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The Evolving Interplay between Social Media and International Health Security: A Point of View

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Abstract

Human communication and interaction had been rapidly evolving with the advent and continuing influence of social media (SM) thereby accelerating information exchange and increasing global connectivity. Despite clear advantages, this new technology can present unintended consequences including medical misinformation and “fake news.” Although International Health Security (IHS) stands to benefit tremendously from various SM platforms, high-level decision-makers and other stakeholders must also be aware of the dangers related to its intentional and unintentional misuse (and abuse). An overview of SM utility in fighting disease, disseminating life-saving information, and organizing people and teams in a constructive fashion is discussed herein. The potential negatives associated with SM misuse, including intentional and unintentional misinformation, as well as the ability to organize people in a disruptive fashion, will also be presented. Our treatise will additionally outline how deliberate misinformation may lead to harmful behaviors, public health panics, and orchestrated patterns of distrust. In terms of both its affirmative and destructive considerations, SM can be viewed as an asymmetric influencing force, with observed effects (whether beneficial or harmful) being disproportionately greater than the cost of the intervention.

Keywords: global health security, International Health Security, social media, misinformation, fake news

1. Introduction

International Health Security (IHS) includes a broad range of intertwined subject areas related to human security [1–4]. Introduced by the United Nations in the mid-1990s, the definition of “health security” is nebulous because of an overlap between its constituent “health” and “security” components [5]. Thus, there continues to be debate about the degree of such overlap and its implications. In addition, although traditional IHS applications focus on bio-terrorism and emerging infectious diseases (EIDs) [6, 7], the concepts of “health” and “security” can be applied more broadly when different man-made and non-man-made factors, from climate change to cyber health security are considered [8–11].

The domination of personal and professional human interactions by the increasingly more powerful and sophisticated social media (SM) platforms brought with

it many benefits and challenges. For example, SM has introduced conditions for cyberbullying, voter/public opinion manipulation, and criminal activity despite its well-intended attempts to bring people together in the digital, boundaryless environment [12]. Here, we will discuss how SM can create both constructive and destructive forces, focusing specifically on IHS and related topic areas.

2. The definition of social media

SM's definition and sphere of influence extend to "any medium involving user-generated content" [13, 14]. Assorted subdomains within SM may include blogs or microblogs, interactive forums, message boards, social networks, wikis, as well as other types of audiovisual media-based platforms (e.g., photo or video sharing sites) [13–15]. Comprehensive acceptance of SM contributed to a startling rise in the overall amount of information being shared, the acceleration and pervasiveness of such sharing, as well as the ability to interact across nearly all areas of human activity, inclusive of public health and medical care [12, 16]. It must be noted that the vast volume of shared information on SM is largely unfiltered and difficult to verify.

The reach and breadth of SM platforms and related communication tools have developed exponentially and matured as the Internet has expanded [14, 17, 18]. During this time, the purpose and focus of various SM tools remained poorly defined [19, 20]. While altruism is at the heart of most large SM platforms, it is difficult to promote (or enforce) its charitable and humanitarian application by end-users, especially in the context of best interest of communities [21–23]. As with all discourses involving the interchange of knowledge, transparency becomes a paramount concern in that any information disclosures are made in a manner that is both open and honest, in effect strengthening the legitimacy of the involved SM platform [24–26]. It is critical that SM adheres to accepted ethical and scientific norms and that this adherence applies to the full range of related domains, including bioinformatics, statistical testing, peer-review, and independent validation [27–34]. It should be emphasized that particularly when it pertains to SM in the context of the subsequent IHS arguments made in this chapter, the most popular, seemingly persuasive, and commonly repeated messaging does not always constitute the absolute truth or reliable information, and that one should be free to question and challenge any data he/she is presented with [35–40]. This is especially applicable in the setting of question-and-answer format of information exchange, where both relevance and quality of information are critical [40].

