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REVIEW ARTICLE

Correction of Short-Video Health Misinformation under Visual Manipulation: A Discussion Based on an Online Experiment

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Abstract

Objective: To establish how visual manipulation of short videos shapes users' perception of the credibility of health misinformation, and which correction strategies reduce that credibility. **Methods:** A 2 (prior intervention: digital health literacy vs. control) × 2 (visual manipulation: expert cues vs. none) × 3 (real-time correction: social correction, algorithmic correction, control) online experiment was conducted. A total of 511 participants were recruited through the Credamo platform and 417 valid responses were retained. **Results:** Visual manipulation produced a significant difference in credibility perception; health short videos carrying expert visual cues were judged more credible, but did not attract greater engagement. Both algorithmic and social correction lowered the credibility of the misinformation. Algorithmic correction was more effective under non-expert visual cues, whereas social correction was more effective under expert visual cues. Exposure to a digital health-literacy intervention alone had no effect on credibility judgements, but the interaction between that intervention and real-time correction was an effective route to reducing misperception. **Conclusions:** Correction of short-video health misinformation must be matched to the visual framing of the content, and prior literacy intervention works only in combination with real-time correction.

Keywords: visual manipulation, health misinformation, short video, digital health literacy, correction

1 Introduction

As an emerging medium in the mobile internet environment, short video has become an important channel through which people obtain information, seek entertainment and interact. According to the latest figures from the China Internet Network Information Center, by December 2023 the number of online video users in China had reached 1.092 billion, the proportion of users accessing the internet by mobile phone had reached 99.9%, and the number of short-video users stood at 1.053 billion, or 96.4% of all netizens [1]. With the continual iteration of media technology, multimodal information presentation has provided fertile ground for the spread of every kind of falsehood. Under the fragmented, superficial and randomised overload of visual information, audiences find it difficult to sustain attention or to judge rationally. Visual content also amplifies misinformation to some degree, makes it more misleading and more deceptive, and more readily provokes an emotional response and action in the audience, so that it spreads virally. Health misinformation, which often presents itself as 'popularising health knowledge', is widely followed and rapidly disseminated on social media, yet contains misleading, erroneous, exaggerated and distorted pseudo-scientific claims [2] that readily damage public health behaviour and public health itself.

The governance of social-media misinformation has become a concern of scholars in many disciplines, yet in an age saturated with visual information the question of how and when to correct short-video health misinformation remains inadequately resolved. A search of Chinese and English databases shows that research on health misinformation and its correction has concentrated on the persuasive strategies of post hoc textual correction, to the neglect of prior intervention and in-process correction in the new media environment. Literacy interventions and correction strategies have mostly been examined as independent mechanisms, and have rarely been studied in combination. Research on misinformation under visual manipulation has moreover concentrated on political communication, leaving an evident gap in work on visual presentation in health misperception [3].

This study therefore adopts a multifactorial online experiment to examine, under visual manipulation, the mechanism by which a prior active literacy intervention and two real-time passive correction strategies operate in the correction of short-video health misinformation, and how they affect users' perception of information credibility. It aims to provide a basis for framing correction strategies for short-video health misinformation under different kinds of visual manipulation,

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for designing targeted literacy interventions, for encouraging public participation in health communication, and for helping short-video platforms establish correction mechanisms.

2 Literature Review and Hypotheses

2.1 Visual Manipulation in Social-Media Misinformation

In an increasingly complex information environment, online media have moved from a text-centred information form into an age of reading images in which the visual is central. Although people have come to recognise that 'a picture is not necessarily the truth', visual information has stronger affective arousal and persuasive power than text [4], and false news presented as video leads more people to believe and to share it [5]. The source is an important indicator by which users perceive the credibility of information, and bears on the assessment of its truthfulness; in the multimodal presentation of the social-media age, sources have become both richer and more blurred [6]. Beyond verbal content, the realism of the visual increases credibility and supplies the user with additional cues. According to the elaboration likelihood model (ELM), visual features can affect users' perception of information credibility along three routes: as heuristic cues, as determinants of attention, and as arguments [7]. Especially in the environment of social-media information overload, where video or images switch rapidly, users rarely have the time to reflect and discriminate, so that their rational judgement is affected and a further condition for the rapid diffusion of misinformation is created.

