Apuntes 96, 129-162
ISSN: 0252-1865
eISSN: 2223-1757
doi: 10.21678/apuntes.96.1985

Artículo enviado el 11 de diciembre de 2022
Artículo aceptado para publicación el 14 de noviembre de 2023

Individual predictors of COVID-19 disinformation detection and sharing via WhatsApp

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Abstract. This study examines cognitive, socio-political, and socio-demographic predictors of the evaluation and willingness to share disinformation about COVID-19 via WhatsApp. Using an online survey, a convenience sample of 553 Costa Rican adults were exposed to disinformation about vaccines and the state's response to the pandemic. Results show that people who support authoritarian, conservative and pro-state ideologies, and those with low reflective thinking, were more likely to believe and share disinformation. Moreover, among people with low reflective thinking, older people were more likely to detect disinformation. Finally, highly religious individuals and younger conservatives with lower education expressed more willingness to share disinformation.

Keywords: disinformation; political ideology; cognition; evaluation; sharing; COVID-19

Predictores individuales para la detección y difusión de desinformación sobre COVID-19 a través de WhatsApp

Este estudio examina los predictores cognitivos, sociopolíticos y sociodemográficos de la evaluación y disposición para difundir desinformación sobre COVID-19 a través de WhatsApp. Utilizando una encuesta en línea, una muestra conveniente de 553 adultos costarricenses fue expuesta a desinformación sobre vacunas y la respuesta estatal a la pandemia. Los

resultados muestran que las personas que respaldan ideologías autoritarias, conservadoras y proestatales, y aquellas con un pensamiento reflexivo bajo, eran más propensas a creer y compartir desinformación. Además, entre las personas con bajo pensamiento reflexivo, los adultos mayores eran más propensos a detectar desinformación. Además, los individuos altamente religiosos y los jóvenes conservadores con menor educación expresaron una mayor disposición para compartir desinformación.

Palabras clave: desinformación; ideología política; cognición; evaluación; compartir; COVID-19

Introduction

Concerns about the spread and effects of disinformation and so-called fake news have increased in recent years. As humanity faces its worst pandemic in 100 years in the form of COVID-19, disinformation related to this global health crisis of poses a severe risk to public health (Brennen et al. 2020). In the words of Antonio Guterres, the Secretary-General of the United Nations, on March 28, 2020, "Our common enemy is COVID-19, but our enemy is also an 'infodemic' of disinformation." Scholars have also warned about this infodemic, which causes confusion and anxiety among people around the world (Tagliabue et al., 2020). In the case of Costa Rica, for example, social media is rife with conspiracy theories and disinformation involving the likes of non-scientifically proven remedies and allegations of potential dangers associated with the vaccines (Tristán & Sibaja, 2021).

In this context, citizens can play a crucial role in the fight against disinformation by making accurate judgements of what is true and false and deciding not to spread disinformation to others. This study contributes to the body of work on the infodemic in two important ways. First, we identify cognitive, socio-political, and socio-demographic factors that can influence whether people believe disinformation about the COVID-19 pandemic. In this way, we supplement research that has tended to emphasize political issues as the main factors shaping people's inclination to share disinformation (e.g., Tardáguila, 2019; Valenzuela, Bachmann & Bargsted, 2021). Second, we focus on the spread of disinformation via WhatsApp given this platform's centrality to daily communication in the Global South (Gómez Cruz & Harindranath, 2020).

Our study consisted of an online survey in which a total of 564 participants read a range of disinformation content about COVID-19. We assessed participants' individual evaluations of the veracity of these messages, as well as their willingness to share them via WhatsApp.

Defining disinformation

Definitions of disinformation abound and often differ. According to UNESCO, disinformation refers to "information that is false, and the person who is disseminating it knows it is false. It is a deliberate, intentional lie, and points to people being actively disinformed by malicious actors" (Ireton & Posetti 2018, p. 46). Disinformation should be distinguished from misinformation, which can be defined as "information that is false, but the person who is disseminating it believes that it is true" (Ireton & Posetti 2018, p. 45-46). Based on this distinction, fake news can be considered a prime example of disinformation. As Tandoc Jr. (2021) shows, scholarly

definitions of fake news typically share two main components: the level of facticity and the intention with which a content is shared. Yet fake news is not the only or necessarily the most common form of disinformation. Centering on the context of the pandemic, in this paper we investigate other forms of disinformation that depart from the traditional pseudo-news format and that are typically shared via WhatsApp.