3. Social media platforms: "weaponizing" human emotions and interactions

The very presence of today's Internet has created the expectation of internationalization and universal information sharing amid the rapidly evolving frameworks of technological and social change [41–43]. As the Internet matured, the type and presentation of the information itself evolved, with increasing participation of highly diversified, user-furnished content [44]. Human beings have always valued the stimuli provided by their senses, either consciously or subconsciously. People tend to create various reference points, both to self and others, allowing the construction of an environment that psychologically conditions its participants. This may lead to a compulsive feedback loop that emerges from intense competitive pressures, with users trying to out-compete themselves and others in search of external affirmation [45–49]. As part of its continued development, the Internet became rich in various

audio-visual representations specifically designed to show appreciation or depreciation of the stimuli [49–51]. From a historical perspective, the first “like” button has been attributed to Vimeo, a video sharing platform that appeared in 2005 [52, 53]. Vimeo designers were inspired by Digg, a Website that encouraged the clicking of a button labeled “digg” when a rewarding picture was observed by an end-user or an interesting article was read. Similar concepts have been fully embraced across the SM sphere and serve as the “fuel” in the highly gamified “ratings” competition [53–56].

The concept of “liking” or providing “virtual endorsement” to an information snippet on an SM platform has sparked intense research into the implications and consequences of such an action that, on initial blush, appears benign [57–59]. More specifically, there is evidence that an action of providing a “like” creates a basis for a “directed voting” or reward system of sorts [59, 60]. Early research by Davey et al. [61] investigated the effect of “being liked” on specific regions of the brain. Primary reward and self-related regions were activated under such conditions (e.g., nucleus accumbens, ventral tegmentum midbrain, ventromedial prefrontal cortex, and amygdala among others) [61]. Furthermore, there was a proportionately greater activation of these neurological regions in response to “being liked” by individuals who are more highly regarded [61]. Sherman et al. [62] used a computer program resembling Instagram (Facebook, Inc., Menlo Park, California, USA) to investigate regions of the brain that exhibited significant activity when an image was “liked.” Their results showed statistically significant activation in the dorsal and ventral striatum, ventromedial prefrontal cortex, midbrain, and amygdala when “liking” an image versus simply pressing “next” to view the subsequent image [62]. The former regions were implicated in reward and the latter being implicated in reward processing [63, 64]. Sherman et al. [62] did note that the esthetic quality of the image itself can lead to activation of similar pathways. If both the “act of liking” and the act of “receiving a like” are being interpreted as rewards, it becomes clear as to why SM has been expanding so quickly. However, this also leads to the question, what are the consequences of such rewards?

Studies have linked these changes to dopaminergic system and its corresponding communication with the striatum [65]. When looking at the effects of “like” from the neuroscience perspective, functional MRI studies of SM users suggest that the “popularity of a photo” has a significant effect on its viewer’s perception. A popular photo was more likely to receive more “likes” from SM peers regardless of the activity being portrayed [66]. Sherman et al. [65] went on to discuss the quantification of social endorsement as an important example of sociocultural learning. Moreover, the question arises as to whether individuals actively engaged in SM-based discourses are more likely to neglect direct human interactions in favor of reaching larger, “virtual and impersonal” audiences [46, 67, 68]. If so, what are the implications of such conditioning to the ability to critically evaluate information encountered on SM platforms? Likewise, how does one sort out what is real versus what is virtual, as well as the impact of information upon each of these domains?

Before venturing back to the primary discussion of the relationship between SM and IHS, the concepts of “vague-booking” and “mediated lurking” should be noted [66, 69]. Berryman et al. [66] define “vague-booking” as sharing “ambiguous but alarming posts” to attract attention. “Mediated lurking” on the other hand is defined as becoming a member/user of a SM platform but “wishing to go largely undetected” [69, 70]. Finally, one would be remiss without mentioning the potential for “cyberbullying” and “cyber aggression” [71, 72]. These phenomena can create a real and damaging link between online and real-life behaviors [71, 73, 74]. Aggressive online behaviors have been categorized into subtypes, which include hostile aggression (e.g., “an act of aggression stemming from a feeling of anger and aimed at inflicting pain or injury”) and instrumental aggression (e.g., “an intention

to hurt the other person, but the hurting takes place as a means to some goal other than causing pain”) [75]. Within this general context, SM facilitates and escalates negative behaviors that may serve to “deliver aggression,” while not being physically present, yet directed toward the person of interest. Jamison et al. [76] investigated the types of malicious actors that are found on Twitter (Twitter, San Francisco, California, USA) and the potential ramifications of their influence. Three categories of malicious actors were identified: (1) automated accounts (i.e., bots without human influence once created), (2) semiautomated accounts (i.e., bots with some degree of human influence), and (3) malicious humans [76]. Malicious SM actors have been labeled “trolls,” with the associated activity of “trolling” defined as “posting denigrating and inflammatory messages in order to argue and/or emotionally upset individuals” [77]. Each form allows for altering influence, as well as delivering aggression. In particular, if the actors can deliver an aggressive message with a disregard for any ramifications, they are in fact executing the purest form of passive aggression, a demonstration of hostile feelings in a non-confrontational manner [78, 79]. All of the above definitions, characteristics, behavioral patterns, and consequences play an important role in the “weaponization” of SM as it relates to IHS. Within this psychological context, a discussion of various aspects of concern regarding targeted SM content manipulation is warranted [80].