Visual misinformation consists chiefly of practices that manipulate, fabricate and recombine visual content [8], and it affects public opinion, attitudes and action. Visual manipulation takes many forms and carries different characteristics, and plays differing roles in shaping credibility [9]. Purveyors of misinformation also commonly deploy a range of visual devices to appeal to different audiences [10]. Research on TikTok has shown that misleading or incorrect information is very common in videos about COVID-19 [11]. Although visual presentation does not necessarily support the substance of the content, the visual frame most common in contemporary health misinformation is associated with 'authority'; the use of visual figures such as the 'expert' to construct authority is in particular an important feature of health misinformation. A video subjected to visual manipulation may become an effective instrument of health misperception, affecting the audience's evaluation of the information's credibility. Perceived credibility of health information on social media also positively affects users' willingness to engage. The following hypothesis is therefore proposed.

H1: Compared with the control group, health short videos presenting expert visual cues attract (a) higher perceived information credibility and (b) higher willingness to engage on social media.

2.2 Correction of Social-Media Health Misinformation

Correction is more effective for health misinformation than for political misinformation, and the more so where the erroneous belief has not become deeply rooted in public consciousness. Research on the correction of misinformation on social-media platforms has mostly used online experiments that simulate different scenarios and measure the effect of correction. Compared with post hoc correction, presenting corrective information immediately or simultaneously when health misinformation is encountered on social media produces a positive effect. Algorithmic correction and social correction, as real-time strategies, have attracted growing attention and are regarded as having some positive effect in correcting misinformation.

Algorithmic correction refers to the use of algorithms by a social-media platform to fact-check the truthfulness of information. General warnings alone produce a move-away effect [12], and may lower people's correct perception of accurate news and lead to distrust of the media; algorithmic correction should therefore identify and link explicitly to the relevant fact-checking site. When information posted to users on social media is labelled 'controversial' or 'false', users significantly lower their trust in it even where it is true; when the algorithm judges a news source or news content to be true, people tend to trust that decision, and telling them that the algorithm has erred does not affect their trust in it. Algorithmic correction can therefore serve as an important route by which users assess credibility [13], and is a more inclusive strategy for dealing with misinformation. Social correction refers to users' own spontaneous correction of misinformation on social media, in which a link to an official fact-check is supplied. In strongly connected social networks, people place greater trust in scientific correction that comes from friends [14]. The following hypothesis is therefore proposed.

H2: Compared with a control group receiving no correction, (a) algorithmic correction or (b) social correction produces a significant difference in lowering users' perceived credibility of health misinformation.

Information credibility is a subjective evaluation of the degree to which one trusts information; it is determined by individual perception and is independent of whether the information is in fact true. Research on political misinformation has found that people are more willing to engage with information they believe to be true, even where it is not. The effect of multimodal misinformation and of rebuttal depends in part on the subject of the information. Under different social and media environments, and for different categories of misinformation, findings on the effect of real-time correction are

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inconsistent. Online experiments have shown that both algorithmic and social correction are effective on Facebook, with little difference between them, whereas social correction on Twitter significantly reduces users' misunderstanding of false information, and more effectively than on Facebook. The difference in effect may arise from differences in users' trust in the different strategies. The following research question and hypothesis are therefore proposed.

RQ1: In real-time correction, is algorithmic or social correction more effective in lowering users' perceived credibility of short-video health misinformation?

H3: The different effects of different real-time correction strategies arise because people differ in the degree to which they trust the different forms of correction.

According to the heuristic-systematic model (HSM), processing visual information commonly places a strain on the brain's capacity, so that the recipient is triggered into a simple experiential evaluation, that is, to judge by the heuristic route. Although the use of the systematic and the heuristic route depends on many factors, under visual overload users rely mainly on cognitive heuristics and process information systematically only rarely. Visual presentation features, as an additional source of information, may affect users' perception of information credibility under different correction strategies. The following hypothesis is therefore proposed.

H4: Under visual manipulation functioning as a heuristic route, (a) algorithmic correction or (b) social correction produces a significant difference in perceived credibility of health misinformation.

