Fake News in Health and Medicine

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Abstract With the rise of social media, the world is faced with the challenge of increasing health-related fake news more than ever before. We are constantly flooded with health-related information through various online platforms, many of which turn out to be inaccurate and misleading. This chapter provides an overview of various health fake news and related studies which have been reported in various news articles and scientific journals. Some of the studies conducted on health misinformation identified a prominence of vaccine- and cancer-related fake news. The popularity of so-called unproven natural cures for cancer and other diseases is alarming. The chapter also highlights the importance of maintaining accurate and effective scientific communication in this COVID-19 pandemic-hit world to safeguard public health. The current pandemic has also proved fertile ground for spreading misinformation. The chapter brings the audience's attention to the consequences of health misinformation, ranging from giving false hope to patients to the hurdles it poses to effective medical care. Finally, the chapter addresses some of the possible strategies to keep health misinformation in check.

Keywords Health misinformation · Natural cures · Vaccine · Pandemic

> A lie can travel half way around the world while the truth is putting on its shoes.—Mark Twain

The earliest social media platform launched was SixDegrees in 1997 [1]. Since the launching of the modern social media app Friendster in 2002 and the many that followed, the twenty-first century has witnessed a social media boom, which includes famous platforms such as Facebook, Twitter, YouTube, and Instagram [1]. There are millions of people using these platforms, which has significantly changed the nature of human interactions and relationships. A parallel boom in the smartphone industry has enabled people to access these sites and information

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just at their fingertips. This digital empowerment has not only improved our lives in a multitude of ways but also paved the way for building several online communities that bring people from various fronts together. Now that the world is more connected than ever, individuals are able to share news and views, disseminate knowledge, exchange culture and experiences, market business, participate in games and entertainment, and also engage in dialogues with an unknown person on the other side of the globe.

The medium through which people access news has also changed significantly over these years. According to a Pew Research Center survey conducted in 2018, around two-thirds of US adults (68%) get news on social media sites, at least occasionally, with around 43% getting news from Facebook [2]. However, we often turn a blind eye to the elephant in the room that is "fake news". Social media sites are a major platform for fake news providers to increase the web traffic of such news. The magnitude of this was evident in the US presidential elections in 2016 where fake news stories from hoax sites and hyperpartisan blogs outperformed real ones from major news outlets on Facebook [3]. There was also a preponderance of pro-Trump (anti-Clinton) fake news over pro-Clinton (anti-Trump) fake news, with 115 pro-Trump fake stories shared on Facebook a total of 30 million times and 41 pro-Clinton fake stories shared a total of 7.6 million times [4]. Reports show that people aged 65 and older tend to share fake news on social media more than younger people, as in the case of the 2016 presidential elections [5]. Another report by the Stanford History Education Group in 2019 provided evidence that high school students had difficulty discerning fact from fiction online, reiterating the importance of promoting digital media literacy among these students [6] who would be future voters in a few years.

Accurate and effective scientific communication is imperative to keep the public informed about the latest scientific developments and empower them to fully benefit from these advancements. Social media has facilitated the health industry in reaching out to the public by providing platforms to share health information, build patient-to-patient support networks, and allow the public to provide useful information and feedback. However, we are living in an era of information overload with a million websites on health issues, inaccurate scientific reporting, and health misinformation. Though health misinformation has always existed, with the surge in social media use, dissemination of fake news related to health and medicine is on an ever-alarming rise than ever before. Such fake news spreads like wildfire in our hyperconnected world, reaching a wide audience. Without proper third-party filtering, fact-checking, or editorial reviews, false information circulated through social media can cause confusion and mislead the audience. The sad truth is that an individual with no proven medical/scientific background can sometimes reach more readers than a credible news channel or journal. With the global media operating 24 h/day and with the increasing demand for news, even some trusted media outlets have misreported scientific facts (Blue Latitude Health). In order to safeguard public health and people's trust in the health industry in general, discriminating between scientifically proven facts and fake news has become the need of the hour.

