

Digital Interventions to Combat Vaccine Hesitancy

Learning Objectives

- Identify prominent digital interventions to combat vaccine misperceptions, increase knowledge, decrease vaccine hesitancy, and increase vaccine uptake
- Learn “Swiss cheese” model of combining different digital interventions to combat vaccine misinformation and promote vaccine confidence
- Apply learnings to activity where you develop a digital intervention strategy for a vaccine

Review: Misinformation and Vaccine Skeptical Content on Social Media

Social media use is **associated** with vaccine hesitancy

Vaccine skeptical content is prevalent on social media and can be both **outright false** or **gray area** misinformation

Content on social media can spread through **subscriptions, networks, and algorithms**

Vaccine skeptical content can be promoted by social media and elude platform moderation

What types of digital interventions are people familiar with?

- Discuss in pairs
- Write on Post - It

Which digital interventions **limit the spread of vaccine-skeptical content** on social media and **improve vaccine confidence and uptake?**

Model of Exposure -> Behavior

On Platform

Exposure



Belief

"This would be important for my followers to know"

Sharing



On Platform

Off Platform

Exposure

Sharing

Belief

Behavior

Behavioral Intentions



"Vaccines are dangerous"

"I shouldn't get a vaccine"

On Platform

Off Platform

Exposure

Behavior

Belief

Sharing

Behavioral
Intentions



"Vaccines are effective"

"I should get a vaccine"

Categorize your interventions

- Place your Post-It on the category you think it fits best

Which digital intervention is best?

- Debunking
- Prebunking
- Platform Moderation
- Friction and accuracy nudges
- Informational campaigns
- Chatbots and AI Assistants
- ... and more!



Which interventions are effective depends on...

- What is the **target outcome** of a campaign?
- What is the current information **status quo**?
- What is the potential **impact** of the rumor on vaccine demand, if people were to believe it?
- How **widespread** is the rumor?
- **Which platforms** is information spreading on, and what moderation options do they have?
- How **scalable** is the intervention?

Activity Introduction (after the break)

- You will split up into groups and design a **digital intervention campaign** focusing on a chosen context
- Deliverables: **5 minute slide presentation**
- We will go over some common interventions, but please do research as well!
- You will choose a scenario with your group, and determine what the key populations, channels, and outcomes are

Prebunking and Debunking

Target: Belief

Prebunking & Debunking

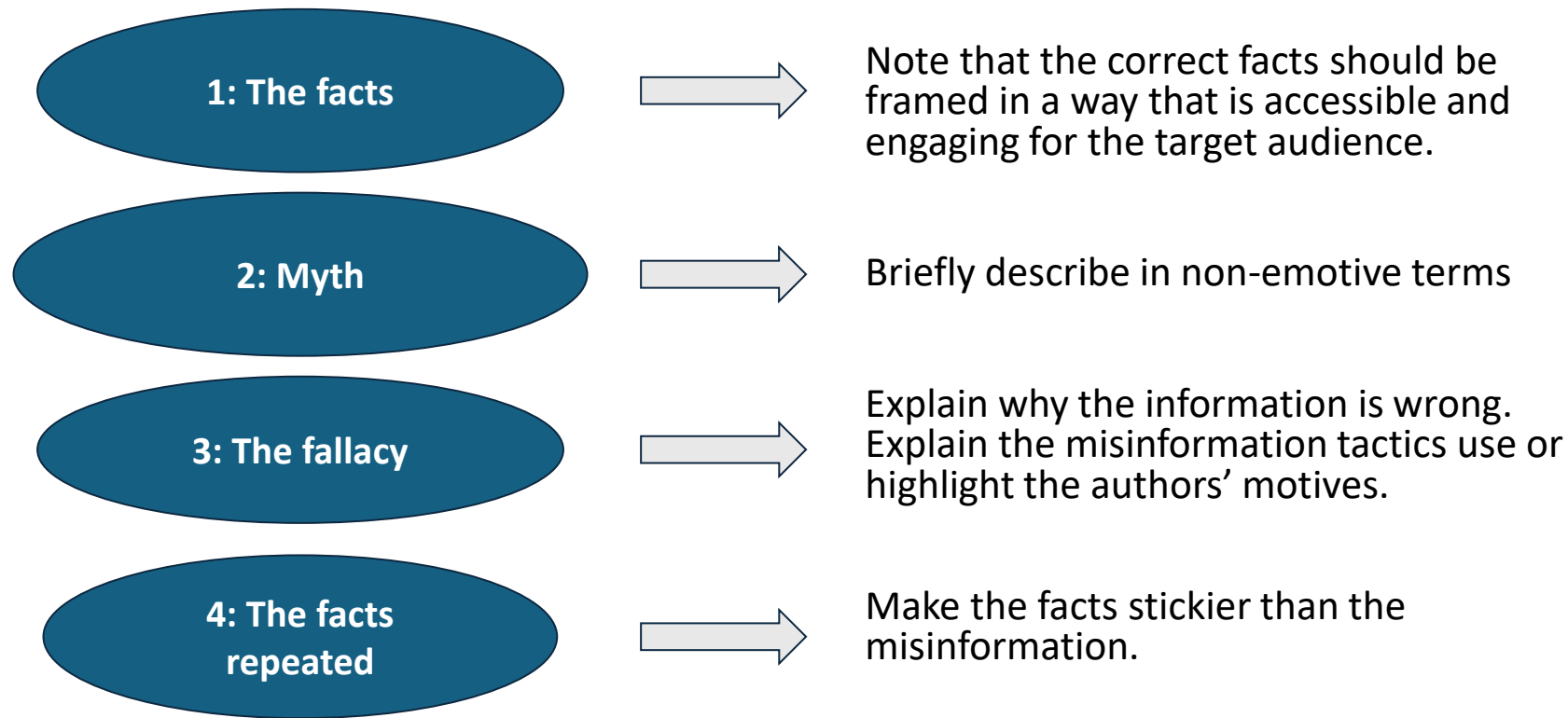
- **Prebunking:** a process of addressing misinformation before it strikes
- **Debunking:** the 'post-exposure' correction of misinformation through the provision of evidence-based counterarguments

Corrections and Debunking

- Corrections have **consistently shown** to reduce belief in misinformation (Schmid & Betsch, 2019; Porter & Wood, 2019; Wood & Porter, 2019)
- The **Backfire Effect**— the fear that exposure to correction will increase belief in the original misinformation is **rare at best** and **should not prevent correction** (Nyhan & Reifler (2010); Wood & Porter, 2019)
- The **Continued Influence Effect** – the continued reliance on inaccurate information in people’s memory after correction – is a concern (Johnson & Seifert, 1994)
- Targeting corrections is challenging – the majority people who seek out untrustworthy content visit no fact-checking sites (Nyhan Reifler, 2024)

Target: Belief

Debunking Best Practices



The Debunking Handbook, 2020

Target: Belief

Example 1: Debunking “HPV Vaccine causes injury”

- Fact

- Large scale studies find no link between the HPV vaccine and auto-immune symptoms. All the scientific evidence tells us HPV vaccines are safe and effective

- Myth

- One common vaccine myth is that they cause negative health impacts. The evidence cited is often specific examples where a child received a vaccination then suffered adverse health impacts afterwards

- Fallacy

- Anecdotes like this mistake correlation for causation. Just because a vaccination and an injury happen close to each other doesn't mean one causes the other. This logic is the same as thinking that wearing lucky colors at a sports game led to your team winning. This argument also employs anecdotal thinking, relying on isolated examples rather scientific evidence. While stories can be persuasive, they can also mislead if a single experience is not representative of the general populace

- Fact Repeated.