2.3 Active Intervention through Digital Health Literacy

Post hoc correction, as a passive strategy, has an inconsistent record against misinformation [15]. It is less effective where the misinformation accords with people's prior attitudes, and may even produce a backfire effect. Although the empirical evidence is at present limited, literacy, as an active strategy for intervening in misinformation, can to some extent make good the shortcomings of post hoc correction and shows promise in dealing with misinformation. Media and information literacy has been found to have a significant effect on people's correct identification of scientific information, though not on their discrimination of pseudo-scientific information. Research on the correction of false health information in WeChat Moments has found personal media literacy to be more effective than correction strategies [16]. Literacy, as an active intervention strategy, can improve an individual's ability to discriminate false news; information literacy significantly raises the likelihood of identifying fake news, whereas other literacies do not. In the present environment of visual information overload, visual literacy too plays an important part in resisting misinformation. Users' internet skills, image-editing experience and social-media use significantly predict their credibility assessments. Digital media visual-literacy interventions that motivate social-media users to verify images for themselves have promise as fact-checking measures [17].

Among the several literacies, health literacy is an important factor in health status, generally denoting the ability of an individual to obtain, process and understand the basic information and services needed to make appropriate health decisions. With the growth of the mobile internet and social media, the concept has expanded into health information literacy, e-health literacy and digital health literacy, and each revision of the concept reflects a change in the human–computer relationship. Digital health literacy denotes the ability, under dynamic and specific circumstances and within the limits of social and technical constraints, to search for, understand, evaluate, apply, share and create health information. It covers not only people's level of health knowledge but also traditional literacy, health literacy, information literacy, scientific literacy, media literacy and computer literacy. Digital health literacy is a multidimensional concept focused on the health domain; it stresses technical skill as well as knowledge norms, and suits the present multimodal social-media environment better than the earlier formulations. This study designs and examines a digital health-literacy intervention. The following hypothesis is therefore proposed.

H5: Compared with the control group, exposure to a digital health-literacy video lowers the credibility of health misinformation.

Correction strategies commonly used against textual misinformation have been shown to resist visual misdirection. Existing research, however, has treated different correction strategies as independent mechanisms against social-media misinformation and has not tested their interaction; nor has targeted literacy intervention been adequately researched for different information domains. It remains unclear how an active intervention and passive correction work together under the visual manipulation of short-video health misinformation. The following research question is therefore proposed.

RQ2: Under visual manipulation, does exposure to a digital health-literacy video interact with real-time correction strategies so as to (a) lower the credibility of health misinformation and (b) improve the effect of correction?

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3 Method

3.1 Experimental Design

3.1.1 Participants

This study used an online controlled experiment to test the hypotheses and answer the research questions. The design was a 2 (prior intervention: digital health literacy vs. other) × 2 (visual manipulation: expert cues vs. no expert cues) × 3 (real-time correction: social correction, algorithmic correction, control) between-subjects experiment. The Credamo platform was used to simulate the control procedure of a randomised experiment, and a survey company was commissioned to recruit participants, who were required to take part by mobile phone only; each IP address could participate once. A total of 511 responses were collected online, and after invalid responses — those failing the attention check, and those taking too long or too short a time — were removed, 417 valid responses were retained. Participants who completed the experiment attentively and whose data were valid received CNY 5 as remuneration. A G*Power 3.1 calculation, with $\alpha = 0.05$ and power $(1 - \beta) = 0.95$, indicated a minimum sample of 251 for the detection of a medium-sized three-way interaction. The sample therefore exceeds the minimum requirement.

3.1.2 Design of the Experimental Stimuli

Official debunking information was obtained from the China Internet Joint Rumour-Debunking Platform, and short videos were then located by searching backwards from topic keywords, to serve as the raw experimental material. The topic finally chosen for the health misinformation was 'three toothpaste ingredients carry a cancer risk'. The topic was chosen for three reasons: it bears closely on everyone's daily life and the misleading content has been explicitly identified by an official body; it has been widely disseminated on social media, and material on the topic has been posted or forwarded by a number of media video accounts as 'health popularisation', which fits the profile of health misinformation; and, like much health misinformation, it rests on an improper reading of scientific findings and readily provokes alarm and other negative emotions among consumers.