There are different types of fake news. One such is inadvertent reporting of mistakes that occur due to errors and gaps in the editorial process. Rumours turning

into fake news form the second category. Conspiracy theories are the third type, which are typically created by people who believe them to be true, and are difficult to verify as true or false. Fourth, fake news can also originate from satire that is likely misconstrued as factual. Fifth, false statements by pharmaceutical companies or medical professionals for making profits also contribute to fake news. The last category is the most problematic, where reports are not outright false but are slanted to mislead the public [7]. Fake news related to health is mostly associated with vaccines, cancer cures, conspiracy theories, and the recent COVID-19 pandemic. A number of studies conducted across the world have shed some light onto the landscape of fake health news stories. Some of these studies and interesting fake news articles are discussed in this chapter.

1 Polish Health Misinformation Study

A pilot study conducted by the Medical University of Gdansk sought to measure the extent of health misinformation stories shared on Polish language social media [8]. This study assessed the top shared health web links between 2012 and 2017 employing the BuzzSumo application, using keywords related to the most common diseases and causes of death. Surprisingly, 40% of the most frequently shared links fell into the category of fake news which was shared more than 450,000 times. It also found that the majority of these were vaccine related. This study came to the conclusion that analysing top shared news in social media could help in identifying medical misinformation.

2 Stanford University Study: Cannabis, a Cure for Cancer

Another study conducted by Stanford University researchers evaluated the growing online interest in using cannabis to cure cancer [9]. By employing the Google Trends' relative search volume (RSV) tool, they compared the online search activity over time (from January 2011 through July 2018) for "cannabis and cancer" versus standard cancer therapies. They arrived at some interesting results and conclusions. Whereas the RSV of "cannabis and cancer" queries increased nearly twofold, the RSV for "standard cancer therapy" queries changed only a little over the duration. The rate of increase in RSV of "cannabis and cancer" queries was ten times faster than that of standard cancer therapies' queries. Cannabis legalisation also had an impact on RSV growth, with higher growth in states where medical or recreational cannabis was legalised before 2011. Using the BuzzSumo social media analyser, they found that 51 of 136 high-impact news stories (37.5%) referencing "cancer cure/therapy/treatment" were the ones claiming a cancer cure with alternative treatments, of which 12 (23.5%) proposed cannabis as a cancer cure. It is disheartening that the top fake news proposing cannabis as a cancer cure

generated 4.26 million engagements, whereas top accurate news stories discrediting this false news generated 0.036 million engagements. This again reminds me of the famous quote by Mark Twain. This study also highlights the importance of physicians and cancer organisations clarifying such misinformation.

3 NBC News Study

NBC News conducted an analysis in 2019 following the same methodology used in the previous two studies [10]. Using the BuzzSumo tool, they searched for keywords related to common diseases and causes of death in the USA. They also extended the search criteria to include topics often targeted by misinformation campaigns such as vaccines, fluoride, and natural cures. Articles with more than 25,000 engagements were considered for the study, with 80 articles in the final study. They found that articles on cancer, unproven cures, and vaccines were the most circulated health misinformation. On specified topics like cancer and fluoride, fake news dominated the overall news. Some of the most shared fake news articles are detailed below.

(a) "Big Pharma" *hiding cure for cancer*: The cancer-related article of highest engagement in 2019 pushed a medical conspiracy that "Big Pharma", consisting of a group of doctors and federal health organisations, is hiding a cure for cancer. The article, "Cancer industry not looking for a cure; they're too busy making money", gathered 5.4 million engagements on Natural News, a website owned and operated by Mike Adams, a dietary supplement purveyor who goes by the moniker "The Health Ranger". Facebook facilitated the highest engagement for the article where Natural News had nearly three million followers until it was banned later.

(b) *Natural cures for cancer and other diseases:* Cancer was the most popular topic of health misinformation, marijuana being one of the most popular alleged cures. Ranking among the top engaged articles were those advocating a fear of processed foods and a change to so-called natural cures without evidence. One article that titled "Scientists Warn People to Stop Eating Instant Noodles Due to Cancer and Stroke Risks" garnered 300,000 engagements. Another article that generated over 800,000 engagements claimed that "Ginger is 10,000x more effective at killing cancer than chemo". Other natural products which were falsely claimed to be cures for cancer, diabetes, asthma, and the flu included papaya leaf juice, elderberry, dates, thyme, garlic, jasmine, limes, okra, and other herbs, vegetables, and exotic fruits.

