When Vaccine Uncertainty Prevails: Association Between Online Social Influence and COVID-19 Vaccine Intentions

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Guided by the integrative model of behavioral prediction and the social identity of deindividuation effects model, this study used an online experiment (N = 322) to test a moderated-mediation model that linked exposure to user comments posted to COVID-19 vaccine news stories and vaccine intentions. The study was conducted in Vietnam when the Delta variant of COVID-19 spread to the country and the efficacy and side effects of the COVID-19 vaccine were controversial in the news. Results showed that, compared with vaccine-hesitancy comments, vaccine-acceptance comments significantly increased vaccine intentions through injunctive norms, response efficacy, and attitudes. This indirect association was only significant among participants who perceived commenters as in-group members. Compared with vaccine-hesitancy comments, a mixture of comments that featured both acceptance and hesitancy significantly increased perceived norms, perceived efficacy, and attitudes. Further, comments significantly changed participants' perceived norms, perceived efficacy, and attitudes compared with the news stories. Theoretical and practical implications are presented.

Keywords: social influence, integrative model, identification, vaccine, COVID-19

Humans are motivated to detect behavioral cues in their environments to make sense of what behavior is acceptable and prevalent, which communicates social norms that guide their own behavior (Lapinski & Rimal, 2005). The underlying assumption of social norm influence is that people have the need to belong to social groups that they identify with (i.e., social identity; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). Thus, behaving in accordance with social norms is deemed sensible and reasonable (Cialdini, 2001). The news media are common sources of norm perceptions because behavioral cues are

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often conveyed through the news content (Tankard & Paluck, 2016). In today's interactive media environment, research shows that people may use news user comments as cues to public opinions and social norms (Hsueh, Yogeeswaran, & Malinen, 2015; Lee & Jang, 2010; Liu & Shi, 2019). Behavioral cues conveyed through comments can be particularly influential for scientifically contentious health behaviors, such as e-cigarette use (Liu & Shi, 2019), genetically modified organism food (Xu, Yu, & Song, 2018), and vaccination (Dixon, 2020). This is relevant to the COVID-19 pandemic because the news media tend to report controversies surrounding vaccine efficacy and side effects, thereby motivating people to learn about others' behaviors to navigate their own perceptions and behaviors.

The goal of the present study is to examine how and why exposure to comments posted to online health news stories about the COVID-19 vaccine might influence vaccine intentions. The study uses an online experiment to test the hypotheses guided by the integrative model of behavioral prediction (IM; Fishbein & Ajzen, 2011) and the social identity of deindividuation effects model (SIDE; Reicher, Spears, & Postmes, 1995). The IM is the latest iteration of the reasoned action approach, which has been the most used norm-based theory to predict health behaviors (Mollen, Rimal, & Lapinski, 2010; Shulman et al., 2017). The SIDE model is rooted in computer-mediated communication and has been applied in user comment studies (Duong, Vu, & Nguyen, 2021; Jang & Walther, 2019; Walther, DeAndrea, Kim, & Anthony, 2010). Whereas the IM theorizes multiple pathways linking comment exposure and behavior, the SIDE model offers a theoretical lens to study the condition underlying this association. The association between online news comment consumption and vaccine intentions has not been studied with both models applied. Moreover, this study seeks to extend the research topic to a non-Western context by focusing on Vietnam when the country was on the verge of a new wave of the dangerous Delta variant of COVID-19, which spread across Southeast Asia in mid-2021.

News User Comments as a Form of Online Social Influence

In the age of digital news production and consumption, news user comments are a common feature of online news sites (Lee & Tandoc, 2017). Comments are defined as an asynchronous subcategory of media-stimulated interpersonal communication that is published in the immediate context of an online news story (Ziegele, Weber, Quiring, & Breiner, 2018). Comments provided to a health news story can lend insights into news users' responses to a health risk (Holton, Lee, & Coleman, 2014). Scholars suggest that commenters' anonymity and their personal experience sharing might be key features that make comments influential. Specifically, anonymous comments allow people to be more forthcoming in self-disclosure (Holton et al., 2014). People also tend to share their personal experiences with the health issues reported in news stories (Duong, Vu, & Nguyen, 2021; Len-Ríos, Bhandari, & Medvedeva, 2014). Such peer experiences may function as a filter for people to evaluate the outcome of a health behavior (Len-Ríos et al., 2014) and gauge social norms surrounding the behavior (Liu & Shi, 2019). Thus, comments can be a form of online social influence that is capable of shaping perceptions of a health issue.

The majority of studies examining comments posted to vaccine news stories focus on analyzing the content of comments and do not examine whether and how individuals might be influenced by observing these comments (e.g., Holton et al., 2014; Meyer et al., 2019). Several studies have examined the effect of civil versus uncivil comments (i.e., polite and respectful comments versus aggressive, disrespectful, and

hostile ones) on vaccine news credibility, but they did not specifically consider vaccine behavior (e.g., Dixon, 2020; Jennings & Russell, 2019; Petit, Li, Millet, Ali, & Sun, 2021). Other research has examined comments posted on social media sites, where commenters' online identities may be revealed (e.g., Kim, Seo, Yoon, Han, & Ko, 2021). Both comment incivility and commenters' identity cues are absent in our study context of Vietnamese news sites because uncivil comments are strictly censored, and news users mostly post anonymously. Furthermore, studies have largely been conducted within the North American media context. Our literature review shows only one study in China, which reveals the effect of comments on human papillomavirus (HPV) risk perceptions and vaccine intentions (Zhang & Wang, 2019). We now present theoretical perspectives that help to predict and explain the possible effects of comments on perceptions and behaviors.