- This is why scientists look at large samples rather than single cases before coming to conclusions.

Prebunking

Prebunking often includes two elements:

1. A **warning** that there is an impending threat
2. A **preemptive refutation** of the arguments used in the misinformation.

Types of prebunking

- Fact-based
- Logic-based
- Source-based

Logic-Based methods have been widely touted due to their scalability (Traberg et al, 2022), although their efficacy has come under question (Pennycook et al, 2024; Williams, 2023)

Example: VAERS database

You may see posts citing deaths or injuries reported to the Vaccine Adverse Event Reporting System (VAERS) database after COVID vaccination.

VAERS is an open database **anyone** can submit to, and a report only means something happened after a shot — not that the shot caused it. Reports are **unverified** by design; the system exists to flag patterns for investigation, not to establish cause. Posts that present raw VAERS counts as conclusive evidence are misusing a tool that was never meant to be read in this way.

Target: Belief

What's wrong with this example?

Misinformation is everywhere on social media. Be skeptical of everything you read.

Article [Open access](#) Published 10 June 2024

Prominent misinformation interventions reduce misperceptions but increase scepticism

Emma Hogg , Brian Aitken, Jiewen Zhang, Tomasz Gackowski & Magdalena Woremszak

Nature Human Behaviour 8, 1545–1553 (2024) | [Cite this article](#)

 [Save article](#)

29k Accesses | 92 Citations | 246 Altmetric | [Metrics](#)

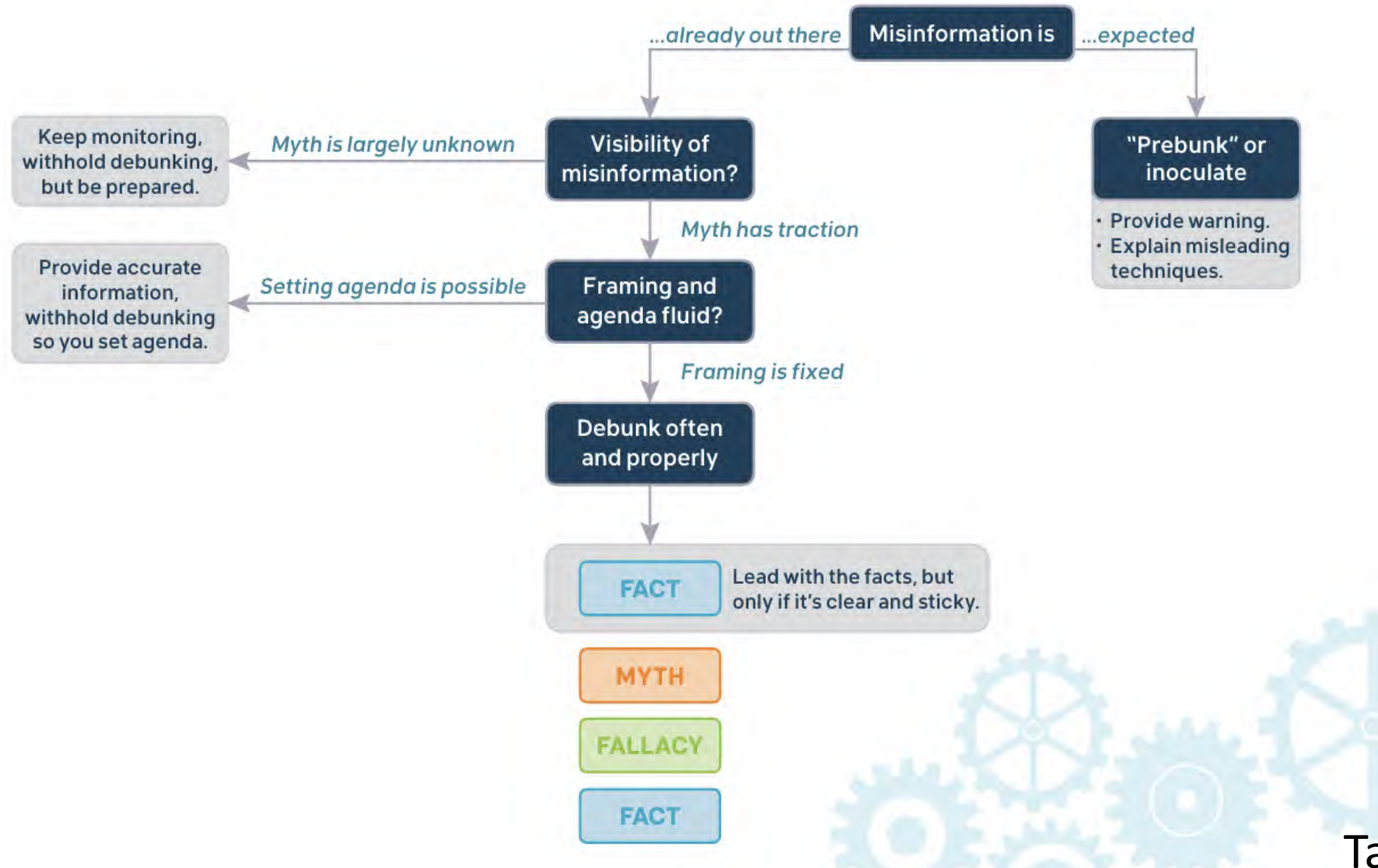
 An [Author Correction](#) to this article was published on 19 July 2024

 This article has been updated

Abstract

Current interventions to combat misinformation, including fact-checking, media literacy tips and media coverage of misinformation, may have unintended consequences for democracy. We propose that these interventions may increase scepticism towards all information, including accurate information. Across three online survey experiments in three diverse countries (the United States, Poland and Hong Kong; total $n = 6,127$), we tested the negative spillover effects of existing strategies and compared them with three alternative interventions against misinformation. We examined how exposure to fact-checking, media literacy tips and media coverage of misinformation affects individuals' perception of both factual and false information, as well as their trust in key democratic institutions. Our results show that while all interventions successfully reduce belief in false information, they also negatively impact the credibility of factual information. This highlights the need for further improved strategies that minimize the harms and maximize the benefits of interventions against misinformation.

When to deploy?