(c) *Vaccine, the villain:* Vaccines are one of the greatest discoveries in the medical field and provide a safe and effective means to fight and eradicate infectious diseases. Though limitations to their effectiveness exist, there are some well-funded anti-vaccination activists who actively work to promote the false claim that vaccines cause harm and death. This analysis revealed the identity of the most popular anti-vaccine news creators of 2019: Adams' Natural News; Children's Health Defense, an organisation led by the anti-vaccine activist

Robert Kennedy Jr.; and Stop Mandatory Vaccination, a website led by the self-described social media activist Larry Cook. Such anti-vaccine news was received well, with over a million engagements. Many of these articles that posit vaccines to be dangerous for children and pregnant women often misinterpret research and even claim vaccines to be the cause of death in some babies [10]. Another article highlighted by NBC News discussed how anti-vaxxers target women who have lost babies unexpectedly to death and turn them into crusaders against vaccines [11].

4 Dandelion, the Magical Weed

Dandelion weed was yet another popular alleged cure for cancer and an immunity booster, which was claimed to work better than chemotherapy [12]. According to CBC News, a 72-year-old leukaemia patient's cancer went into remission 4 months after he had dandelion root tea [13]. The article with the headline "Dandelion weed can boost your immune system and cure cancer" received more than 1.4 million shares, likes, and comments, according to two separate web analysis tools [7]. Although dandelion extracts have been shown to suppress different types of cancer cell proliferation in vitro [14, 15], there is no clinical evidence so far to support its miraculous properties in curing cancer or boosting immunity.

5 Polarised Facts

Polarised facts which are often heard in a political context are not entirely foreign to the medical field. A study by Hofmann sought to investigate how polarised research, where researchers hold radically opposite views on the same issue, produces polarised facts [16]. Using mammography screening for breast cancer as an example, a widely debated topic, he demonstrated a strong polarisation of the results. The biggest advantage of the screening is reduced breast cancer mortality, while the major disadvantage is overdiagnosis and overtreatment. Hence, overdiagnosis to mortality reduction ratio (OMRR) is an estimate of the risk-benefit ratio for mammography screening. Some researchers are proponents of high reduction in mortality and low rate of overdiagnosis with screening, while others claim mortality reduction to be moderate and overdiagnosis high. Analysing 8 published studies on OMRR revealed a huge difference among the ratios, up to 25-fold, from 0.4 to 10. Interestingly, a strong correlation existed between the OMRR and the authors' attitudes to screening ($R = 0.9$). This analysis sheds some light on how strong professional interests can polarise research and potentially influence important health policy decisions and therefore proposes that researchers disclose professional interests along with financial interests when submitting research articles.

6 Fake News During the Pandemic

Health agencies have the added responsibility of managing misinformation during a health crisis like a pandemic. It is important that health agencies and related organisations are equipped with a social media management plan to counter misinformation during crises. Two great examples are the 2014 Ebola crisis and the current COVID-19 crisis.

(a) Ebola
During the 2014 Ebola crisis, there was a constant stream of inaccurate claims circulating through social media. After the first patient was diagnosed in the USA, the number of virus-related tweets per minute skyrocketed. People continued tweeting and spreading fear despite the fact that all the potential cases tested came out negative in Newark, Miami Beach, and Washington, DC. A statement was issued by the Department of Public Health in Iowa dispelling social media rumours that Ebola had arrived in the state. In order to curb the spread of misinformation, the Centers for Disease Control and Prevention (CDC) sent out constant updates on Ebola on its website and social media accounts. The CDC swung into action fairly quickly by sending a tweet illustrating how people can and cannot contract the virus within less than 3 h after confirming the Ebola case in Dallas. This was retweeted more than 4000 times. The CDC's "Facts About Ebola" image was tweeted by another account with one million followers and was retweeted almost 12,000 times, spreading the message much further than it did through the original CDC tweet. The CDC also hosted a Twitter chat answering questions about Ebola. All these measures helped to spread the right information to people in a timely manner and stem fearmongering on the web to some extent [17].