Some studies have shown that people are critical of the quality of current journalism they have access to, and tend to distrust content that circulates on social media platforms (Wagner & Boczkowski, 2019). Moreover, people have begun adapting to a climate of widespread ambivalence regarding the information they receive (Wenzel, 2019). This has led the public to implement strategies that include relying on personal experience and knowledge to assess the veracity of content, looking for multiple and alternative information sources (including from different ideological positions), and seeking confirmation via fact-checking initiatives or trusted individuals within their social networks.

In the case of WhatsApp, research suggests that sharing practices are distributed equally across social groups and can have significant influence on learning about political issues (Valenzuela et al. 2021). Studies in Latin America have typically focused on electoral campaigns and have shown that WhatsApp is crucial in the spread of disinformation (Tardáguila, 2019). These studies also detect that, given the nature of communication exchanges on WhatsApp, most disinformation content tends to circulate through images with textual content (e.g., Resende et al., 2019).

Political ideology as a predictor of disinformation evaluation and sharing

Current evidence posits that political ideology plays an important role in the belief in and dissemination of false information, especially in the disinformation domain of fake news (see, for example, Guess, Nagler & Tucker, 2019). Although political ideology has multiple definitions in the social sciences (see Bobbio, Matteuci & Paquino, 2004), it can be safely inferred that ideology refers to the political component of a system of beliefs (Sartori, 1995). Traditionally, ideology has been associated with left-wing and right-wing orientations. These categories are useful for comparing voters, political parties, and elites. However, the use of both orientations is dependent on historical contexts and moments, and is not applicable to all societies. Instead, multidimensional representations are required to understand debates about secularity–religiousness, authoritarianism–democracy, and ethnicity–integration, among other counterpositions (Sartori, 2005).

Drawing on the work of Altman et al. (2009), who proposed a multidimensional perspective of ideology for Latin American political parties and systems, Pignataro and Cascante (2018) studied the ideology of Costa Rican citizens using three ideological dimensions that focus on the role of the state in the economy, in society, and in relation to human rights: democracy vs. authoritarianism, liberal vs. conservative, and pro-state vs. pro-market. The first ideological dimension (authoritarianism vs. democracy) considers whether the state should increase criminal penalties, regulate the media and journalism, restrict immigration, and allow workers to be part of a labor union, among other considers. The second ideological dimension (liberal vs. conservative) characterizes conservatives as individuals who defend the retention of Catholicism as the official religion of the Costa Rican state while opposing same-sex marriage, in vitro fertilization, the legal use and distribution of marihuana, and environmental protection by private corporations. According to the third ideological dimension (pro-state vs. pro-market), individuals who favor statism believe that the state must guarantee free access to health care and education, tackle income inequality, regulate markets, own essential companies and industries, and protect national producers of goods and services. By contrast, pro-market individuals defend greater economic liberalization along with a free and unregulated market in the global economy. In our study, we drew on the multidimensional approach of Pignataro and Cascante to examine how political ideology relates to disinformation detection and sharing.

The literature concerning authoritarian ideology and disinformation has shown that people with authoritarian attitudes consume a less diverse diet of news sources (Sindermann et al., 2020), are more tolerant of ideologically consonant politicians who share false information (De Keersmaecker & Roets, 2019), and are more resistant to changing their beliefs after exposure to corrective information (Rollwage, Dolan, & Fleming, 2018). Other studies have suggested that because authoritarian-minded individuals are skeptical about the functioning of democratic institutions—including low media trust—they are more likely to believe and accept disinformation (e.g., Freelon, Marwick & Kreiss, 2020).

Evidence on the role of conservatism in the disinformation domain has shown, on the one hand, that both conservatives and liberals belief false information if it reinforces their views (Van Bavel & Pereira, 2018). On the other hand, several studies have found that conservatives are more likely than liberals to believe and share fake news (e.g., Deppe et al., 2015; Pennycook & Rand, 2019). Several explanations have been proposed for why this may the case. Compared to liberals, conservatives appear more

sensitive to threats and to believing negative information (Fessler, Pisor & Holbrook, 2017); more associated with close-minded (Sinclair, Stanley & Slei, 2020), dogmatic (Jost et al., 2003), and intuitive thinking styles (Pennycook & Rand, 2019); and less receptive to ideologically dissonant information (Sinclair et al., 2020). Moreover, conservatives are more susceptible to believing conspiracy theories (Douglas et al., 2019).

To the best of our knowledge, no previous work has shown how pro-state and pro-market individuals respond to and disseminate disinformation. In this context, one purpose of our study is to shed some light on whether this understudied but important dimension of political ideology shapes the individual evaluation and sharing of disinformation in the context of the COVID-19 pandemic.

Reflective thinking, digital information skills and disinformation

Cognitive factors that allow the identification of disinformation are essential to understanding the effects that these messages have on people's compliance with pandemic protection guidelines. Specifically, this study focuses on the capacity for reflective thinking and on the digital information skills associated with the ability to distinguish between true and false information.