4. Social media in public health

As outlined in previous sections, SM has several emerging real-life applications in public health [81]. It is a powerful platform for real-time data collection, especially during fast-moving events such as epidemics or outbreaks [81, 82]. User inputs on SM platforms may help with the detection—and subsequent mapping—of geographic patterns for disease-specific signs or symptoms, confirmed cases, and/or other relevant parameters [83]. The resultant data can then be filtered, tracked, collected, analyzed/modeled, and reported [84, 85].

The use of SM to analyze various aspects of disease outbreaks (e.g., prediction, detection, and tracking) was described in the early 2010s by several independent groups [86–89]. SM was felt to be instrumental in containing the Ebola outbreak in Nigeria through enhanced information sharing and coordination between front line personnel [85]. While Internet “search engines” are valued tools, primarily because they can be used in the leveraging of targeted marketing and sales, their use in characterizing the epidemiology, and geographic evolution of an emerging disease [90–92] as well as other more scientifically focused endeavors [93, 94] is of unquestionable worth. Increased frequency of specifically tracked search queries, such as “how does one prevent the flu,” “what is the treatment of the flu,” and “what are the most common symptoms of the flu” have shown accuracy and temporal correlation with the extent of disease spread and its prevalence, especially when contrasted against more traditional means of tracking outbreak progression. There is also a strong correlation between trends identified by “Internet search engines” and phenomena such as emergency department visits by patients with influenza [95]. A striking example of the correlation between Google™ Trends and an emerging infectious threat was recently demonstrated in an “infodemiological” study of the Wuhan coronavirus (2019-nCoV) [96]. Still, it is not surprising that some pragmatic researchers urge caution when using such information in the absence of complete epidemiological understanding, context, and expert interpretation [97, 98].

Despite some flaws, strict adherence to proper scientific methodology and structured peer review can provide reasonably robust ways of enforcing proper balance to help minimize the risk of propagation of false or misleading information

[99–101]. To ensure wide adoption, SM platforms tend to be open and inviting, thus providing an essentially unrestricted forum for the exchange of ideas. Much of this occurs in the name of “protecting and enabling free speech.” Consequently, short of legal action, objective accountability for communicated content is lacking at best [102–105]. In certain scenarios, unrestricted online attacks can be very destructive, including consequences in both in the “real” and “digital” domains, and both personally and professionally [12, 106]. Some forms of malicious SM participation have been discussed in an aforementioned section. Among established SM platforms, there seems to be a struggle to find a balance between self- or user/community-censorship and various forms of “online aggression” [12, 72, 107]. Significant spillover into public health can occur, especially among minors, and can have tremendous impact when “online actions” translate into “real-world implications” [108–111].

5. International Health Security: constructive uses of social media

It has been shown that SM-based vigilance can be useful for outbreak or epidemic interception, tracking, and data reporting [86, 87, 112, 113]. In the midst of the 2014 Ebola outbreak in West Africa, isolated islands of the disease were successfully contained leveraging SM-based coordination tools, including targeted identification of misinformation and its prompt correction [85]. SM can also be valuable to public health community when determining how human networks behave in the context of social determinants of health (e.g., health behaviors, resource availability, and general compliance) [114]. Thus, SM may be particularly helpful in promoting positive health behaviors [115]. All of the above implementations of SM in public health are now being actively employed during the Wuhan 2019-nCoV outbreak, with focus on augmented intelligence in the context of preventing the spread of the disease [116, 117]. An additional use case for SM, as reported in conjunction with the 2019-nCoV, is the promotion of psychological crisis interventions using popular SM channels to share strategies for dealing with stress and anxiety associated with the outbreak [118].