Theoretical Framework

The Integrative Model of Behavioral Prediction

Research linking media exposure, social influence, and health behaviors has largely applied the IM and its earlier version, which is the theory of planned behavior (Shulman et al., 2017). The IM posits that intentions are the best predictor of behaviors and are influenced by three factors: attitudes, perceived norms, and perceived efficacy. Perceived norms comprise perceived social approval of a behavior (i.e., injunctive norms) and perceived prevalence of the behavior (i.e., descriptive norms). Perceived efficacy includes perceptions of one's ability to perform the behavior (i.e., self-efficacy) and perceptions of whether the recommended behavior will be effective to oneself (i.e., response efficacy). Attitudes are "individuals' latent disposition or tendency to respond with some degree of favorableness or unfavorableness to a psychological object" (Fishbein & Ajzen, 2011, p. 76). Perceived norms, perceived efficacy, and attitudes are considered proximal variables because they directly predict behavioral intentions (Fishbein, 2009).

One key theoretical extension in the IM is the inclusion of distal variables such as demographics, individual differences, and media exposure, which are theorized to shape the beliefs underpinning perceived norms, perceived efficacy, and attitudes (Fishbein & Ajzen, 2011). Media exposure has been a key distal variable in communication research applying the IM. Several studies have found support for the indirect effect of health message exposure on behaviors via the proximal variables (e.g., Martinez & Lewis, 2016; Rhodes, Stein, Fishbein, Goldstein, & Rotheram-Borus, 2007). To our knowledge, no research has considered the influence of news user comments on vaccine intentions through the lens of the IM framework.

The Social Identity of Deindividuation Effects Model

While the influence of perceived norms, perceived efficacy, and attitudes on behavior has been well-established in the IM, the interplay between the distal communication variable and these proximal variables, particularly the norm construct, has received less attention (Yanovitzky & Rimal, 2006). Social norms are commonly perceived through direct or indirect observations of others' behaviors (Cialdini, 2001; Tankard & Palack, 2016). However, not all observations might lead to norm formation. Researchers argue

that people only draw social norms from behaviors exhibited by people who are perceived as sharing similarities on such stereotypical dimensions as values, beliefs, and various demographic factors (i.e., in-group members; Terry & Hogg, 1996). This proposition is the gist of the social identity theory (SIT), which postulates that norms are inextricable properties of groups, and thus, norms are influential insofar as they are communicated by in-group members (Hogg & Reid, 2006; Turner et al., 1987). Prior studies show that people could elicit norms from perceived in-group members, while rejecting normative messages communicated by people whom they perceived as belonging to an out-group (e.g., Duong, Monahan, Kollar, & Klevens, 2021; Goode, Balzarini, & Smith, 2014). As such, norm formation is a function of in-group identification in which behavioral cues exhibited by in-group members are influential.

The SIDE model was built on the SIT to explain how norms might be formed in the computer-mediated communication context (Postmes, Spears, & Lea, 2000). The model postulates that online interactions with others whose visual identity is absent likely lead to a depersonalization effect, which makes awareness of group identity become salient while diminishing attention to individual differences (Postmes, Spears, Sakhel, & de Groot, 2001). That is, visual anonymity motivates people to view others as abstract groups instead of concrete individuals. Therefore, behaviors of anonymous others in a mediated context can be perceived as characteristics of social groups, which communicate group norms. The SIDE model then proposes that norms are influential when online others are perceived as in-group members (Reicher et al., 1995). The model is very compatible with the Web-based news platforms that accommodate user comments (Walther, 2011). For example, research shows that the effect of anonymous comments on intentions to communicate about reported health risks is only significant when participants identify with commenters (Duong, Vu, & Nguyen, 2021). Applying the SIDE model to our research context, the anonymity of people who provide comments to the COVID-19 news stories likely elicits perceptions of commenters as abstract groups whose behavioral cues might trigger norm perceptions. Such perceptions might be contingent on whether commenters are perceived as in-group or out-group members.

Based on the IM and the SIDE model, we first examine one-sided comments (vaccine hesitancy vs. vaccine acceptance) through the following hypotheses:

H1:   *Compared with vaccine-hesitancy comments, exposure to vaccine-acceptance comments will lead to higher perceived norms, higher perceived efficacy, and more positive attitudes.*

H2:   *The effect of comments on perceived norms, perceived efficacy, and attitudes will be contingent on social identification.*

H3:   *Exposure to comments will indirectly predict vaccine intentions through the mediating effect of perceived norms, perceived efficacy, and attitudes among participants who perceive commenters as in-group members, and not among those who perceive commenters as out-group members.*

Effect of Mixed Comments and Negativity Bias

The preceding hypotheses outlined the possible effects of one-sided comments, but they have not addressed the circumstance in which commenters' behavioral cues are mixed. That is, the behavioral cues communicated in a comment board of a news story show both intentions to vaccinate and intentions to not vaccinate, which is analogous to a two-sided message (Petit et al., 2021). Research reveals that comments disapproving a product, idea, or behavior generally have a stronger effect on perceptions than comments signaling approvals (Möller, Baumgartner, Kühne, & Peter, 2021). When people view comments that contain opposite behavioral cues, comments that disapprove of a behavior tend to carry more weight than comments that support the behavior (Boot, Dijkstra, & Zwaan, 2021; Liu & Shi, 2019). To explain this result, researchers have often turned to the negativity bias principle.