(b) COVID-19
An excellent example of fake news in the medical/health field is the current COVID-19 pandemic that has forced many countries into lockdown to prevent further spread. On a daily basis, we read and hear many claims related to the pandemic through various social media platforms, many of which are not true. Many of us tend to believe these without verifying their authenticity and participate in propagating this false information. As rightly said, a little knowledge is a dangerous thing. Ali Therani, founder of Astroscreen, a London-based start-up which uses artificial intelligence to seek out disinformation on social media, says that coronavirus fake news does not appear to be a targeted campaign; instead people spread fake cures or conspiracy theories themselves [18].

There are many conspiracy theories on the origin and spread of the virus. One such conspiracy theory claims that 5G masts are the true cause of the coronavirus outbreak. Unfortunately, celebrities with huge followings were also part of spreading the story. NHS England's national medical director Stephen Powis dismissed the claims as "rubbish" and the worst kind of fake news. To make matters worse, a 5G mast was set on fire in Birmingham, UK, on 3 April 2020 in a suspected arson attack, after the technology was linked online to the spread of coronavirus [19]. Many other theories regarding the virus' origin have

been circulating on social media. Some of them claim that it was conceived as a bioweapon, while others believe it was accidently released from a lab in Wuhan, the city where the coronavirus outbreak was first detected [20]. Despite rampant speculation, however, currently there is no evidence to prove either of these claims. A statement released by the US national intelligence director's office on 30 April 2020 dismissed the claims of its origin as a bioweapon. It also said the intelligence community is rigorously examining "whether the outbreak began through contact with infected animals or if it was the result of an accident at a laboratory in Wuhan" [20]. Moreover, a study of the coronavirus genome published in March 2020 in *Nature Medicine* from Scripps Research in California concluded that SARS-CoV-2 is not a laboratory construct or a purposefully manipulated virus. Instead, they proposed two plausible modes of origin: natural selection in an animal host before zoonotic transfer and natural selection in humans following zoonotic transfer [21]. Other baseless claims include that coronavirus was sent to Wuhan by a Canadian-Chinese spy team and that it might have originated in the USA and been brought to Wuhan by the US Army [22].

News about unproven cures for COVID-19 has been rampant on social media since the beginning of the pandemic. Unfortunately, in Iran, over 700 people died from ingesting toxic methanol following the spread of rumours that it helps cure the coronavirus [23]. In India, a cow urine drinking party of around 200 people was conducted by a Hindu group (Akhil Bharat Hindu Mahasabha) based on the belief that it would ward off the deadly virus [24]. Developed nations are also not immune to receiving such misinformation. US president Donald Trump, during the White House coronavirus task force briefing, suggested scientists explore the possibility of injecting bleach to treat COVID-19. Thankfully, a prompt response was given by medical doctors and disinfectant firms warning people about the danger of ingesting or injecting disinfectants [25]. During the initial stage of the pandemic, Trump also touted the malaria medication hydroxychloroquine as a possible treatment for coronavirus, although the claims had no adequate clinical backing. Hospital admissions from hydroxychloroquine poisoning have been reported in different parts of the world [26]. All this false information comes as a real blow to the tremendous efforts made by scientists and healthcare professionals around the world to tackle the pandemic.

Facebook-owned WhatsApp is a popular messaging service, where multiple groups can be created, and is yet another major platform for spreading misinformation. Since the pandemic started tightening its grip on the world, I have been receiving a constant flow of messages in different WhatsApp groups, on topics varying from home remedies to prevention of COVID-19 and videos from people including doctors and nurses from pandemic-affected and other countries and snapshots of NHS messages (in a UK WhatsApp group) and news updates. Some of the fake health messages which I have received through WhatsApp are shown in Fig. 1. One of the messages recommends eating alkaline foods as a way to beat the coronavirus. I received the same message in different WhatsApp groups. Though lemon, due to its citric acid content, has a pH around 2.2, the picture claims its pH to