6. International Health Security: potentially harmful aspects of social media use

The sharing of non-peer-reviewed information over SM entails the potential of transmitting misinformation or misinterpretation of such unfiltered content [119], especially if it is out of context. The hourly volume of SM messaging that may contain “inaccurate or fake news” outnumbers “fact checking” capabilities by as much as 10-fold [120]. In addition, the average time between the release of “fake news” and any “fact checking” response may be greater than 12 hours, thereby causing significant damage before the misinformation can be rectified [120]. Thus, misinformation introduced into public discourse can be substantial if placed by a highly motivated and appropriately equipped individual (or group). In the context of IHS, the consequences can be profound when “fake news” is carefully crafted and communicated in a strategic manner (**Table 1**). “Fake news” can be damaging in several ways, from spreading false claims (e.g., that risk of vaccines is greater than their benefits), to misinforming the public regarding a particular health condition (e.g., misstating signs and symptoms of a viral infection). Programmatic moderation of content is one of the solutions that SM outlets have embraced, but this process is very resource-intensive, may be quite cumbersome, and may not apply universally across different types of data [121, 122]. Additionally, in regard to

| Harmful behavior | Description | Comments |
|----------------------------|--|---|
| Cyberbullying | SM content that is of intimidating or threatening in character, with potential for risk to self or others. Associated harm may be both mental and physical | Robust surveillance, reporting, and prompt remediation; establishing and enforcing accountability, as applicable |
| Fabricated or “fake” news | Intentional release of erroneous news and information via both traditional and SM. Consequences can be both unintended and unpredictable, including intentionally or unintentionally harmful or damaging behaviors, or misdirected action | Adherence to established news reporting standards; Sound editorial policies and procedures. Appropriate fact-checking and prompt intervention to avoid any resultant or potential harm |
| Intentional misinformation | Leading individuals to perform actions that may have harmful consequences on self or others. Release of intentional misinformation may result in random and unpredictable downstream events. The process involves the end-user receiving, processing, and implementing any information before actual harm can result | Empowering SM moderators to remove harmful content; Vigilance, fact-checking, and timely intervention to prevent any potential or actual damage from dissemination of false information; legal consequences for intentional introduction of potentially damaging misinformation |
| Misinterpretation | Erroneous conclusions made regarding data generated or compiled from SM inputs. Although usually not intentional, this may lead to misguided planning or implementations, with some potential for harm | Careful cross-checking and verification of both the source data and the analytical methods; use of established decision-making algorithms and verification mechanisms |

SM, social media.

Table 1.

Primary modes of deleterious behavioral patterns described on social media, with associated characteristics, potential for negative consequences, and proposed remedial/corrective measures.

SM and addiction, there are significant correlations between symptoms of addiction to technology use and mental health conditions [123]. Furthermore, more advanced technological applications, such as virtual reality, have been associated with dissociation and lower “sense of presence” in objective reality [124]. Various psychological aspects and nuances associated with SM use were discussed earlier in the chapter, and the reader is referred there to avoid content redundancy.

Although SM can provide an excellent medium for open discourse on a broad range of topics, the troubling reality is that SM may foster a society with fewer defined boundaries (e.g., “real-life friend” versus “social media friend”) [125, 126]. Thereby no longer plainly demarcating a defined personal space and presenting a risk of intentional or unintended “invasion” [127, 128]. Although SM’s negative aspects have been addressed, there is little doubt that responsible use of SM facilitates the public awareness of various health/mental health matters and thus can provide an overall positive influence.

There are examples of SM as a successful tracking tool of actual disease outbreaks/epidemics [86]. However, the risk of “false alarms” does exist, potentially affecting the utility of SM as a useful public health tracking tool at the population level [129]. The tracked data often lack specificity [130], can be misinterpreted and/or distorted, and subsequently promoted by influential personas without appropriate training or content expertise [131, 132]. Reversing damage caused by distortion of the facts and misinterpretation can be challenging [133–137]. For example, the controversy regarding the alleged association between childhood vaccination and autism exemplifies how concerns of global nature can be distorted in a highly publicized fashion [138–140]. Despite multiple research studies that were

unable to definitively prove a connection between childhood vaccines and autism, large groups within the society still advocate otherwise [141–143]. Unfortunately, misplaced trust tends to be given to the messengers and various SM tools, rather than the authorities and the medical community [144–146]. These considerations need to be taken from the perspective of IHS, especially when one realizes that the “most prominent voice” is not universally the one with the correct or the best answer [147, 148].