Target: Belief

Think-Pair-Share

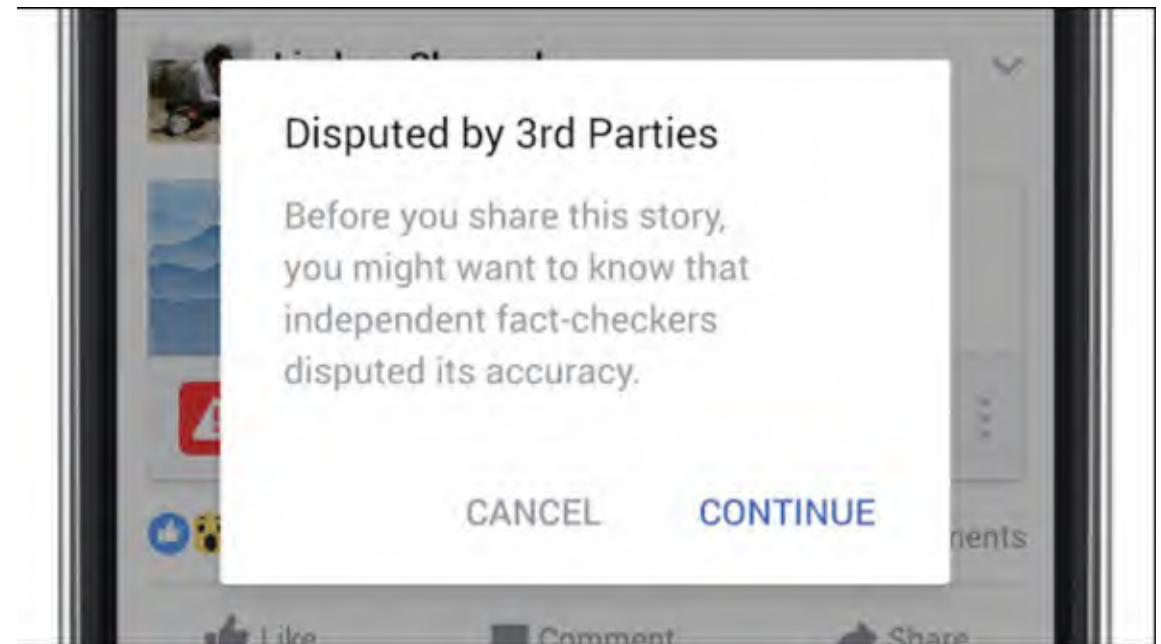
- Think (2 minutes)
 - Think of of an example of **1 scenario** that would require a debunk and **1 scenario** that would require a prebunk
- Pair (4 minutes)
 - Share your scenarios with the person sitting next to you
 - Pick one of the scenarios and write a prebunk or debunk using best practices
- Share (4 minutes)
 - Share your scenario and example with the room

Warning Labels

Target: Belief & Sharing

Warning Labels

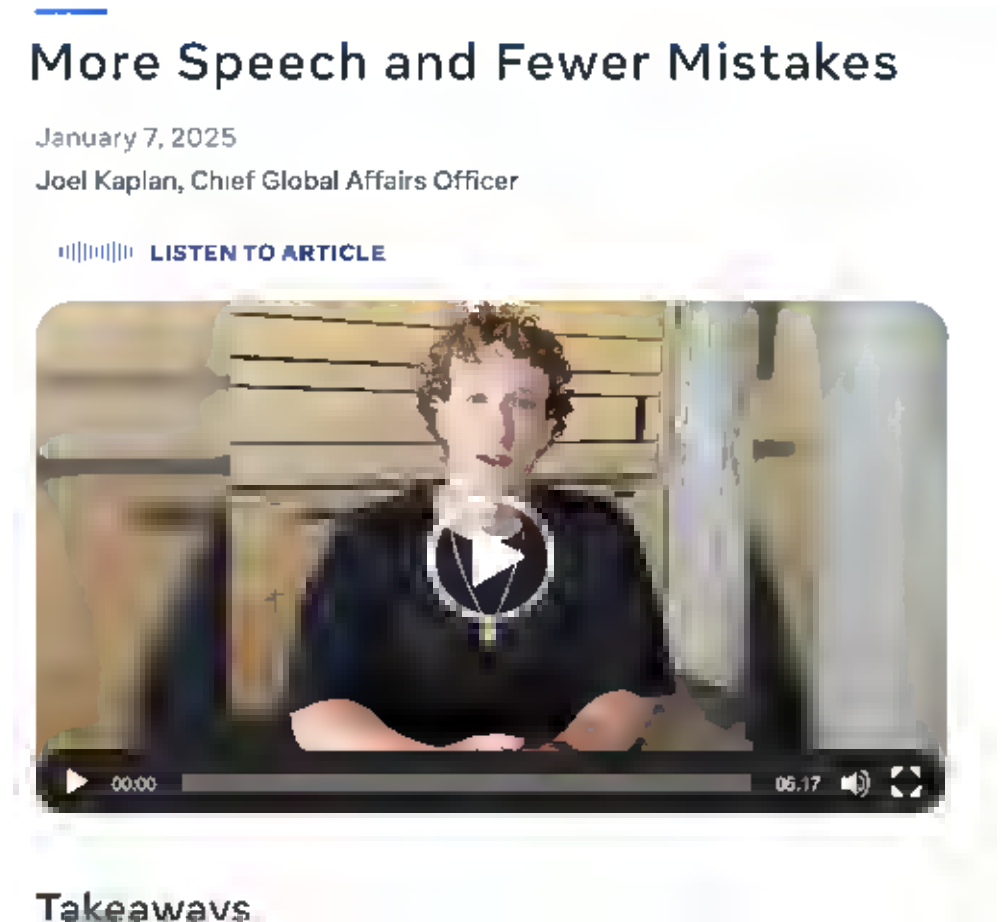
- Generally effective at reducing belief and sharing of misinformation (for a review - Martel & Rand, 2023)
- Present correction **concurrently** rather than before or after
- Effect sizes are minimal (e.g. 8-10% reduction in exposure)
- Language, timing, size, source, coverage all affect efficacy



Target: Belief & Sharing

Experts and professional fact-checkers

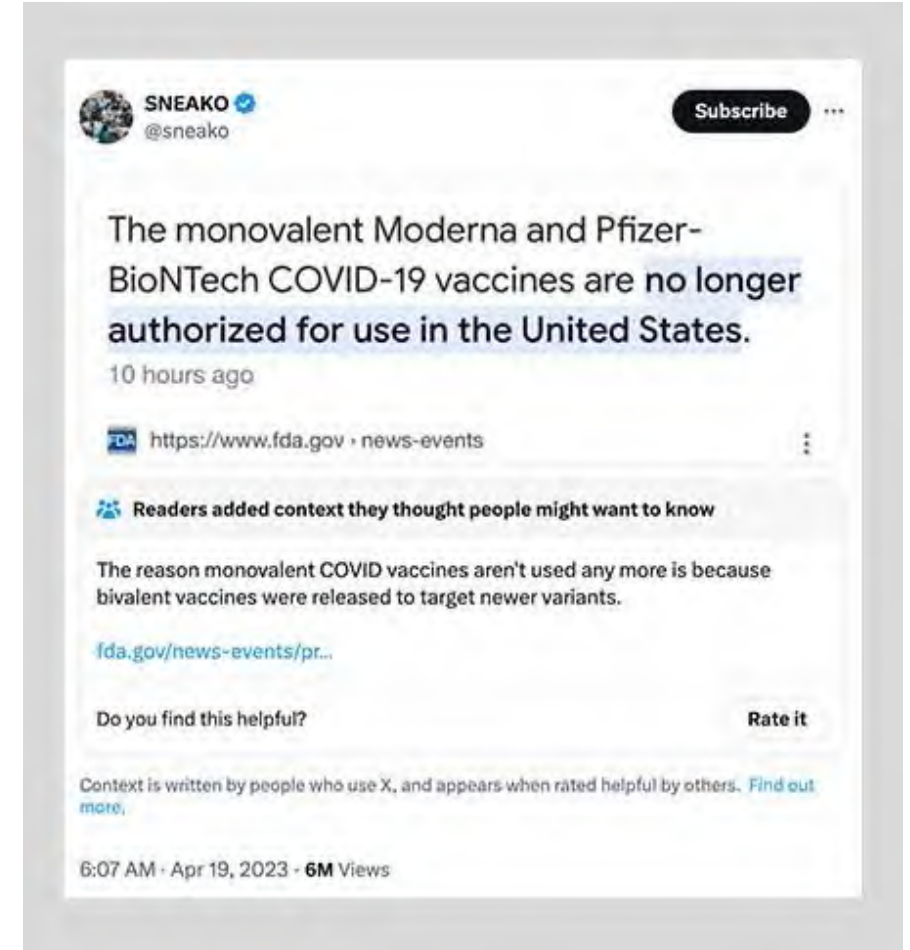
- Experts are most **trusted** source of corrections (Martel et al, 2023)
- But, **difficult to scale** on social media
- Politically **controversial**



