



The biggest pandemic risk? Viral misinformation

A century after the world's worst flu epidemic, rapid spread of misinformation is undermining trust in vaccines crucial to public health, warns Heidi Larson.

A hundred years ago this month, the death rate from the 1918 influenza was at its peak. An estimated 500 million people were infected over the course of the pandemic; between 50 million and 100 million died, around 3% of the global population at the time.

A century on, advances in vaccines have made massive outbreaks of flu — and measles, rubella, diphtheria and polio — rare. But people still discount their risks of disease. Few realize that flu and its complications caused an estimated 80,000 deaths in the United States alone this past winter, mainly in the elderly and infirm. Of the 183 children whose deaths were confirmed as flu-related, 80% had not been vaccinated that season, according to the US Centers for Disease Control and Prevention.

I predict that the next major outbreak — whether of a highly fatal strain of influenza or something else — will not be due to a lack of preventive technologies. Instead, emotional contagion, digitally enabled, could erode trust in vaccines so much as to render them moot. The deluge of conflicting information, misinformation and manipulated information on social media should be recognized as a global public-health threat.

So, what is to be done? The Vaccine Confidence Project, which I direct, works to detect early signals of rumours and scares about vaccines, and so to address them before they snowball. The international team comprises experts in anthropology, epidemiology, statistics, political science and more. We monitor news and social media, and we survey attitudes. We have also developed a Vaccine Confidence Index, similar to a consumer-confidence index, to track attitudes.

Emotions around vaccines are volatile, making vigilance and monitoring crucial for effective public outreach. In 2016, our project identified Europe as the region with the highest scepticism around vaccine safety (H. J. Larson *et al.* *EBio-Medicine* **12**, 295–301; 2016). The European Union commissioned us to re-run the survey this summer; results will be released this month. In the Philippines, confidence in vaccine safety dropped from 82% in 2015 to 21% in 2018 (H. J. Larson *et al.* *Hum. Vaccines Immunother.* <https://doi.org/10.1080/21645515.2018.1522468>; 2018), after legitimate concerns arose about new dengue vaccines. Immunization rates for established vaccines for tetanus, polio, tetanus and more also plummeted.

We have found that it is useful to categorize misinformation into several levels. Among the most damaging is bad science: people with medical credentials stoking overblown or unfounded fears. The canonical example is the 1998 publication by infamous former physician Andrew Wakefield purporting to show a link between autism and the measles, mumps and rubella (MMR) vaccine. Despite having his licence revoked and his work retracted, Wakefield persists in campaigning against the vaccine. Expert consensus alleges that his efforts have contributed to persistent vaccine anxieties and refusals, including a 2017 measles outbreak in Minnesota. Had Wakefield been

disciplined and his article retracted 12 months after publication rather than 12 years, we might not be remarking that this year marks the twentieth anniversary of its publication.

The second-most-dangerous category includes those who see anti-vaccine debates as a financial opportunity for selling books, services, or other products. (Wakefield, who maintains that financial concerns have not affected his research and that he has been unfairly vilified, gave paid testimony against the vaccine and filed a patent that allegedly stood to become more valuable were the vaccine to be discredited.)

The next tier of damaging misinformation comes from those who see anti-vaccine debates as a political opportunity, a wedge with which to polarize society. Multiple reports this year found that Russian trolls and bots used emotional, angry language to spread misinformation and exacerbate the divisions between those for and against vaccines (see D. A. Broniatowski *et al.* *Am. J. Pub. Health* **108**, 1378–1384; 2018).

Next are 'super-spreaders', who propagate misinformation through social media to like-minded vaccine-questioners. A common claim is that suspected adverse reactions to vaccines (typically coincidences) are confirmed reactions. Finally, there is misunderstood or inadequate information that might be circulating generally.

Targeted social media can combat misinformation. Both Denmark and Ireland faced groups broadcasting testimonies on social media and television news of young girls alleged to have been harmed by human papillomavirus (HPV) vaccination. In Denmark, national immunization rates fell from over 90% in 2000 to under 20% in 2005.

In response, Danish public-health officials emphasized the risk of disease, and promoted stories of people who had lost wives and mothers to cervical cancer. They also created a Facebook page for answering parents' questions. Ireland's social-media efforts used similar tactics to rebuild HPV-vaccine confidence; numbers for 2018 show an increase of 6% for vaccine uptake from 2017.

No single strategy works for all types of misinformation, particularly among those who are already sceptical. Educational materials and resources are important, but limited; health officials and educational campaigns often fall short because they craft messages based on what they want to promote, without addressing existing perceptions. Dialogue matters. Strategies must include listening and engagement.

We have to get better at this: if a strain as deadly as the 1918 influenza emerges and people's hesitancy to get vaccinated remains at the level it is today, a debilitating and fatal disease will spread. ■

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