The negativity bias principle proposes that negative information tends to influence cognitive perceptions more strongly than comparably positive information (Ito, Larsen, Smith, & Cacioppo, 1998). This is because people place more emphasis on negative events than positive events so they can be prepared for threats in the interest of survival (Shoemaker, 1996). Thus, negative information often gains more attention and becomes more pronounced in memory. Informed by this principle, researchers predict that viewing mixed comments may reduce vaccine news credibility compared with viewing the news stories without such comments. However, this prediction has not been supported (Dixon, 2020; Petit et al., 2021). Researchers then speculate that the concurrent presence of both positive and negative comments might cancel out each other's effect (Petit et al., 2021). Additionally, research has not examined the effect of mixed comments on the IM proximal variables related to vaccination. Therefore, the effect of mixed comments in this behavioral context remains unclear. Thus, we ask:

RQ1:   Will there be differences between (a) mixed comments and vaccine-hesitancy comments and (b) mixed comments and vaccine-acceptance comments about perceived norms, perceived efficacy, and attitudes?

RQ2:   Will there be an interaction effect between mixed comments and social identification, as inquired in (a) RQ1a and (b) RQ1b on perceived norms, perceived efficacy, and attitudes?

RQ3:   Will there be a conditional indirect effect of mixed comments and social identification, relative to (a) vaccine-hesitancy comments and (b) vaccine-acceptance comments, on vaccine intentions through the mediating effects of perceived norms, perceived efficacy, and attitudes?

Additionally, to explore the absolute effects of one-sided comments and mixed comments on vaccine perceptions compared with the news story content only, we ask:

RQ4:   Will there be differences between participants in the control condition and those in the treatment conditions about perceived norms, perceived efficacy, and attitudes?

Study Context: The Delta Variant and Vaccine Hesitancy in Vietnam

The COVID-19 pandemic is a formidable global health crisis, having killed nearly 2 million people worldwide at the time we conducted this study (World Health Organization [WHO], 2021a). When the pandemic wreaked havoc across several countries throughout 2020, Vietnam was praised by the international community for its effective response strategy despite its long border with China, where the disease was first reported (Abuza, 2021). This success story, however, took a dramatic turn in June 2021, when the Delta variant spread to the country. This variant was the most potent coronavirus that severely affected countries with low COVID-19 vaccination rates (Roy, Dhillon, Habib, & Pugazhandhi, 2021). Within only the two-month period of June and July 2021, Vietnam reported more than 165,000 cases and nearly 2,000 deaths (WHO, 2021b). Ho Chi Minh City, the largest city in Vietnam, became the epicenter. With hospitalizations steeply increasing, the city faced a medical collapse; the government was forced to build several field hospitals, urgently import vaccines, and mobilize the medical workforce to control the pandemic (Onishi, 2021).

Critics commented on Vietnam's struggle against COVID-19 as the country being a victim of its own success (Abuza, 2021). Inspired by the country's early accomplishments in curbing the pandemic, leadership put its faith in the pursuit of developing its own vaccine rather than quickly approving and contracting for supplies of vaccines from overseas (Strangio, 2021; K. Vu & Nguyen, 2021). As a result, only 4% of the country's 96 million people had at least one dose of the COVID-19 vaccine—the lowest vaccination rate in Southeast Asia at the time of this writing (Rising, 2021). To ramp up the speed of vaccination, public health officials knew that they had to motivate people to get the vaccine early. However, this was not an easy task because people showed reluctance to accept the vaccine. The delay in acceptance of a vaccine is termed as vaccine hesitancy (MacDonald, 2015).

Although no study has examined the causes and scope of possible COVID-19 vaccine hesitancy in Vietnam, there were reasons to consider the effects of the news media (Puri, Coomes, Haghbayan, & Gunaratne, 2020). During the first wave of the COVID-19 pandemic, the news media in Vietnam often reported on controversies and the side effects of the vaccine. This was unsurprising because research revealed that journalists tended to adopt an alarm news frame that emphasized adverse health consequences to draw attention and make the news stories newsworthy (Chang, 2012; Slater, Long, Bettinghaus, & Reineke, 2008). Although journalists eventually shifted to a coping frame, focusing on treatment and solutions to motivate vaccination, prolonged exposure to news stories reporting the side effects of the COVID-19 vaccines might have had an effect on people's perceptions. Previous studies indicated that Vietnamese people could be sensitive to news stories reporting the adverse effects of vaccination, which could be associated with vaccine hesitancy (Li et al., 2016; Tran et al., 2018). In a recent survey targeting young adults in Ho Chi Minh City about their intentions to vaccinate against COVID-19, researchers found that participants were concerned about the vaccine's side effects (Khuc et al., 2021). This concern likely derived from their exposure to the news stories communicating about vaccine's side effects.

As Vietnam adopted a neoliberal capitalist market model and substantially reduced state funding to the press, news agencies had to seek revenues from sales and advertising (H. T. Vu, Trieu,

& Nguyen, 2020). Having news users interacting with the news content helped to retain readership and make news stories more engaging. Most Vietnamese news sites included comment sections below news stories. Controversial health news topics such as the COVID-19 vaccine often received a high volume of comments, which were available alongside the news stories. Thus, we conducted an experiment to examine the effect of such comments, as proposed in the hypotheses and research questions presented earlier.

Method

Sample

Data were collected in early June 2021. Participants were undergraduate students attending a national university in Ho Chi Minh City. Only participants 18 years old or older who had not received the COVID-19 vaccine were eligible (N = 358). After data cleaning (incomplete data, same response patterns, very short or long reading time), the working sample consisted of 322 participants (M_{age} = 19.8; SD = 1.20). The average age of participants was 20 years (SD = 1.20). More than half were female (58.4%). The majority frequently consumed online news (65%), and 81.6% of those frequently followed COVID-19 news online. Participants received $3 for compensation. The study was approved by the first author's Institutional Review Board.