There is a clear and present danger of malignant actors abusing SM to spread disinformation that may potentially lead to third-party harm [149, 150]. In 2009, in the midst of the swine influenza season, there was a substantial uptick in SM reporting of various conspiracies about the flu virus, its alleged genetically engineered origins, and other unfounded rumors [151–153]. Thousands of user views of the questionable material were recorded by involved SM platforms, which was likely a significant underestimate [151–153], with literally thousands of other search results on the “swine flu epidemic” topic [154]. Similar sources of misinformation continue to be abundant despite their unfounded assumptions and obvious danger [155, 156]. For example, SM outlets are rich with unfounded speculation regarding the most recent coronavirus outbreak in Wuhan, China [157, 158]. Vijaykumar et al. [159] describe the so-called “social media virality risk,” which attempts to quantify the amplification of the population’s perception of public health risk in the overall context of “social media effectiveness.” Their conceptual model is called Risk Amplification through Media Spread (RAMS) [159].

Of critical importance, SM platforms may be preferred by individuals (or groups) who perceive the lack of other means to express their beliefs and thoughts. As such, SM can be thought of as “virtual aggregators” for people who share generally compatible and/or synergistic viewpoints [160–162]. Moreover, there is a non-trivial risk of evolution of such “virtual groups” beyond “online presence” [163]. Traditionally, unconventional or controversial beliefs tended to be often marginalized by the society, with relative lack of effective platforms to share thoughts and ideas [164–166]. In current times, essentially every idea can have an “online home” with SM actively facilitating the aggregation of like-minded people into groups [167, 168]. And although “virtual homes” can become hubs for creativity, innovative thinking, scientific discovery, understanding, diversity, and idea exploration, they can also be the sources of damaging misinformation. Finally, there is at least some evidence that SM may also create an avenue for people to explore different points of view, thus potentially providing an avenue for “new perspectives and open mindedness” [159, 169]. **Table 2** shows an overview of characteristics likely to be correlated with misinformation, with a focus on SM-related aspects.

Equipped with SM tools, “malignant actors” can develop a substantial potential for harm and otherwise destructive consequences. Thus, the malignant use of SM poses a risk to IHS. Beyond this, unimpeded access to Internet infrastructure, when “passively” permitted by countries/governments, can create conditions for the “malignant actor” or “fictitious public discourse” to lead to societal disruption and harm, involving both institutions and individuals [170, 171]. The subsequent sections will discuss malignant use cases where SM manipulation is centralized (e.g., government) versus decentralized (individuals, special interests, and non-governmental groups).

When centralized control of Internet infrastructure (e.g., government) is present, a narrative can in theory be created at the top echelons of power, and wide dissemination of messaging can be reasonably easily achieved. Under well-intended circumstances, this capability should be used to facilitate education and positive health behaviors. Having said that, if a central authority is the “bad actor” and their messaging is used to “manipulate” public discussions, the message may constitute an

| Factor | Comment |
|--|--|
| Anonymous authorship | Although some press/news releases may not give credit to specific author(s) or source(s), stories/information from anonymous sources (especially if impossible to independently verify) should prompt additional confirmation; this is especially true when making policies or implementing procedures based on such information |
| Attractive or “catchy” headline | A “catchy” headline tends to attract a larger number of viewers and may help enhance subsequent dissemination of (mis)information |
| Cult-like followership | Concepts that attract cult-like (often fanatical) followership tend to be more prone to aggregate “SM communities” around them. This, in turn, may assist in further propagation of biased/false information |
| Disclaimer regarding the information is provided alongside the content | In most cases, sources that feature a disclaimer should be considered with caution, mainly because disclaimers tend to be used in the setting of potential liability risk |
| Dramatic or otherwise emotional nature of the content | If the content contains dramatic or emotional language, and/or leads to a strong emotional response, it was most likely intended to do so. Oftentimes, hidden agenda(s) may be present |
| Forward-looking claims or predictive statements may be embedded | News content that provides specific claim of a future event is most likely unauthentic. Likewise, when faced with reports of an effective therapy, end-users should carefully seek verification and remain skeptical |
| Information superficially “appears” to be legitimate | When “crafted and disseminated” in a specific and deliberate fashion, wrong information may appear legitimate. Only after a more careful/detailed review, factual or logical inconsistencies may be found |
| Reputable source/origin of the information is claimed by authors | FN may gain more credibility if the source “appears” legitimate. Having said that, any significant claims from an apparently respected source must be substantiated and verified, especially if the story’s author is not clearly identifiable (see above under “anonymous authorship”) |
| Propagation by high-profile individuals | Superficial appearance of credibility can often be maintained around fictional story accounts, especially when reputable individuals (e.g., community leaders, politicians, scientists) participate in information dissemination |
| The story is too good to be true... | In cases where SM information appears to be “too good to be true,” the end-users should remain critical and question any such reports/stories |
| Unusual or atypical domain name/uniform resource locator (URL) | When content is located on a Website, or originates from a source with an unusual domain name, suspicious user identification, and/or URL, skepticism is always wise |