Two levels of socio-cognitive processing have been identified in the literature: controlled and automatic. The former uses heuristics, cognitive shortcuts or so-called biases, which allow people to respond to information quickly or even unconsciously. The second level of processing requires reflective evaluation and favors deliberation as a prior step to decision-making: it is a conscious activity and demands greater cognitive resources for its execution (e.g., Kahneman, 2011). Several studies have investigated the effect of this type of processing on the identification of disinformation (e.g., Bago, Rand & Pennycook, 2020). The evidence suggests that reflective processing promotes the recognition of fake news and improves the distinction between false and true information. Relatedly, Mosleh et al. (2021) found that people with higher reflexive competencies avoid following Twitter profiles that reproduce disinformation.

As another important cognitive factor, digital information skills refer to the extent to which people can identify true and reliable information, and include the possession of sufficient knowledge and operational command of the internet to allow searches for information, the use of discretion for information selection, the identification of reliable sources, and the recognition of false information (Beauvais, 2022; Jones-Jang, Mortensen & Liu, 2021; Van Deursen & Van Dijk, 2014). Unfortunately, not all adults possess

the basic information skills required to process disinformation effectively (Van Deursen & Van Dijk, 2009). In this article we argue that it is crucial to study people´s digital information skills to improve our understanding of how people accept and share disinformation.

Socio-demographics as moderators of disinformation detection and dissemination

Despite its many contributions, research on disinformation has paid little attention to the role of sociodemographic characteristics, predominantly considering them control variables (see Guess et al., 2019). The few studies that have prioritized demographics have focused on gender, age, and education—and mostly in the domain of fake news. The scant evidence arising from these studies indicates that females trust fake news more than males (e.g., Shu, Wang & Liu, 2018); that older people believe and share fake news more because they have less-developed information skills with which to distinguish facts from false information (e.g., Guess et al., 2019); and that education is positively associated with a greater ability to recognize and refute fake news, and with a lower propensity to share disinformation (e.g., Jones-Jang et al., 2021).

To supplement these findings, in this study we considered the significance of gender, age, and education in shaping how individuals' cognitive and socio-political characteristics influence the detection and dissemination of COVID-19-related disinformation via WhatsApp. We also included other variables that are important for human development in the case of Costa Rica, particularly geographic residence and subjective income (i.e., whether a person's income is sufficient to meet their household needs). We studied subjective income as a proxy of socio-economic status—as opposed to using an objective measure—based on the premise that it more accurately captures subtle characteristics of socio-economic status (Operario, Adler, & Williams, 2004). Moreover, for a given population, subjective income does not impose on respondents' predetermined assumptions about the relevance of socio-economic processes (Howe et al., 2011).

Finally, we studied the moderating role of religiousness. Religious fundamentalism has been positively associated with fake news acceptance because fundamentalist individuals engage less in analytical and open-minded thinking (Bronstein et al., 2019). Given that 77% of Costa Ricans have a religious affiliation (CIEP, 2018), we studied whether religiousness —as a more prevalent characteristic in the population than religious fundamentalism—has similar effects.

The present study

Based on the above, we posed two main research questions:

1. What are the individual predictors of disinformation detection in relation to COVID-19?
2. What are the individual predictors of willingness to share disinformation about COVID-19 via WhatsApp?

Specifically, the study is guided by the following research questions:
1a. To what extent do ideology, reflective thinking, and digital information skills predict the evaluation of disinformation messages about COVID-19?
1b. To what extent are these associations moderated by socio-demographic characteristics, subjective income, and religiousness?
2a. To what extent do ideology, reflective thinking, and digital information skills predict the intention to share disinformation messages about COVID-19 via WhatsApp?
2b. To what extent are these associations moderated by socio-demographic characteristics, subjective income, and religiousness?

Method

Study design

To address our research questions we conducted an online survey, in June 2021. Participants read several disinformation messages related to COVID-19, which allowed us to examine individual evaluations of veracity as well as participants´ willingness to share disinformation via WhatsApp.

Sample

We recruited a convenience sample of Costa Rican adults via Facebook and paid advertising to seek the highest possible recruitment of diverse users. In total, 564 people gave their consent to participate. Seven participants were excluded because they incorrectly answered a single-response attention check question (in which they were required to select the name of the Costa Rican minister of health. Four individuals were also excluded because they did not use WhatsApp. As a result, the final sample consisted of 553 people. Of these, 74% identified themselves as women, with an age range between 17 and 75 (M = 37.38, SD = 13.16). With regard to education, 3% of the sample have completed primary education, 17% secondary education, and 80% university education. Geographically, 51% of participants reside in the province of San José, 14% in Alajuela, 11% in Heredia, 13% in Cartago, 4% in Puntarenas, 4% in Guanacaste and 3% in Limón. Historically, social inequality has affected more Costa Ricans living in the coastal provinces

of Limón, Puntarenas and Guanacaste. It should be noted that the sociodemographic distribution of our sample is not representative of the Costa Rican adult population (see Table 1).