Target: Belief & Sharing

Crowdsourced Fact-Checking

- Work has shown that **crowdsourced fact-checking is accurate** (Allen, J. et al, 2021; Martel et al, 2023; Allen, J. et al, 2024; Allen, M. et al, 2024)
- Reduces **engagement and diffusion** of misinformation (Slaughter et al, 2025) although timing was critical → earlier notes reduced viral diffusion



Target: Belief & Sharing

Community Notes

- Used by X, Meta, Google
- People in community can submit “contextual notes” – not fact checks -- to content
- Must contain **source link**
- Only notes that are upvoted by **diverse perspectives** are surfaced
- Most notes are about politics, notes about vaccines have been shown to be accurate (Allen, M. et al, 2024)



Target: Belief & Sharing



SNEAKO 
@sneako

Subscribe



The monovalent Moderna and Pfizer-BioNTech COVID-19 vaccines are no longer authorized for use in the United States.

10 hours ago



<https://www.fda.gov/news-events>



Readers added context they thought people might want to know

The reason monovalent COVID vaccines aren't used any more is because bivalent vaccines were released to target newer variants.

[fda.gov/news-events/pr...](https://www.fda.gov/news-events/pr...)

Do you find this helpful?

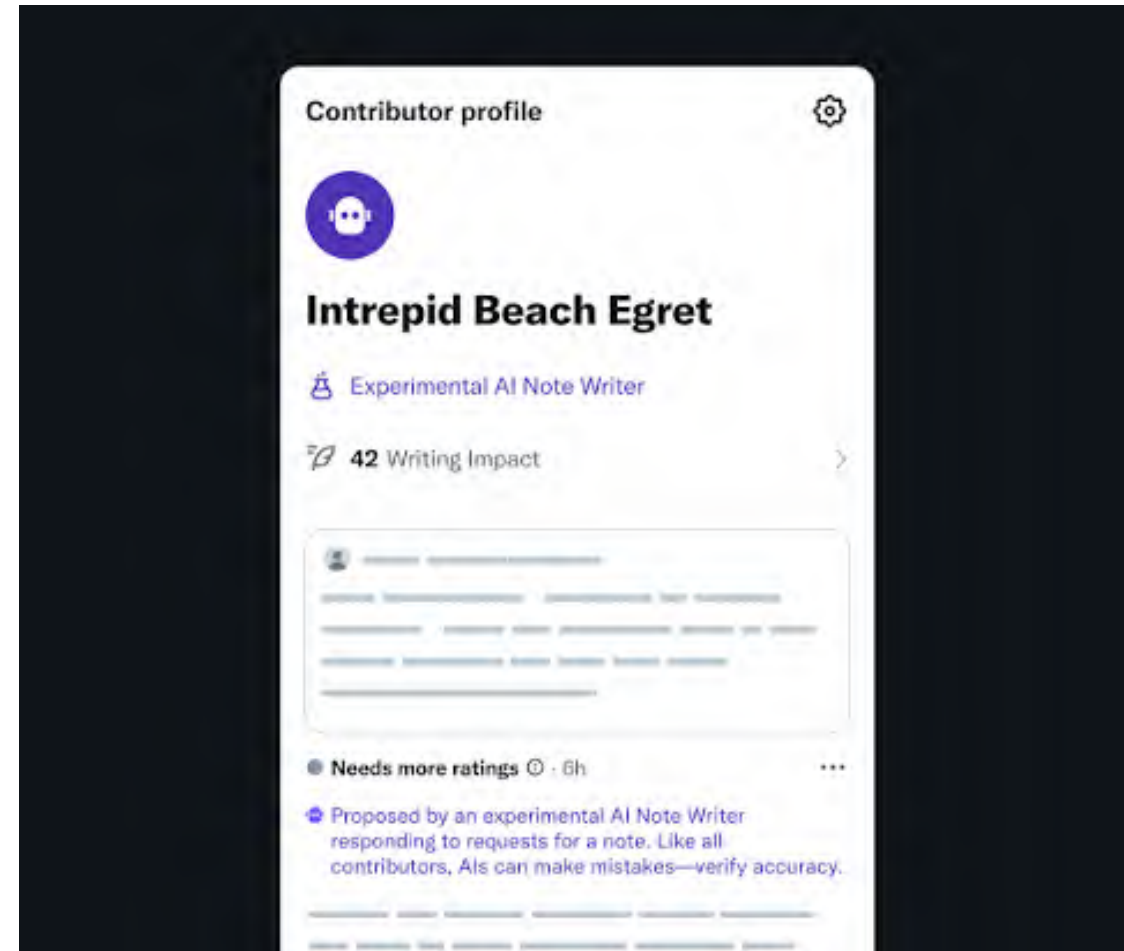
Rate it

Context is written by people who use X, and appears when rated helpful by others. [Find out more.](#)

6:07 AM · Apr 19, 2023 · **6M** Views

AI Notes and Corrections

- Twitter/X have recently rolled out AI-written notes
- An analysis of bot fact-checks finds that bots are moderately accurate, although unclear if this extends to vaccines (Renault et al, 2026)
- Open area of study – How accurate? How trusted?



Target: Belief & Sharing

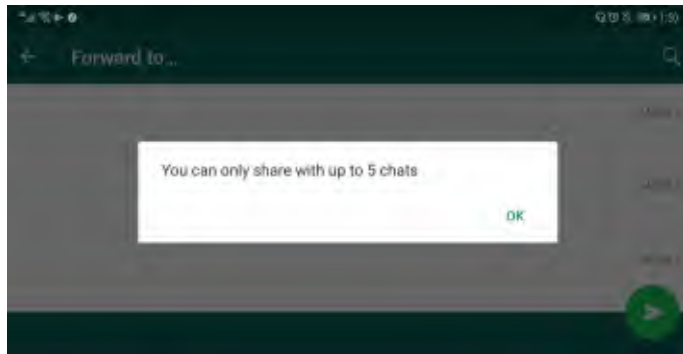
Think-Pair-Share

- Think (2 mins)
 - List the pros and cons of AI / bot corrections
- Pair (4 mins)
 - Discuss list with partner
 - How can we design bots to be more effective?
- Share (4 mins)
 - Group discussion

Friction + Platform Solutions

Target: Exposure & Sharing

Review: Platform Actions



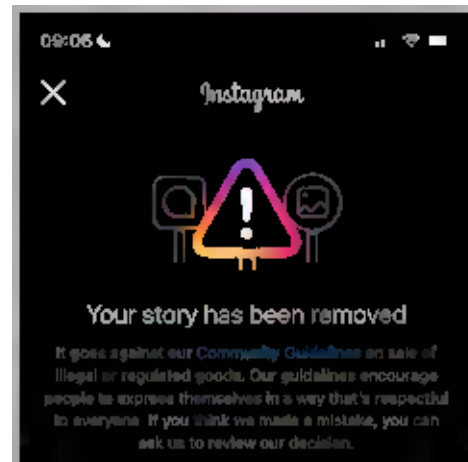
Friction “circuit breaker”