Design and Procedure

To test the hypotheses, we conducted a between-subject online experiment that included three treatment conditions (C1: news story + vaccine-hesitancy comments; C2: news story + vaccine-acceptance comments; and C3: news story + mixed comments) and a control, using the Qualtrics survey website. Participants were contacted via an invitation e-mail, which contained the study description, informed consent, and the link to the study. The study description stated that it examined health news consumption. It also informed participants that the survey link would be available within one hour after the link was activated. After participants read the informed consent, they clicked the link to access the Qualtrics survey. Participants first reported their risk perceptions about the current COVID-19 pandemic. They were then randomly assigned to one of the four conditions. Participants in the control condition viewed the news stories, and those in the treatment conditions viewed both the news stories and the comments. Participants then responded to a questionnaire that included the study variables. Finally, they were debriefed on the purpose of the study and thanked for their participation.

Stimulus Materials

To avoid the potential case-category confounding effect associated with using a single news stimulus (Jackson, 1992), three different news stories were created and randomized in each experimental condition. That is, participants in the same condition were randomly shown one of the three news stories. The news stories were created based on real news stories published by the most popular news sites in Vietnam (*Zing News, VnExpress*, and *Thanhnien News*), with some adaptations. The news stories reported the progress of the COVID-19 vaccine development, with statements about the vaccine efficacy and side

effects being equally included. The news stories also reported the government taking steps toward importing the vaccine, but did not include information about Vietnamese people being willing to vaccinate. To control for potential news source bias, the news sites were not revealed.

A total of 20 comments (10 vaccine-acceptance and 10 vaccine-hesitancy comments) were adopted from real comments posted to the vaccine news stories. Sample vaccine-acceptance comments were, "*How do I register to get the vaccine? I really wish to get the vaccine early so that I can travel,*" and "*The efficacy of the COVID-19 vaccine is all clear. If anyone needs me to be the vaccine test subject, I will volunteer right away.*" Sample vaccine-hesitancy comments were, "*The virus only affects old people or people with pre-existing health conditions. I am young and strong. I exercise every day and eat healthily. I don't need to get the vaccine,*" and "*Just wait a little more to see the outcomes of the vaccine. I will not be the subject of the vaccine test now.*" No personal information related to commenters was revealed other than their pseudo names, which signaled neither gender nor age (e.g., "Nguyen" could be both the family name and first name of many male and female Vietnamese people of all ages). In the first treatment condition, the 10 vaccine-hesitancy comments were shown. In the second treatment condition, the 10 vaccine-acceptance comments were shown. The third treatment condition showed mixed comments that contained five vaccine-hesitancy and five vaccine-acceptance comments (Figure 1). Participants in the control condition read the news stories that did not include comments.
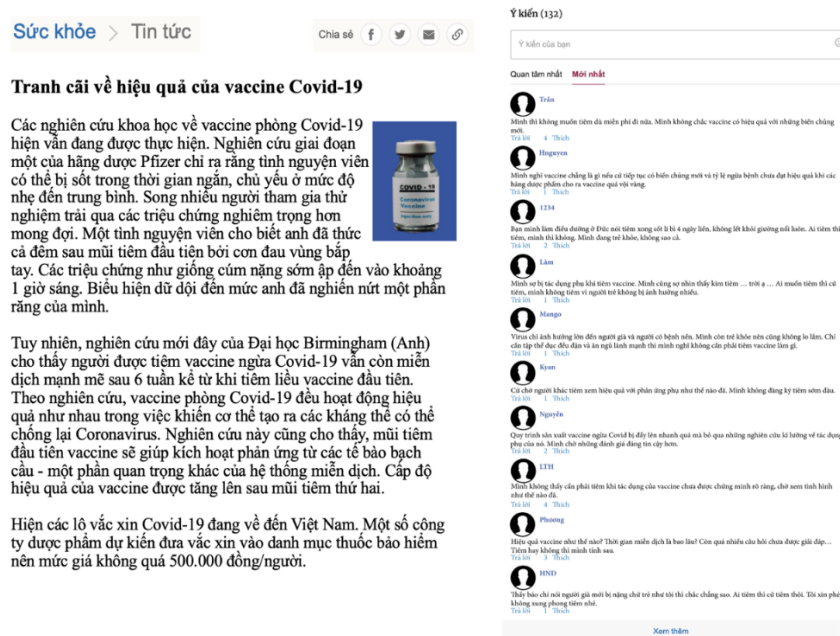

Figure 1. Sample news story and vaccine-hesitancy comments.

Measures

The questionnaire was translated from English to Vietnamese by the authors. It was then reviewed by a bilingual expert and pretested with a group of undergraduate students to ensure question clarity and survey functionality ($n = 89$, not included in the analysis).

Dependent Variables

Participants responded to 12 items (Fishbein & Ajzen, 2011), with half measuring descriptive norms ($a = .88$; $M = 3.98$; $SD = .62$) and the other half gauging injunctive norms ($a = .88$; $M = 4.09$; $SD = .57$). A sample descriptive norm item was, "How many people living in your community will get the COVID-19 vaccine?" ($1 = none$; $5 = almost\ all$), and a sample injunctive norm item was, "My family members agree that I should take the COVID-19 vaccine" ($1= strongly\ disagree$; $5 = strongly\ agree$).

Self-efficacy was measured with two items ($r = .48$; $p < .01$; $M = 3.39$; $SD = .84$), and so was response efficacy ($r = .42$; $p < .01$; $M = 3.56$; $SD = .67$). An example of self-efficacy items was, "When the COVID-19 vaccine is available, getting the vaccine is easy for me," and a sample response-efficacy item was, "I believe the COVID-19 vaccine is effective in preventing this disease" ($1 = strongly\ disagree$; $5 = strongly\ agree$).

Based on Fishbein and Ajzen's (2011) attitude scale, attitudes toward the COVID-19 vaccine were assessed with a semantic differential scale of five items, such as bad/good, foolish/wise, etc., ranging from −3 to +3 ($a = .88$; $M = 3.97$; $SD = .74$).