On the basis of the original short videos, experimental materials were produced, together with a digital health-literacy intervention video. The intervention warns users against false health information online, emphasising the visual misdirection typical of short-video health misinformation — above all the construction of authority through the figure of the 'expert' — and how to respond to it. The control was a video from social media about saving water, also 45 seconds long. In the visual-manipulation conditions, expert cues were conveyed by a doctor as the principal figure, whereas the control presented the same statement and point of view through text and images combined, again one minute long. To simulate the real conditions under which users watch short videos on a phone, social correction was simulated by a user posting a rebuttal of the content's truthfulness in the scrolling comments and stating that it had been verified by a professional fact-checking body, while algorithmic correction was simulated by an artificial-intelligence risk warning stating that the video might contain misleading or erroneous information, with a link to a fact-checking site. To eliminate interference from other factors, the account name, avatar, likes, forwards and comment counts that normally appear in the interface were hidden in all the materials.

3.2 Procedure

After beginning the experiment, participants signed an informed-consent form and read a short introduction. To prevent them from guessing the true purpose, the study was described only as research on social-media short videos. Participants were then randomly assigned to one of the 12 conditions and told that they would watch three short videos attentively. They first watched either the digital health-literacy intervention or the water-saving video, then an unrelated travel video followed by an attention check, and then the health short video for their condition, after which they completed a questionnaire. At least 30 seconds had to be spent on each video page before continuing. The whole procedure took about five minutes, and participants also completed a demographic questionnaire. At the end, participants were told that the video they had watched was health misinformation and were given an official fact-check explanation and link.

3.3 Variables and Measurement

3.3.1 Information Credibility

Credibility judgement was the dependent variable, denoting the subjective feeling and assessment of the truthfulness of the content after watching the video. Participants answered 'To what extent do you consider this short video to be true / objective / credible / accurate?' on a five-point Likert scale (1 = definitely false, 5 = definitely true). The four items were combined into an index of information credibility with good reliability and validity (Cronbach's $\alpha = 0.943$). A higher score

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indicates greater trust in the health misinformation, that is, a higher level of misperception.

3.3.2 Perceived Trust in Correction

Participants in the experimental groups other than the control rated their trust in the correction message they had encountered on a five-point Likert scale, with the items 'the algorithm/comment is credible', 'the algorithm/comment is persuasive', 'the algorithm/comment is reliable' and 'the algorithm/comment is accurate'. These were combined into a measure of trust in social correction and a measure of trust in algorithmic correction (Cronbach's $\alpha = 0.918$).

3.3.3 Willingness to Engage on Social Media

Willingness to engage was measured as forwarding, commenting and liking. Participants answered three questions on a five-point Likert scale: to what extent would you be willing to forward, comment on or like this short video? The three items were combined into a measure of willingness to engage on social media with good reliability and validity (Cronbach's $\alpha = 0.871$).

3.3.4 Sociodemographic Variables

The sociodemographic variables comprised sex, age, education and use of social-media short videos. Of the participants, 54.2% were women; 47.2% were aged 19–29, the largest group; 65.9% held a bachelor's degree, the largest group; and 68.8% watched short videos for one to two, or two to three, hours a day.

4 Results

Before the formal analysis, a randomisation check and a manipulation check were carried out. The randomisation check found no significant differences among the conditions in sex, age ($p = 0.199$), education or social-media use, indicating that randomisation was successful.

A manipulation check is an effective means of assessing the validity of an experimental manipulation and of securing construct validity. To avoid participants guessing the purpose of the study, the check was administered after the manipulation. Asked what the literacy-intervention video had been about, 100% answered correctly; recall of the algorithmic correction was correct in 98.6% of cases and of the comment-based correction in 96.2%. An independent-samples t-test on the visual manipulation showed that the group with expert cues was significantly more likely than the group without them to consider the presentation professional ($p < 0.001$). The manipulation therefore achieved its intended effect.