FN, fake news; SM, social media; URL, uniform resource locator.

Table 2. Factors that may signal that one is exposed to attempts at the dissemination of “fake news” and misinformation on social media platforms.

attempt to influence various policy objectives, such as a particular therapy, vaccine, or preventive health measure (s) [172, 173]. Corrupt central authorities may also manipulate SM messaging for monetary gain and/or political goals [174–176]. In this context, focused SM messages may involve falsified statements, manipulated statistics, and edited images. Such messaging can be directed at a particular target, including religious, ethnic, racial, political, and gender-specific or other groups [177–179].

When central control is not present, but laws and/or executive orders render SM fully unrestricted to all potential actors, then the so-called *peripheral control* can be attained [180–182]. Under such circumstances, individuals or interests can freely target selected individuals, groups, and organizations for manipulation via dissemination of false information via SM [183–186]. In the arena of *peripheral control*, third-party entities (e.g., interest groups) who wish to influence a particular policy

are able to use SM disguised as indigenous individuals or organizations, modulating the discourse to their benefit [187]. Inherent to modern capitalist societies is that major SM platforms are for-profit entities and thus can be maneuvered using financial resources to influence a society from the periphery [130, 188]. Finally, there is a less likely possibility that the more dominant SM platforms may evolve into new “central authorities” over time.

From public health standpoint, the potential for harm is both real and significant. Hypothetically, a broad range of harmful actions may be initiated using misguided SM, including the manipulation of populations to report to wrong/inappropriate locations for assistance [189, 190], misdirecting local populations with regard to the evacuation routes, sanctuaries/safe places, as well as creating public distress that leads to waste or misuse of precious public health resources [191–193]. Of importance, healthcare workers could theoretically be manipulated through SM platforms against accepting the risks associated with care for those in need, thus effectively negating a provider’s professional obligations [194, 195]. Although various conspiracy theories have been propagated throughout the history, their dissemination has escalated in the era of multiple SM platforms [196, 197]. As a result, the risk exists of an “engineered reality” by individuals or entities, using SM as the ultimate “mind bending” tool [198]. The theme of SM contributing to fear and misinformation or disinformation in the IHS context continues into the 2020s, with similar concerns being noted around the SARS-CoV-2 outbreak [199].

Finally, ongoing high-level efforts are underway to reduce the harm from SM-based disinformation at the national and international levels. More specifically, there is an increasing number of governmental and non-governmental organizations that actively focus on this important health security problem. This growing list includes the National Cyber Directorate in Israel, the National Security Communications Team (NSCT) in the United Kingdom, the Australian Security Intelligence Organization (ASIO) and the Department of Home Affairs in Australia, the Security Intelligence Service and the Defense Intelligence Service in Denmark, and the National Security Agency in France, among many others. In addition, major SM providers are signatories to the European Union (EU) Code of Practice on Disinformation. However, the same providers are not bound by this Code of Practice outside of the geographic boundaries of the Union [200].

7. Conclusions

Continuous worldwide information sharing fosters innovation and knowledge creation, thus facilitating humanity’s ongoing progress. The same is true regarding the implementation of SM tools in the area of public health/health security. Although there are undoubtedly important benefits of SM in this realm, the in-depth understanding of modern SM platforms is still somewhat limited. The introduction of SM into the domain of public health presented the community with a unique opportunity for the development of highly efficient, integrated tools for disease tracking and epidemiologic trend identification. At the same time, users must remain cautious because the potential for both intentional and unintentional misuse of data may be present, resulting in substantial and often unpredictable harm. Finally, malignant actors in control of the SM narrative can cause deliberate harm through the intentional propagation of “fake news” and misinformation. Consequently, risks and benefits associated with the use of SM in the realm of public health/IHS must be carefully considered to minimize any negative downstream consequences.

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