Vaccine intentions were assessed with three items (Nan & Madden, 2012). Sample items were, "When the COVID-19 vaccine becomes available, how likely will you be to get the vaccine?" and "How likely would you be to get the COVID-19 vaccine in the next three months? ($1 = very\ unlikely$, $5 = very\ likely$; $a = .84$; $M = 3.87$; $SD = .64$).

Four items were adopted from prior research (Walther et al., 2010) to measure social identification. Sample items were, "I feel a bond with the people who provided these comments," and "I see myself as a part of these commenters" ($1 = strongly\ disagree$, $5 = strongly\ agree$; $a = .92$; $M = 3.15$; $SD = .99$). As guided by prior research (Terry, Hogg, & White, 1999), the variable was split at the median to represent an in-group and an out-group.

Other Variables

This study was conducted when the Delta variant's risk was heightened. Thus, risk perceptions might affect participants' vaccine perceptions and intentions. Studies related to pandemics showed that risk perceptions likely influenced the IM variables (Choi, Shin, Park, & Yoo, 2018; Duong, Nguyen, McFarlane, & Nguyen, 2021). Thus, it was measured as a covariate with six items (e.g., "I am likely getting infected with COVID-19 virus if it spreads in my community," and "If I get infected with COVID-19 virus, I will have severe

health problems" (1 = *strongly disagree*, 5 = *strongly agree*; *a* = .72; *M* = 3.84; *SD* = .59). Participants also reported their age, sex, and online news consumption.

Data Analysis

All analyses were conducted using SPSS 27. To test H1, H2, RQ1, and RQ2, a series of two-way multivariate analyses of covariance (MANCOVAs) were conducted with the treatment conditions and social identification as fixed factors and the IM proximal variables as the dependent variables. To answer RQ4, a one-way MANCOVA was conducted to compare the IM proximal variables between the control and the treatment conditions. PROCESS macro 3.5 (Model 7; Hayes, 2017) was used to test the moderated-mediation model (H3, RQ3). The indirect effects were obtained using the bias-corrected method based on the bootstrapping of 5,000 samples. All statistical tests controlled for risk perceptions. No differences between conditions were found for age, $F(3,316) = 2.184$, $p = .09$, and sex, $\chi(3) = 5.150$, $p = .16$. Thus, these variables were excluded from the model tests.

Results

Manipulation Check

Manipulation checks were conducted to examine participants' comprehension of the stimuli. Participants were asked if the news story contained information about people who would take the COVID-19 vaccine (1 = *strongly disagree*; 5 = *strongly agree*). ANOVA results indicated no differences across conditions, $F(3,318) = .631$, $p = .59$. One-sample *t*-test results showed that the mean score across conditions ($M = 2.30$; $SD = 1.11$) was significantly below the mean of the scale, $t(321) = -11.492$, $p < .001$, which suggested that participants understood the news content. Participants in the treatment conditions were asked about the commenters' intentions to vaccinate (1 = *strongly disagree*; 5 = *strongly agree*). ANOVA results showed a significant difference between the three treatment conditions, $F(2,235) = 92.394$, $p < .001$. Post hoc Tukey results revealed that participants viewing vaccine-hesitancy comments reported commenters' vaccine intentions significantly lower than those viewing vaccine-acceptance comments ($M = 2.21$; $SD = .81$ vs. $M = 4.30$; $SD = .71$, $p < .001$) and mixed comments ($M = 3.77$; $SD = .75$, $p < .001$). Thus, the manipulation was deemed successful. Table 1 shows bivariate correlations among the dependent variables.

Table 1. Bivariate Correlations.

	1	2	3	4	5	6
1. Descriptive norms						
2. Injunctive norms	.57**					
3. Self-efficacy	.42**	.36**				
4. Response efficacy	.30**	.39**	.25**			
5. Attitudes	.43**	.52**	.26**	.38**		
6. Risk perceptions	.09	.14*	.14*	.09	.11*	
7. Vaccine intentions	.47**	.59**	.44**	.43**	.61**	.14*

*$p < .05$. **$p < .01$.

Hypothesis Testing

H1 proposed that viewing vaccine-acceptance comments would lead to higher descriptive norms, injunctive norms, self-efficacy, and response efficacy, and more positive attitudes than viewing vaccine-hesitancy comments. Results indicated a significant main effect of comments on the outcomes, Wilks's $\lambda = .81$, $F(5,146) = 6.753$, $p < .001$, partial $\eta^2 = .19$. Table 2 shows the main effects of comments on the dependent variables. Participants viewing the vaccine-acceptance comments reported significantly higher descriptive norms, injunctive norms, and response efficacy, and more positive attitudes than those viewing the vaccine-hesitancy comments (Table 3). The effect of comments on self-efficacy was nonsignificant.

Table 2. Main and Interaction Effects.

			Descriptive norms	Injunctive norms	Self-efficacy	Response efficacy	Attitudes
		df	F	F	F	F	F
	Comments	1	13.011***	25.484***	.887	4.933*	21.807***
C1 vs. C2	SI	1	.385	.195	.824	.335	.504
	Comments × SI	1	11.842***	13.283***	13.117***	25.813***	14.956***
C1 vs. C3	Comments	1	17.883***	14.776***	4.186*	4.747*	17.755***
	SI	1	6.227*	1.578	8.139**	4.940*	3.129
	Comments × SI	1	.007	2.189	1.723	2.554	3.577
C2 vs. C3	Comments	1	1.131	.372	1.704	.095	.033
	SI	1	.225	4.630*	.335	5.115*	7.959**
	Comments × SI	1	9.130**	3.112	5.235*	8.700**	7.532**

Note. SI = social identification.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 3. Means, Standard Deviations, and Pairwise Comparisons.