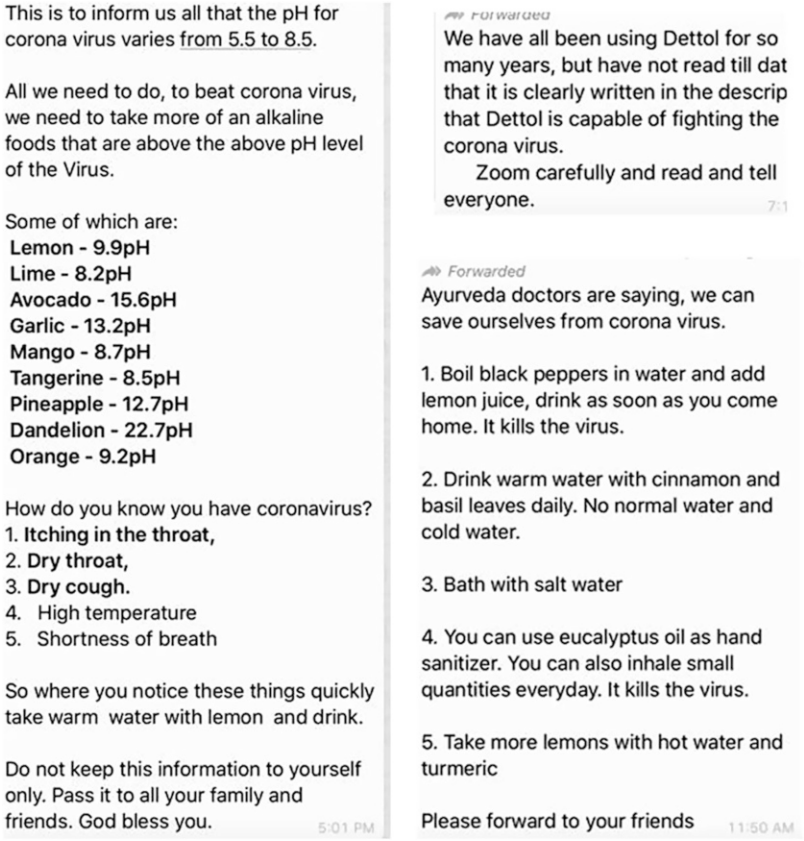

Fig. 1 Sample of COVID-19 fake news

be 9.9 and claims dandelion has an extremely high pH of 22.7. It's a known fact that all the food we ingest, despite its pH, is exposed to the strongly acidic gastric fluid in the stomach. Being a respiratory virus, linking the coronavirus's viability to the pH of food is quite illogical as well as scientifically unproven. In an effort to prevent the public from falling for such a hoax, the World Health Organization (WHO) has an official page called Mythbusters with a brief description and pictorial representation of myths and facts. The National Health Service (NHS) is also constantly updating their websites regarding the latest information on COVID-19.

7 Consequences of Health Misinformation

Health misinformation has a huge impact on society. According to a study by leading health economists from Kingston University, London, more than 60% of online fake news about healthcare issues is considered not credible. More

importantly, people's trust in fake news seems to increase with increased exposure. In other words, repetition counts: "the more someone sees something, the more they believe it" [27]. This study also revealed that warnings about potentially inaccurate information had a limited impact on users' behaviour in terms of believing or sharing information. An article by David N Rapp discusses how reading inaccurate information is likely to influence subsequent decision-making processes, even when a person is better informed. This is explained as a predictable consequence of the routine cognitive processes [28].

One of the most vulnerable groups affected by fake news is those patients who suffer a debilitating condition and seek quick relief. Dr. Shilpi Agarwal, a board-certified family medicine physician in the Washington, DC, area, pointed out that "False medical information and news makes patients scared unnecessarily and can often delay necessary medical care and attention" [29]. Fake news misleads many patients to pursue unproven cures for life-threatening diseases, disregarding the approved medical treatments. This makes the doctor's job harder, and the patient may also develop trust issues with the doctor. "We often spend a good amount of a medical visit correcting misinformation and re-educating the patient", says Agarwal. Health misinformation about vaccines is a major threat to global health, as it can lead to lower vaccination levels below herd immunity and put minors at risk.

