linden S, Goldberg B, Rathje S, Lewandowsky S. Psychological inoculation improves resilience against misinformation on social media. *Sci Adv*. 2022;8(34):eabo6254. doi: 10.1126/sciadv.abo6254.
51. Levin Y. It Was a Mistake to Let Kids Onto Social Media Sites.

- Here's What to Do Now. The New York Times. Available from: <https://www.nytimes.com/2022/08/05/opinion/social-media-parents-children.html>. Accessed August 11, 2022.
52. Ghaffary S. How to Fix Facebook. Vox. Available from: <https://www.vox.com/recode/22762596/how-to-fix-facebook-mark-zuckerberg>. Accessed August 11, 2022.
53. Napoli PM. Back from the dead (again): the specter of the fairness doctrine and its lesson for social media regulation. *Policy Internet*. 2021;13(2):300-14. doi: 10.1002/poi3.253.
54. Center for Digital Wellbeing. International Regulation of Social Media. Available from: <https://digitalwellbeing.org.au/publications/>. Accessed August 11, 2022.
55. The World Medical Association. WMA Statement on the Professional and Ethical use of Social Media. 2022. Available from: <https://www.wma.net/policies-post/wma-statement-on-the-professional-and-ethical-use-of-social-media/>. Accessed May 4, 2023.
56. De Gagne JC, Yamane SS, Conklin JL, Chang J, Kang HS. Social media use and cybercivility guidelines in U.S. nursing schools: a review of websites. *J Prof Nurs*. 2018;34(1):35-41. doi: 10.1016/j.profnurs.2017.07.006.
57. Hennessy CM, Smith CF, Greener S, Ferns G. Social media guidelines: a review for health professionals and faculty members. *Clin Teach*. 2019;16(5):442-7. doi: 10.1111/tct.13033.
58. Bayer JB, Anderson IA, Tokunaga RS. Building and breaking social media habits. *Curr Opin Psychol*. 2022;45:101303. doi: 10.1016/j.copsyc.2022.101303.
59. The Social Dilemma. Available from: <https://www.humanetech.com/the-social-dilemma>. Accessed November 20, 2022.
60. Gharib M. WHO is Fighting False COVID Info on Social Media. How's That Going? NPR. Available from: <https://www.npr.org/sections/goatsandsoda/2021/02/09/963973675/who-is-fighting-false-covid-info-on-social-media-hows-that-going>. Accessed November 20, 2022.
61. Statista. Facebook Users by Country 2022. Available from: <https://www.statista.com/statistics/268136/top-15-countries-based-on-number-of-facebook-users/>. Accessed August 10, 2022.