Condition (M/SD)	Descriptive norms	Injunctive norms	Self-efficacy	Response efficacy	Attitudes
Control	3.79/.63	4.11/.52	3.36/.85	3.37/.72	3.91/.74
C1	3.82/.44	3.84/.51	3.40/.88	3.58/.56	3.65/.66
C2	4.18/.60	4.33/.51	3.41/.79	3.76/.64	4.22/.69
C3	4.13/.68	4.18/.61	3.43/.87	3.62/.71	4.08/.74
F-test results	$F(3,315) = 9.638$, $p < .001$, partial $\eta^2 = .08$	$F(3,315) = 10.869$, $p < .001$, partial $\eta^2 = .09$	$F(3,315) = .140$, $p = .94$	$F(3,315) = 4.985$, $p < .01$, partial $\eta^2 = .05$	$F(3,315) = 9.273$, $p < .001$, partial $\eta^2 = .08$
Pairwise comparison					
Control vs. C1	$p = .72$	$p < .01$	$p = .68$	$p = .09$	$p < .05$
Control vs. C2	$p < .001$	$p < .05$	$p = .69$	$p < .001$	$p < .01$
Control vs. C3	$p < .001$	$p = .35$	$p = .52$	$p < .05$	$p = .11$

H2 examined the interactions between comment exposure and social identification, which were found significant, Wilks's $\lambda = .99$, $F(2,146) = 8.769$, $p < .001$, partial $\eta^2 = .23$. Table 2 shows the interaction effects on descriptive norms, injunctive norms, and attitudes. Table 4 reports the descriptive statistics of the dependent variables on the levels of social identification. Figures 2a, 2b, and 2e showed that the effects of comments were only significant when participants identified with anonymous commenters. When the dependent variables were self-efficacy and response efficacy, data showed a crossover interaction pattern (Figures 2c, 2d).
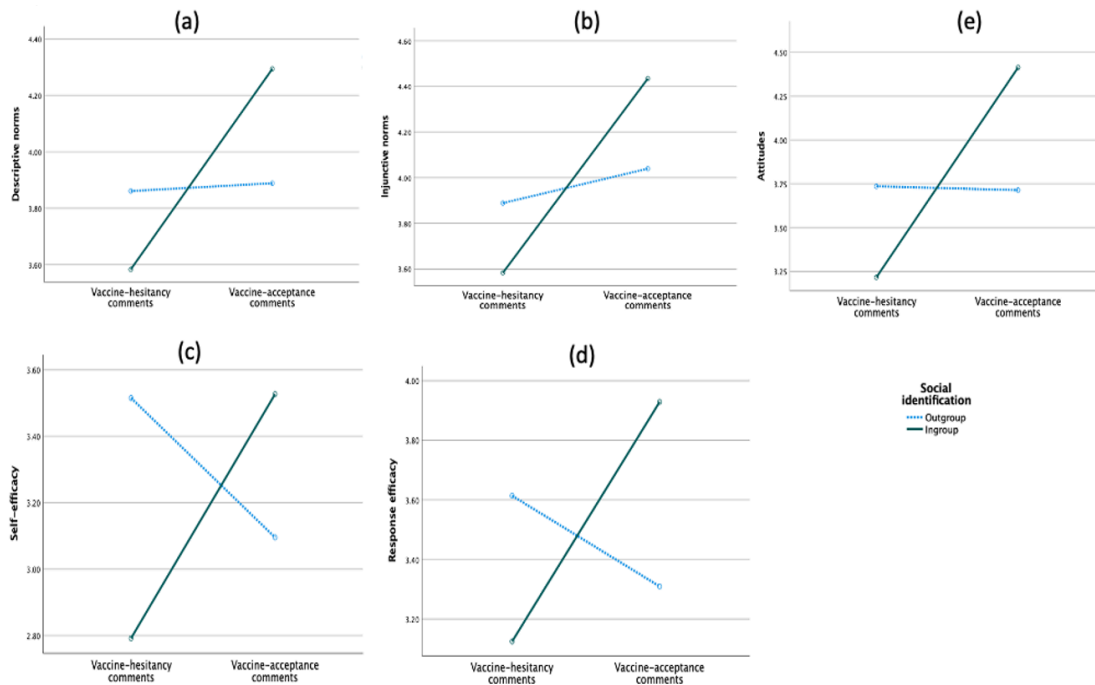
Figure 2. Interaction effects between one-sided comments and social identification.

H3 predicted an indirect effect of comments on vaccine intentions via descriptive norms, injunctive norms, self-efficacy, response efficacy, and attitudes, and this indirect effect is contingent on social identification. The mediating effects of injunctive norms, response efficacy, and attitude were only significant when participants perceived anonymous commenters as in-group members (Table 5). The mediating effects of descriptive norms and self-efficacy were nonsignificant. There was no evidence of a direct effect of comments on vaccine intentions after controlling for the mediating variables ($B = -.13$; $SE = .08$; 95% CI [$-.283, .015$]).

RQ1a asked whether there would be differences between mixed comments and vaccine-hesitancy comments. Results showed a significant main effect of comments, Wilks's $\lambda = .86$, $F(5,151) = 5.132$, $p < .001$, partial $\eta^2 = .15$, on all dependent variables (Table 2). As shown in Table 3, participants viewing the mixed comments reported significantly higher descriptive norms, injunctive norms, self-efficacy, and response efficacy, and more positive attitudes than those viewing the vaccine-hesitancy comments. No interaction effects between comments and social identification were found (RQ2a, Table 2). As such, RQ3a was not further examined.

Table 4. Means and Standard Deviations of Dependent Variables on the Levels of Perceived Social Groups.