4.1 Main Effect of Visual Manipulation

To test for differences in the credibility of health short videos and in willingness to engage under different visual manipulations, a one-way ANOVA was used. Visual manipulation produced a significant difference in perceived credibility of health misinformation. Further analysis showed that, among the different manipulations, health short videos presenting expert cues scored higher in perceived credibility than those without; in other words, the presence of expert cues in short-video health misinformation raises the perceived credibility of the information. Hypothesis H1a is therefore supported by the data. The visual features of health short videos, however, produced no significant difference in willingness to engage, so H1b is not supported.

4.2 Main Effect of Real-Time Correction

To test the effect of real-time correction strategies on credibility judgements of health misinformation, a one-way ANOVA was used with LSD post hoc multiple comparison. Compared with the control group, which received no correction at all ($M = 3.41$, $SD = 1.18$), both social correction ($M = 2.87$, $SD = 0.953$) and algorithmic correction ($M = 2.79$, $SD = 0.91$) significantly lowered users' perceived credibility of the health short-video content ($p < 0.001$). Specifically, compared with both social correction (mean difference = 0.54) and algorithmic correction (mean difference = 0.62), the control group was less effective in lowering the perceived credibility of health misinformation, and the difference was significant. Hypothesis H2 is therefore supported by the data. Further testing found no significant difference between the two real-time correction strategies in perceived credibility of health misinformation ($p = 0.412$); the different real-time correction strategies therefore did not produce differences in perceived credibility (RQ1).

Users' trust in the different forms of correction was also examined. Overall, participants trusted algorithmic correction more than social correction. Since the two forms did not differ significantly in perceived credibility of health misinformation, no further test was carried out, and H3 is not supported.

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4.3 Test of the Combined Manipulation

To test comprehensively whether, under different visual manipulations, the correction strategies differ in users' perceived credibility of health misinformation, a two-way ANOVA was used (table 1). The results showed that both real-time correction and visual features produced significant differences in perceived credibility, $F(1, 413) = 20.254$, $p < 0.001$, $\eta^2 = 0.047$. The interaction between real-time correction and visual features was also significant, $F(1, 413) = 5.757$, $p = 0.017$. Further analysis showed that, for health short videos with non-expert cues, algorithmic correction was more effective than social correction in lowering perceived credibility, whereas for those with expert cues, social correction was more effective than algorithmic correction (mean difference = 0.80). Hypothesis H4 is therefore supported.

Table 1 Effect of real-time correction on perceived information credibility under visual manipulation

Source	Type III sum of squares	df	Mean square	F	Significance	Partial eta squared
Corrected model	48.306[a]	3	16.102	15.953	<0.001	0.104
Intercept	3979.241	1	3979.241	3942.373	<0.001	0.905
Visual features	20.444	1	20.444	20.254	<0.001	0.047
Real-time correction	27.446	1	27.446	27.191	<0.001	0.062
Visual features × real-time correction	5.811	1	5.811	5.757	0.017	0.014
Error	416.862	413	1.009			
Total	5280.25	417				
Corrected total	465.168	416				

Note: a. $R^2 = 0.104$ (adjusted $R^2 = 0.098$).

A one-way ANOVA was used to test the effect of the prior intervention — exposure to digital health literacy alone — on the credibility of health misinformation. Compared with the general-literacy intervention, exposure to the digital health-literacy video alone produced no significant difference in perceived credibility, so H5 is not supported.

The combined effect of the digital-literacy intervention, visual features and real-time correction on perceived credibility was then examined (table 2), with a third-order interaction term entered in the model. Visual features and the prior intervention had no significant effect on perceived credibility, whereas real-time correction had a significant effect, $F(1, 410) = 19.415$, $p < 0.001$. The interaction between the prior intervention and visual features, and that between the digital health-literacy intervention and real-time correction, were also significant, and the three-way interaction among the prior intervention, visual features and real-time correction was significant, $F(3, 410) = 6.175$, $p < 0.001$. Compared therefore with the other control interventions, the combination of the digital health-literacy intervention with a real-time correction strategy significantly lowered the perceived credibility of health short videos under visual manipulation and improved the effect of correction (RQ2).