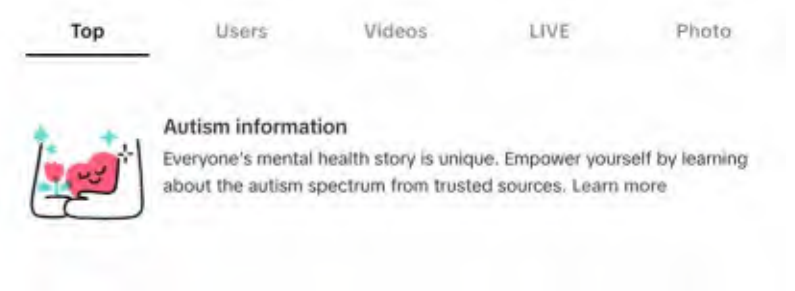
Algorithmic Demotion



Account Banning



Content removal



Content promotion

Accuracy Prompts

- Prompting people to think about accuracy **increases sharing discernment**
- Can be deployed effectively via ads or by platform (Lin et al, 2024)
- Intervention is **scalable**
- Limitation: effects are **small** and **transient**



Target: Exposure & Sharing

Informational Campaigns

Target: Knowledge, Intentions, Behavior

Behavioral Nudges

- Several megastudies have different behavioral nudges – delivered via text or WhatsApp -- to encourage flu vaccination (Milkman et al, 2024, Milkman et al, 2021; Dai et al, 2021)
- **Default plan** or **ownership** was most effective – more effective than social norms, protecting loved ones, jokes, misinformation resources (although all worked)
- Addressing hesitancy in addition to behavioral nudge had **no additional effect**

Text 1 (sent on 9/25/2020)

WalmartRx - Hi John! It's flu season & you can get a flu shot at Walmart. To help you remember, you'll receive another text in a few days. Flu vaccines prevent getting or spreading the flu.
INFO = info, STOP = opt out.

Text 2 (sent on 9/28/2020)

WalmartRx - Remember a flu shot is waiting for you at Walmart.

Target: Behavior



Data-driven social media campaign



- Co-produced, data-driven social media campaign to raise awareness of continued importance of routine childhood immunisation during and after the COVID-19 pandemic.
- The campaign formed part of a broader initiative to strengthen the capacity of key stakeholders in the Europe and Central Asia region to design, implement and evaluate social media interventions to promote vaccine uptake

PHASED APPROACH FROM STRATEGY TO ACTIVATION*

PHASE 1 INSIGHT DEVELOPMENT	PHASE 2 MESSAGING APPROACH	PHASE 3 CAMPAIGN TOOLKIT & SOCIAL MEDIA CONTENT PLAN	PHASE 4 LOCAL ADAPTATION
Gather insight for primary audience via country workshop	- Review & feed back on key message document - Review and feedback on creative campaign narrative - Guidance documents provided	Materials development: - Campaign outline - Social media content plan - Measurement framework - Evaluation report template - Campaign toolkit - Social listening guidance	Activation at local level (2w) - Testing and optimization of live campaigns (ongoing) - Reporting & evaluation (1w)

Social listening analysis

- Social listening analysis demonstrated a **lack of conversations about childhood immunization online**, with conversations heavily dominated by COVID-19 vaccines. Further literature research aligned with these findings.
- Campaign's objectives
 - To encourage online conversations on routine immunization
 - To convince parents and caregivers whose children are of routine immunization age, that vaccination is well worth serious consideration, despite their personal concerns; and
 - To clarify misunderstanding about vaccine safety and efficacy.

Countries of study

Identified personas that work across all countries included:

- Albania
- Armenia
- Bosnia and Herzegovina (BaH)
- France
- Georgia
- Kazakhstan
- Kosovo
- Kyrgyzstan
- Moldova
- Montenegro
- North Macedonia
- Romania
- Serbia
- Tajikistan
- Turkey
- Uzbekistan

IDENTIFYING DIGITAL PERSONAS

Data sources

To build personas we reviewed data from two main sources:

1. Digital 'Audiense' dashboards segmenting audiences based on immunization related content.
2. Social Media Conversations and Attitudes in Europe and Central Asia Towards Immunization.

Methodology

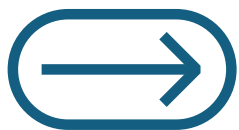
- Literature review of existing research into routine & COVID-19 immunization hesitancy.
- Review of Audiense's automated audience profiling for each country, including personality, socio-economic measures, demographics, influencers & brands, interests, media affinity
- Segmentation of Audiense's profiling into four prevalent and distinct personas.
- Collation of feedback from workshop with country teams to update and finalize personas and ensure their resonance.

CONSIDERATIONS

Recommend local country teams to overlay their knowledge of local landscape to build out personas and make as locally relevant as possible.

Digital behaviours skew heavily towards COVID-19 related information. Further insight on attitudes towards routine immunizations would help to develop personas further.

The personas should be treated as directional rather than conclusive, and used as inspiration to guide the development of the campaign without restricting local knowledge or process.



POST 1

Recommended post

Routine childhood vaccinations aren't just about doing what is best for your child now, but for their whole life. A life that won't be interrupted by disease or the long-lasting impact of a childhood spent battling preventable illnesses. Do the best for your child.

Alternative posts

- As parents, we know to treasure every last minute of our little ones' earliest years. In the last 60 seconds, routine childhood vaccines have saved five more lives. Five children spared from life-threatening diseases, able to grow up healthy. Spare a minute to protect your child.
- The world can seem a scary place when you're a parent. Diseases like measles are life-threatening, but easily preventable by routine childhood vaccines. Give yourself peace of mind, and keep your child protected from the dangers you cannot see.