Dependent variable (M/SD)	C1 (n = 78)		C2 (n = 77)		C3 (n = 82)	
	Out-group (n = 66)	In-group (n = 12)	Out-group (n = 21)	In-group (n = 56)	Out-group (n = 18)	In-group (n = 64)
Descriptive norms	3.86/.39	3.58/.58	3.89/.45	4.29/.62	4.35/.56	4.07/.70
Injunctive norms	3.89/.50	3.58/.56	4.04/.48	4.44/.47	4.13/.48	4.19/.65
Self-efficacy	3.52/.81	2.79/1.01	3.09/.72	3.53/.79	3.61/.72	3.38/.91
Response efficacy	3.61/.53	3.13/.53	3.31/.60	3.93/.56	3.67/.79	3.61/.69
Attitudes	3.74/.68	3.22/.28	3.71/.62	4.41/.63	4.06/.90	4.09/.69

RQ1b asked whether there would be differences between mixed comments and vaccine-acceptance comments about descriptive norms, injunctive norms, self-efficacy, response efficacy, and attitudes. Data indicated a nonsignificant main effect of comments, Wilks's λ = .97, $F(5,150)$ = .902, p = .48. RQ2b asked about the interaction effects between comments and social identification, which were significant, Wilks's λ = .90, $F(5,150)$ = 3.329, p < .01, partial η^2 = .10, for descriptive norms, self-efficacy, response efficacy, and attitudes (Table 2). RQ3b asked about the conditional indirect effect of comments in the context of mixed comments and vaccine-acceptance comments. Table 5 shows the significant mediating effects of response efficacy and attitudes, and the nonsignificant mediating effects of descriptive norms, injunctive norms, and self-efficacy. The direct effect was nonsignificant (B = .09; SE = .07; 95% CI [−.051; .235]).

RQ4 asked whether there were differences between the control condition and the treatment conditions about the IM variables. Results showed a significant main effect among conditions, Wilks's λ = .79, $F(5,311)$ = 5.054, p < .001, partial η^2 = .08, for descriptive norms, injunctive norms, response efficacy, and attitudes, but not self-efficacy (Table 2). Post hoc LSD comparisons revealed that participants in the control condition reported significantly lower descriptive norms and response efficacy compared with those in the vaccine-acceptance and mixed comment conditions. They also reported higher injunctive norms and attitudes than those in the vaccine-hesitancy condition, but lower than those in the vaccine-acceptance condition.

Table 5. Conditional Indirect Effect of Comments on Vaccine Intentions.

	Mediator	Moderator	B	SE	Boot 95% CI
			Conditional indirect effect		
C1 vs. C2	Descriptive norms	Out-group	.01	.01	−.021; .023
		In-group	.02	.06	−.106; .134
	Injunctive norms	Out-group	.04	.04	−.039; .119
		In-group	.25	.11	.077; .514
	Self-efficacy	Out-group	−.04	.03	−.115; .002
		In-group	.07	.06	−.001; .303
	Response efficacy	Out-group	−.06	.04	−.148; .001
		In-group	.15	.08	.028; .331
	Attitudes	Out-group	−.01	.05	−.114; .083
		In-group	.38	.09	.212; .565
C2 vs. C3	Descriptive norms	Out-group	.03	.04	−.036; .127
		In-group	.02	.02	−.073; .017
	Injunctive norms	Out-group	.03	.04	−.048; .110
		In-group	−.05	.03	−.133; .003
	Self-efficacy	Out-group	.09	.07	−.007; .211
		In-group	−.03	.03	−.095; .022
	Response efficacy	Out-group	.07	.05	−.018; .170
		In-group	−.06	.03	−.127; −.008
	Attitudes	Out-group	.09	.08	−.037; .277
		In-group	−.09	.04	−.182; −.016

Discussion

This study aimed to test whether and how comments posted to online news stories may influence COVID-19 vaccine intentions as guided by the IM and the SIDE model. Specifically, we tested the indirect effect of comments on vaccine intentions via perceived norms, perceived efficacy, and attitudes, while considering the moderating role of social identification. Our study was conducted in Vietnam when the Delta variant spread to the country and mixed information about vaccine efficacy and side effects was widely circulated in the media. Thus, data of this study reflected a snapshot of a critical turning point of the pandemic. Our interpretations of the results should therefore be considered within this particular time frame.

Results showed that exposure to vaccine-acceptance comments predicted higher perceived norms, perceived efficacy, and more positive attitudes compared with exposure to vaccine-hesitancy comments. Exposure to mixed comments resulted in significantly higher perceived norms, perceived efficacy, and more positive attitudes than exposure to vaccine-hesitancy comments. The differences in perceived norms,

perceived efficacy, and attitudes were observed between exposure to only the news stories and exposure to both the news stories and different types of comments. Specifically, whereas vaccine-hesitancy comments reduced injunctive norms compared with the news stories, vaccine-acceptance comments increased descriptive norms compared with the news stories. Thus, data showed that comments swayed perceptions of vaccination, depending on commenters' behavioral cues. Additionally, comments affected perceptions beyond exposure to only the news stories.

There was no significant difference between exposure to mixed comments and vaccine-acceptance comments. This suggested that mixed comments were perceived as positive toward the vaccine, which also rejected the negativity bias assumption. These results might be due to a general favorableness toward vaccination in Vietnam because scholars found that the baseline level of vaccine hesitancy was lower in developing countries than developed countries (Bhopal & Nielsen, 2021; Solís Arce et al., 2021). Perhaps, the study context might have had a significant bearing on these results, such that participants paid more attention to vaccine-acceptance cues in mixed comments to be consistent with their existing positive beliefs about vaccination.