Table 2 Effect of the combined manipulation on users' perceived information credibility

Source	Type III sum of squares	df	Mean square	F	Significance	Partial eta squared
Corrected model	60.769[a]	6	10.128	10.268	<0.001	0.131
Intercept	1938.939	1	1938.939	1965.793	<0.001	0.827
Visual features	2.654	1	2.654	2.690	0.102	0.007
Real-time correction	19.149	1	19.149	19.415	<0.001	0.045
Prior intervention	0.053	1	0.053	0.054	0.817	0.000
Visual features × real-time correction × prior intervention	18.271	3	6.090	6.175	<0.001	0.043
Error	404.399	410	0.986			
Total	5280.25	417				
Corrected total	465.168	416				

Note: a. $R^2 = 0.131$ (adjusted $R^2 = 0.118$).

5 Conclusion and Discussion

With the spread of the mobile internet, multimodal presentation combining text, images and video has become ubiquitous, and the rapid development of artificial intelligence and deepfake technology has further aggravated the harm done by misinformation under visual manipulation. In the present short-video environment, this study focused on health misinformation and used an online controlled experiment to test the effect of an active literacy intervention and two

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real-time correction strategies on users' perceived credibility of health misinformation under visual manipulation.

First, visual manipulation produces a significant difference in users' perceived credibility of health misinformation. Unlike structured text-and-image information, video is encoded very differently in processing. In the mobile-social age, information overload and visual overload discourage people from deliberating critically about either content or presentation. Doctors and experts appear frequently on social networks to popularise health, the quality of that information varies widely, and much of it is misleading, which obstructs sound health communication and the governance of information. Existing research on health misinformation and its correction has mostly discussed textual correction and the source of publication; the present findings take the presentation of visual features as an important dimension of credibility assessment, and so extend that research.

Second, real-time correction strategies can to some extent lower the credibility of health misinformation, which accords with earlier findings that warnings about and corrections of false information can both be effective tools against it. Further analysis found that, under different visual features, algorithmic and social correction differ significantly in users' perceived credibility. Specifically, in health short videos with non-expert cues, algorithmic correction was more effective in lowering misperception; in those with expert cues, social correction was the more effective. This finding sharpens the design of future correction strategies for health misinformation and allows their effect to be raised in a targeted way. On one hand, social-media platforms should make full use of artificial intelligence, machine learning and related techniques to identify and flag videos whose truthfulness is doubtful, combine this with manual labelling to identify and oversee the enormous volume of short videos, and work with authoritative debunking platforms on fact-checking so as to limit the effect of health misinformation on the public. On the other hand, they should rely on widening the reach and visibility of user comments to help correct false information; where false information is widely disseminated on a platform, mobilising users to respond to it in real time becomes an important mode of correction.

Third, exposure to the digital health-literacy intervention alone produced no difference in perceived credibility, yet under visual manipulation the combination of that intervention with a real-time correction strategy was an effective route to improving the correction of health misinformation. This conclusion agrees with the results obtained on Facebook in a Western context, where watching a news-literacy video alone did not inoculate against misinformation. Although the literacy intervention in this experiment did not resolve people's cognition and judgement of misinformation, literacy is the product of long accumulation, and a single experiment may not fully demonstrate that the intervention is ineffective. In the new media environment, an important aspect of literacy intervention is the participant's ability to adapt to new technology and to identify information, which may combine with correction strategies as a latent factor and so affect public behaviour; the present findings confirm that interaction. Although the digital health-literacy intervention did not directly affect the accuracy of users' information credibility, it may affect their subsequent judgement latently. Public 'healthy scepticism' about information should therefore be cultivated positively, rather than media distrust provoked. In short, literacy intervention should be strengthened as an important ex ante warning strategy, and information designed that raises the public's digital health literacy in the digital-media age in a targeted way, so as to counter the harm that widely disseminated health short videos do to the public and to society.

In sum, this study takes visual manipulation as a heuristic route and extends the dimensions along which users' perception of information credibility is shaped, enriching research on the correction of health misinformation in the short-video age. On one hand, understanding the heuristic process in information evaluation can help design interventions aimed at raising users' digital health literacy and reduce the cognitive bias that reliance on the heuristic route produces. On the other hand, combining different presentations of visual features allows more effective real-time correction strategies to be explored. Examining schemes that join active intervention to passive correction enriches the correction strategies available for health short videos. The findings will in sum help social-media platforms design effective literacy interventions for correcting misinformation and guide positive health communication on social media.

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