Hashtags

#EverywhereYouCantBe #KeepingKidsProtected #ParentalPeaceOfMind

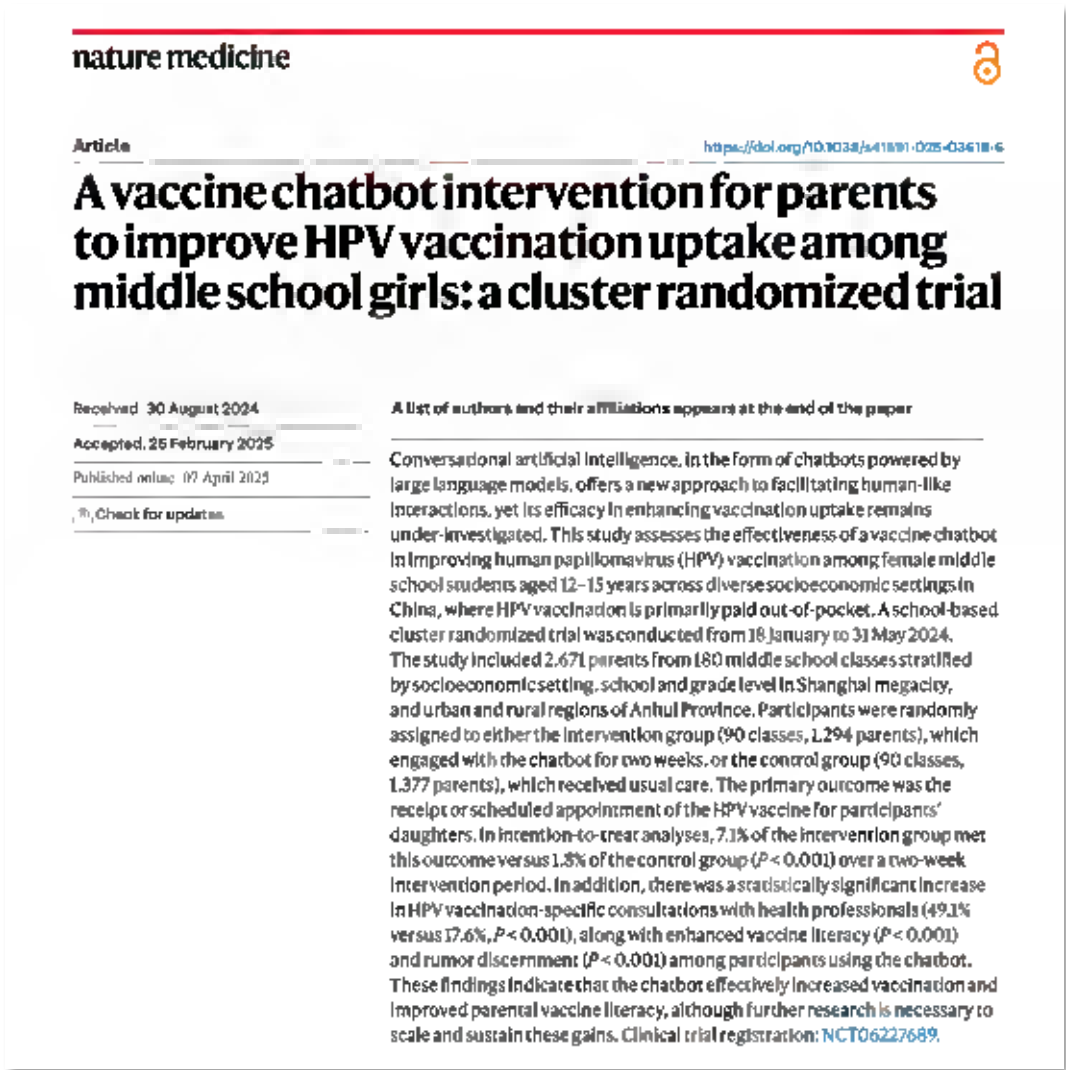


GIF animation

Chatbots + AI Assistants

Target: Knowledge, Intentions, Behavior

LLM-powered HPV vaccine chatbot for improving vaccine uptake in China



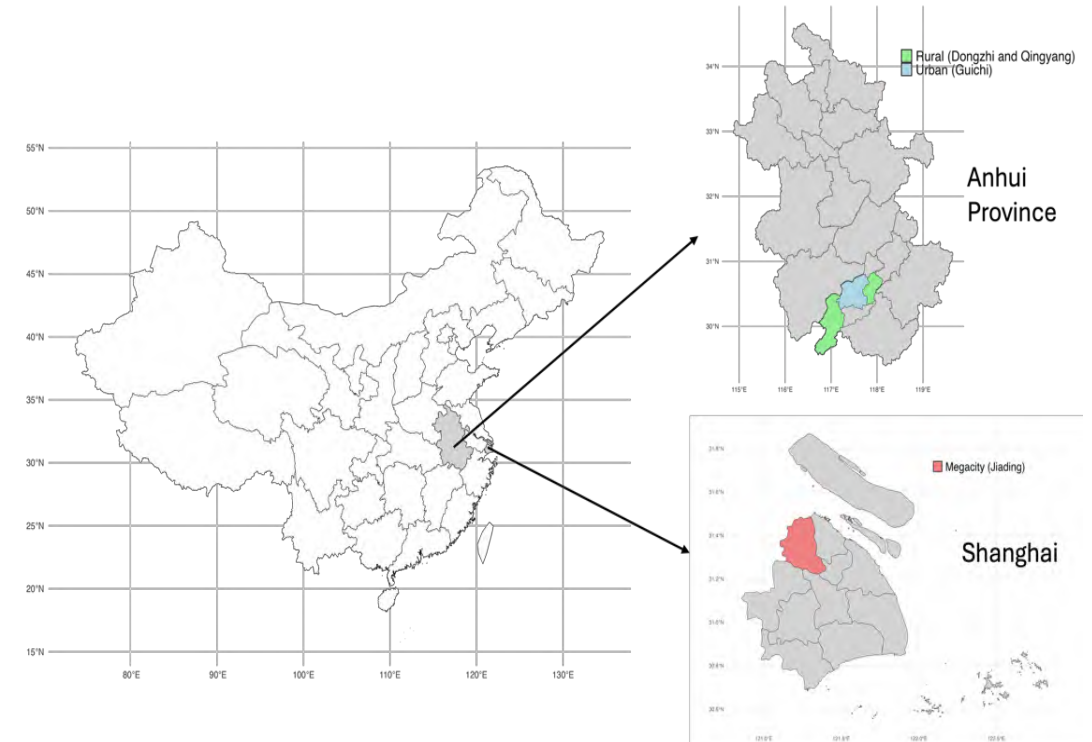
Aim: To assess the effectiveness of a vaccine chatbot in improving HPV uptake among female middle school students aged 12-15 years across diverse socioeconomic settings in China

Design: A school-based cluster randomized trial was conducted from January to May 2024.



HPV Vaccination in China

- China accounts for 20% and 16% of global cervical cancer cases and deaths, and vaccination coverage is critically low (10.15%).
- HPV vaccination is not included in the national immunization program. Despite affordable domestically produced vaccines, most Chinese pay out-of-pocket, leading to low uptake, especially among adolescents before sexual activity.
- Parental hesitancy, driven by low HPV knowledge, safety concerns, and cultural norms, hampers vaccination efforts, with only around 61% of parents willing to vaccinate children.
- Pilot programs for government-funded vaccination exist, but improving awareness, trust, and access—particularly in rural areas—is essential to meet WHO targets.



Participants

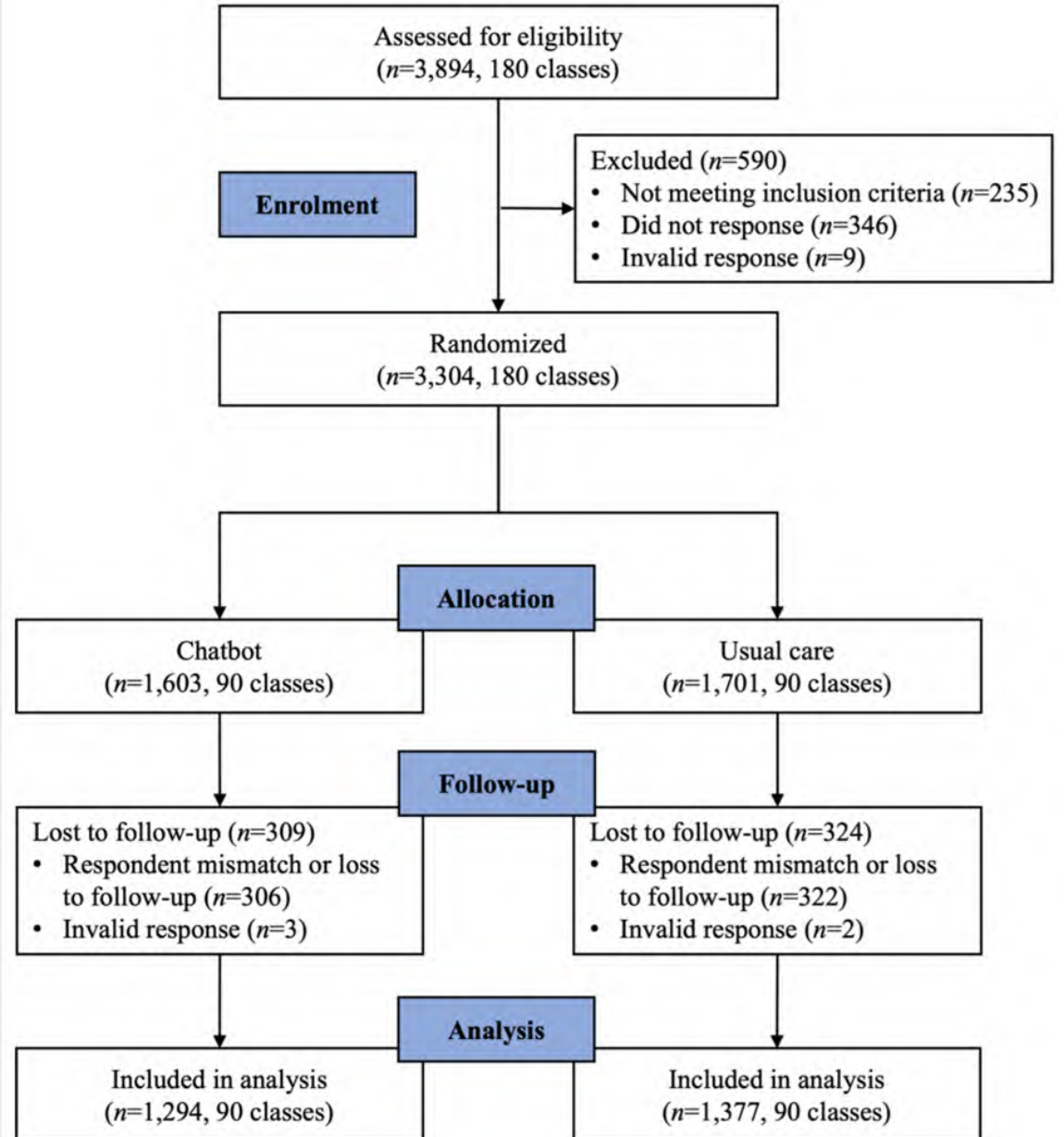
2,671 parents from 180 middle school classes stratified by socioeconomic setting, school and grade level in Shanghai megacity, and urban and rural regions of Anhui Province.