In the context of opposite one-sided comments, the effect of comments on perceived norms and attitudes was only significant among participants who perceived commenters as in-group members. These results indicated a *contingent* moderation pattern, in which the nonzero relationship between exposure to comments and the outcome variables was isolated to only participants who identified with the commenters (Holbert & Park, 2020). Such results were in line with the SIDE model (Reicher et al., 1995). However, data did not show the same moderation pattern when the dependent variables were self-efficacy and response efficacy. Participants who perceived commenters as in-group members reported higher self-efficacy and response efficacy when viewing vaccine-acceptance comments as compared with those viewing vaccine-hesitancy comments. Meanwhile, those who perceived commenters as out-group members reported higher self-efficacy and response efficacy when viewing vaccine-hesitancy comments than when viewing vaccine-acceptance comments. Prior research also reported similar findings (Terry & Hogg, 1996). Researchers explained that, unlike perceived norms, efficacy rested mostly within individuals' perceptions of their personal control of the behavior rather than being guided by group prototypes and norms (Turner et al., 1987). Thus, perceptions of commenters as out-group members might motivate participants to estimate their efficacy in the opposite direction to that of the commenters. Additionally, no interaction effect was found in the context of mixed comments and vaccine-hesitancy comments. About mixed comments and vaccine-acceptance comments, the interaction effects were significant for some proximal IM variables. However, these results seemed inconclusive because of the absence of the significant main effect of comments. Future research can explore these circumstances to provide a clearer picture.

Data of the one-sided comment conditions indicated that injunctive norms, response efficacy, and attitudes were mediators among participants who identified with the commenters. Results supported the feasibility of combining the IM and the SIDE model to examine online news comments and vaccine behaviors, particularly when the behavioral directions in comments unanimously showed commenters' intentions to accept or reject vaccination. To some extent, results were consistent with findings from similar studies

conducted in other health behavioral contexts, which suggested that comments could be a form of online social influence affecting health behaviors (Duong, Vu, & Nguyen, 2021; Walther et al., 2010).

Results offered theoretical implications related to the IM. Despite being a prominent theoretical framework guiding health communication research (Fishbein & Cappella, 2006), the IM has received critiques related to the lack of experimental evidence (Hardeman et al., 2002; Sniehotta, Presseau, & Araújo-Soares, 2014) and the inconclusive contribution of the norm construct (White, Smith, Terry, Greenslade, & McKimmie, 2009). Moreover, most studies aimed to improve the model's predictive power by identifying additional proximal variables, including social identification (Fishbein & Ajzen, 2011). Although incorporating social identification as a determinant of intentions explained some variances in intentions, this contribution tended to be small (Fishbein & Ajzen, 2011). Theorists proposed that a more fruitful approach was to consider social identification as a moderator (Fishbein & Ajzen, 2011; Terry & Hogg, 1996; White et al., 2009). However, they acknowledged that integrating theoretical approaches to account for this proposition could be challenging. The present study responded to these issues by using an experiment to investigate online news comments as a distal variable, while conceptualizing social identification as a moderator utilizing the SIDE model—a solid theoretical model in computer-mediated communication (Huang & Li, 2016). This study also extended the IM research to the international health context of Vietnam, which has rarely been studied. Overall, results suggested that the IM and the SIDE model could be successfully applied to the context of online news consumption and vaccination, particularly when news consumers' bipolar opinions about vaccine intentions were salient.

Practitioners use news media as primary tools to disseminate vaccine information (Viswanath et al., 2021). This study alerted practitioners that social information in the form of news user comments available on mainstream news sites could shape or alter perceptions linked to vaccine intentions. Practitioners working to embed vaccine motivation messages in news stories might consider highlighting vaccine-acceptance comments to leverage online social influence to motivate positive perceptions and behavior. They should consider which type of norm is at play in their intervention contexts. For example, results revealed that behavioral cues proscribing vaccination (i.e., injunctive norms) might be more influential than behavioral cues prescribing the behavior (i.e., descriptive norms), which confirmed that COVID-19 preventive behaviors in Vietnam were likely influenced by injunctive norms (Duong, Nguyen, McFarlane, Nguyen, & Nguyen, 2021). Therefore, crafting messages projecting injunctive norms might be an option for vaccination campaigns. Practitioners might also consider addressing vaccine uncertainty by providing information that highlights the experts' consensus on vaccine efficacy and safety (van der Linden, Clarke, & Maibach, 2015). Besides, observing the dialogues of news consumers may help practitioners learn the tactics used by both vaccine promoters and rejecters to adapt their campaign messages (Meyer et al., 2019).

This study has limitations. The sample consisted of young adults who were not representative of the population. Because young adults generally experienced lower risk of COVID-19 illness than older people, they might be more likely to resist vaccination. Thus, future studies should include other population segments using representative samples. This study did not measure actual vaccination behavior, but relied on behavioral intentions. It should be noted that the study was conducted when vaccines were not available for most Vietnamese people. Therefore, vaccine intentions were the best proxy for vaccination behavior.

Also, perceptions and vaccine intentions were measured immediately after message exposure; thus, the long-term effect of the exposure remains an empirical question. Finally, this study did not consider participants' emotions that might be salient in such a devastating health crisis. Future studies should consider the role of emotions in affecting vaccine perceptions and behavior.

Conclusion

This study showed that news user comments could be a form of online social influence affecting COVID-19 vaccine intentions. It also showed the condition and mechanisms characterizing this association, which contributed to extending the reasoned action approach literature to the online media environment in an international health setting. Because people often turn to the governmental sources for health information in times of health crises (Lazarus et al., 2021; van Velsen et al., 2012), using mainstream online news media to motivate COVID-19 vaccination remains an important strategy for practitioners in developing countries. This strategy requires practitioners to address any potential forms of social influence that may affect vaccine perceptions and behaviors, including news user comments, as indicated in the present study.

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