Giving false hope to patients is a major consequence of health misinformation. A perfect example is an article published in the *Telegraph* entitled "Gene editing could end HIV, scientists hope, after second patient is 'cured' using rare mutation" [30]. The title somewhat misleads the reader to assume that some sort of gene editing was used to cure HIV. However, the main content of the article talks about using stem cell transplantation from a donor with a mutation in an HIV co-receptor CCR5 gene to cure the disease, and gene editing is proposed only as a possibility in the future. For an undiscerning public, especially those living with HIV and requiring a lifetime of medication, such headlines could lead to false expectations, which have to be then managed by healthcare professionals. Loss of valuable time for health professionals is another undesired outcome.

"Misinformation is being weaponised against vulnerable communities in a particular place at a particular time", says Dr. Shakuntala Banaji, Professor of Media, Culture, and Social Change at the London School of Economics (LSE). For instance, in 2018 an explosion of misinformation on WhatsApp about child kidnappers fuelled gruesome mob violence in an Indian village. Similarly, misinformation about coronavirus is promoting violent reactions across the world, from abuse levelled at Asian Americans in the USA to blaming Muslims for the virus in India [18].

Incidents like the 5G mast being set on fire following linking of the baseless conspiracy theory to the pandemic is yet another example of a dangerous act instigated by misinformation.

8 Managing Health Misinformation

It's a tough battle ahead to manage and reduce misinformation in health care. Social media platforms, healthcare providers, scientists, and the public all need to work hand in hand to fight this fake news pandemic which has crippled the virtual world. An article by Brady et al. discusses the grounds for propagation of misinformation from a physician's perspective. The article indicates that whereas a large proportion of misinformation can be traced back to computer-generated "bots" (automated programs designed to perform a specific task), credible sources like medical professionals have also contributed to spreading misinformation [31]. The article cautions medical authors about using online "quick shots", such as the visual abstract often used in journals now which can potentially cause oversimplification and omission of small but critical details of a medical study, which can therefore lead to misrepresentation by readers. Given that this new format is more Twitter-friendly than the traditional abstract, there is a risk of spreading inaccurate information. Another point raised was the existence of non-overlapping "social media bubbles" of physicians and patients, with the physicians probably unaware of the false information exposed by the patients. The article also highlights the importance of a greater presence of physicians on social media platforms to combat the spread of misinformation by actively engaging in discussions, critically evaluating posted information, and extending their social media bubble to include patients. It's reassuring to see that the WHO has an online page called Mythbusters, with a brief description and pictorial representation of various myths and facts, in order to prevent the public from falling for the common fake news related to COVID-19. The National Health Service (NHS) is also constantly updating their websites regarding the latest information on COVID-19.

As readers, we have a great deal of responsibility to filter the kind of information we receive, apply caution, and handle the information diligently. One way to do that is to seek information from reliable sources like the NHS or Cancer Research UK for information related to cancer or the British Heart Foundation for a new heart disease study. Instead of simply sharing Facebook news, retweeting, or forwarding a WhatsApp message, it's advisable to take time to verify if the content is worth sharing. If the authenticity cannot be verified by one's limited medical background, it may be better not to share such information. If you are a patient, it's advisable to talk to your doctor about a new treatment or drug that has captured your attention. It's always better to get information from multiple reliable sources and apply one's own logical reasoning to it, rather than just seeing and believing. According to an article published in the journal *Science*, one explanation for the faster and broader reach of falsity over truth is that false rumours are significantly more novel than the truth across all novelty metrics [32]. Hence readers have to be wary of the sensational headlines of many fake news stories that grab their attention. Promoting media literacy in schools would be an important step to prepare teenagers who may have difficulty discerning facts from fiction online.

Social media platforms have also taken measures to curb the spread of misinformation around coronavirus. On WhatsApp, one is now only able to send frequently forwarded messages in a single chat at a time. This has brought down message forwarding by 70%. Meanwhile, the Google-owned platform YouTube is removing anything that contradicts advice from the WHO, while Facebook users who have read, watched, or shared false information about the virus will now receive a pop-up alert urging them to visit the WHO's website. Facebook, which was heavily criticised following the 2016 elections, has now partnered with third-party fact-checkers to rate and review the content on the platform. Together, technology and human experience combined with media literacy will be instrumental in combating the issue.

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