Intervention

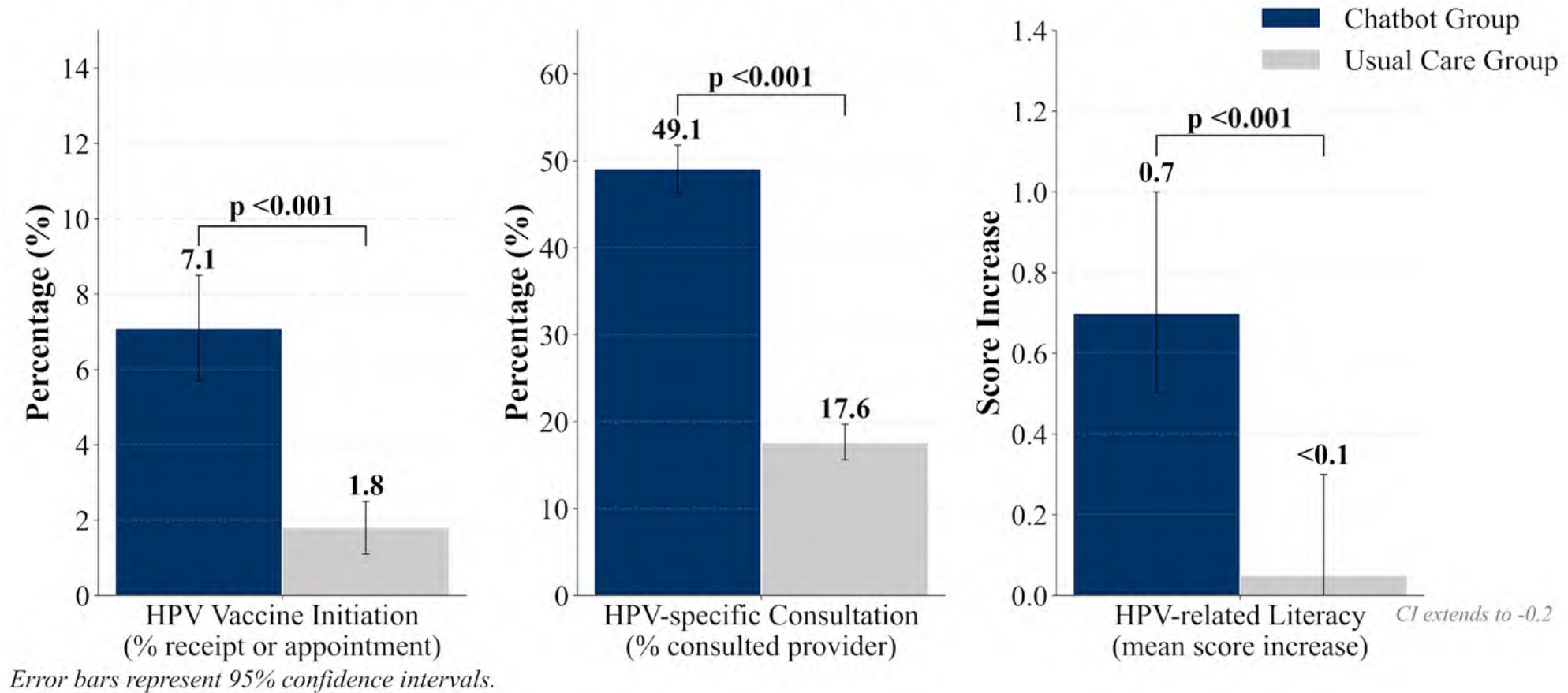
Engagement with the chatbot for two weeks, with the control group receiving usual care.

Primary outcome

Receipt or scheduled appointment of the HPV vaccine for participants' daughters within 2 weeks after enrollment.

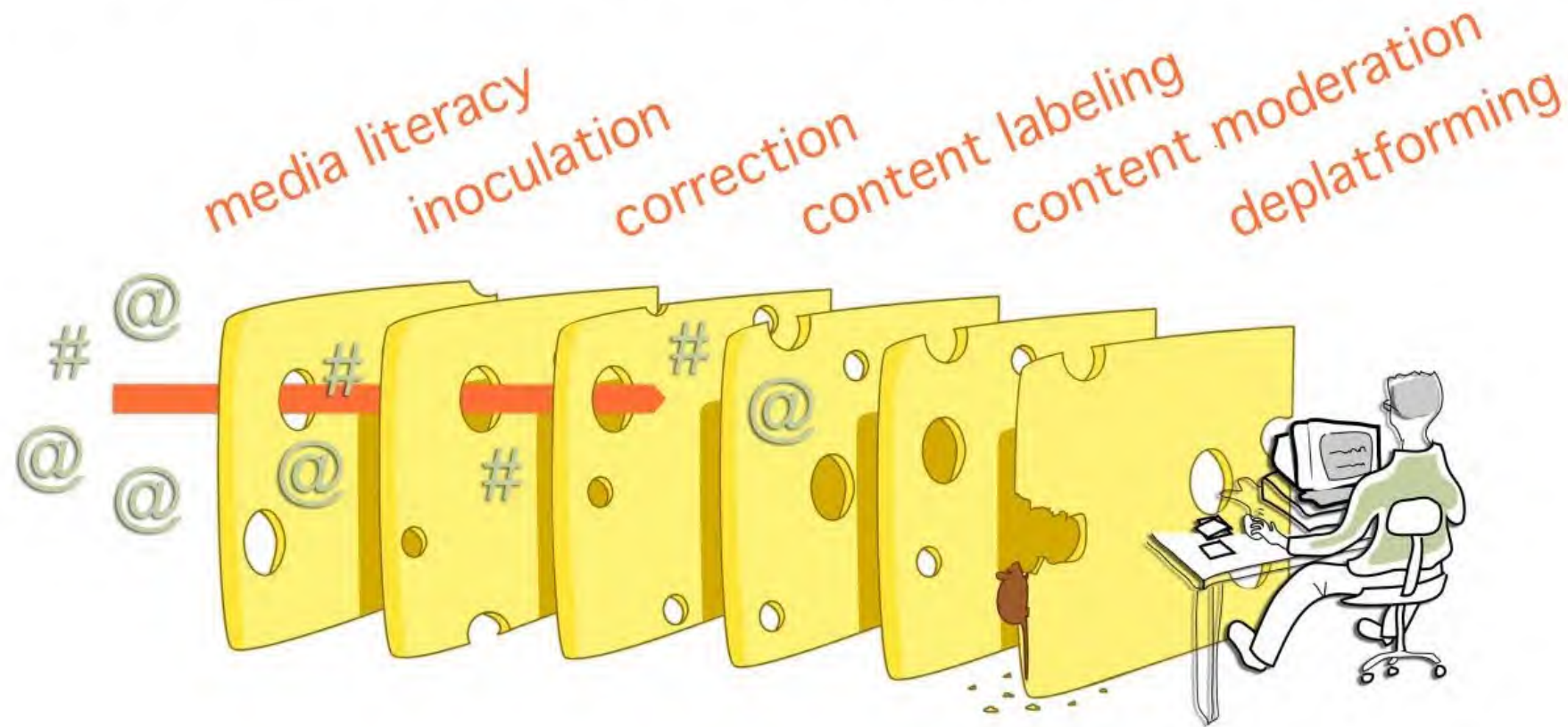


AI Chatbot Significantly Boosts HPV Vaccination, Consultation & Literacy



The chatbot effectively increased vaccine uptake and improved parental vaccine literacy, especially in rural areas where healthcare resources are more limited. Further research is necessary to scale and sustain these gains.

The Swiss Cheese Model of Mitigating Online Misinformation



Bode & Vraga, 2021

Article | [Open access](#) | Published: 23 June 2022

Combining interventions to reduce the spread of viral misinformation

[Joseph B. Bak-Coleman](#) , [Ian Kennedy](#), [Morgan Wack](#), [Andrew Beers](#), [Joseph S. Schafer](#), [Emma S. Spiro](#), [Kate Starbird](#) & [Jevin D. West](#)

Nature Human Behaviour **6**, 1372–1380 (2022) | [Cite this article](#)

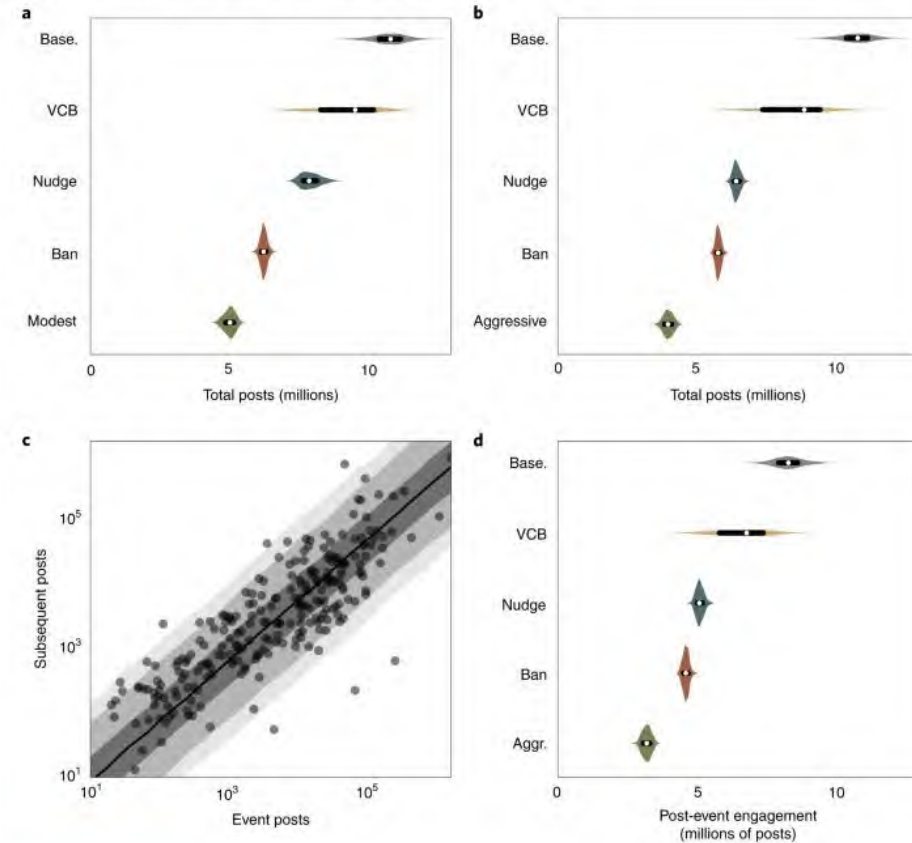
 [Save article](#)

36k Accesses | 147 Citations | 386 Altmetric | [Metrics](#)

Abstract

Misinformation online poses a range of threats, from subverting democratic processes to undermining public health measures. Proposed solutions range from encouraging more selective sharing by individuals to removing false content and accounts that create or promote it. Here we provide a framework to evaluate interventions aimed at reducing viral misinformation online both in isolation and when used in combination. We begin by deriving a generative model of viral misinformation spread, inspired by research on infectious disease. By applying this model to a large corpus (10.5 million tweets) of misinformation events that occurred during the 2020 US election, we reveal that commonly proposed interventions are unlikely to be effective in isolation. However, our framework demonstrates that a combined approach can achieve a substantial reduction in the prevalence of misinformation. Our results highlight a practical path forward as misinformation online continues to threaten vaccination efforts, equity and democratic processes around the globe.

Fig. 4: Simulated impact of combining interventions.



Interventions in **isolation** are **ineffective**, but the **combination of interventions** can be effective at slowing the impact of misinformation and increasing vaccine confidence

Break

Activity

- We will split up into groups of 5
- You are an advisor at a public health organization
- Each group will pick a different context (we will give some examples, but you can pick new one that you are most familiar with)
- Each group design an intervention (e.g. debunking; chatbot; accuracy prompt) or combination of interventions from earlier
- Deliverable: **5 minute slide presentation**
 - What the context is
 - What the intervention(s) are
 - How you will measure success

Example

Country	Vaccine / problem	Platform ecosystem
Mainland China	HPV uptake among young women	Xiaohongshu, WeChat, Weibo. State-mandated moderation; no researcher data access
Hong Kong	Childhood vaccination	WhatsApp, Facebook, YouTube; strong local news sector; bilingual
United Kingdom	Low RSV vaccination update in pregnant women	TikTok, X, Reddit. Online Safety Act in force
United States	Measles outbreak in an under-vaccinated community	Facebook, X. No third-party fact-checking; Community Notes only

What to cover

- The context
 - Who is the target audience?
 - What vaccine is covered?
 - What platforms and channels will be targeted?
 - What rumors are circulating, or might emerge?
- The intervention (e.g. debunking; chatbot; accuracy prompt) and aims
 - What outcome are you targeting? E.g. sharing, knowledge, intentions, behavior?
- The messenger: who delivers it, and why they are credible to this audience