Table 1
Sociodemographic characteristics of study sample and Costa Rican population

	Sample	**Population**
Gender		
Female	74%	50%
Male	26%	50%
Total	100%	100%
Age in groups		
18 - 34	47%	37%
35 - 54	41%	35%
55 +	12%	28%
Total	100%	100%
Education		
Elementary	3%	42%
Secondary	17%	37%
University	80%	21%
Total	100%	100%
Province		
San José	51%	32%
Alajuela	14%	20%
Cartago	13%	11%
Heredia	11%	10%
Guanacaste	4%	8%
Puntarenas	4%	10%
Limón	3%	10%

Source: Encuesta Nacional de Hogares 2019. Available in: http://www.inec.go.cr/.

Stimulus materials

The participants read four disinformation messages about COVID-19. After reading each message, they reported how false or truthful they assessed it to be, and how willing would be they to share the message via WhatsApp. For this purpose we used a dataset of real-world disinformation messages about COVID-19 that were fact-checked by the Costa Rican newspaper *La Nación* two months before the beginning of our study (N = 40). Our analysis showed

that most of the disinformation consisted of short texts—between 40 and 50 words—that were accompanied by visual elements. A small proportion of the messages consisted of audio or video formats—and for this reason our stimuli comprised only text-based disinformation. Furthermore, most of the textual messages did not follow the typical pseudo-journalistic design that characterizes fake news (see Egelhofer & Lecheler, 2019). Therefore, our stimulus material can be characterized as a form of text-based disinformation that is distinct from fake news. Thematically, we found that most of the disinformation centered on two themes around COVID-19: fabricated content about the dangerous side-effects of vaccines, and false information about how the Costa Rican state responds to the sanitary crisis.

Based on the content analysis, we designed four text-based disinformation stimuli—two about vaccines and two about the state pandemic response. The content, length, structure, and format of the stimuli mirrored the disinformation messages that were fact-checked by *La Nación.* Also, the stimuli and their design were adapted to resemble messages circulating via WhatsApp. Moreover, all stimuli were similar in terms of the type of language used and the emotional nature of the words. Because of the aforementioned rigorous criteria that we used to construct the intended four stimuli, we deemed it unnecessary to pilot a larger set of messages. For the sake of space, the two stimuli about vaccines and the two about the state response can be read in Appendix A.

Procedure

First, individuals gave their consent to participate in the study. Then, a questionnaire was administered to measure socio-demographic characteristics and subjective income. It also contained an attention check question and a filter question about daily use of WhatsApp. Afterwards, participants read the four disinformation messages in random order—to control for order effects. After reading each stimulus, the participants reported their individual evaluation of the veracity of the message, followed by their intention to share it via WhatsApp. Afterwards, the survey measured political ideology, religiousness, reflective thinking and digital information skills. The study concluded with a debriefing. All participants who gave their initial consent completed the study—with an average completion time of 14.02 minutes.

Measures

Dependent variables

To measure individual evaluation about the veracity of each disinformation stimulus, participants read the following text: "On a scale of 1 to 5, in which

1 means "not at all true" and 5 means "completely true," in your judgment, how false or true was the information you read?" For analysis purposes, the individual evaluations of the two stimuli about vaccines were grouped as a single variable (M = 1.69, SD = .90). The same procedure was carried out for the two stimuli about state pandemic response (M = 2.36, SD = .99).

To measure the intention to disinform about COVID-19 via WhatsApp, participants answered the following question: "On a score between 0 and 10, how willing would you be to share this information via WhatsApp?" The intention to share disinformation about vaccines had a mean score of 1.14 (SD = 2.24), whereas sharing disinformation about state pandemic response had a mean value of 1.69 (SD = 2.50).

Independent variables

To measure political ideology, we used the 14-item scale developed by Pignataro and Cascante (2014). The scale is a 5-point Likert scale (1 = completely disagree, 5 = completely agree) and measures three dimensions of ideology. First, there are four items in which low values indicate support of democracy and high values, authoritarian ideology. An example of these items is "The state must regulate news media and the Internet." Second, five items measure conservative (low values) vs. liberal ideology (high values). An example of these items is "I agree with same-sex marriage." And third, five items measure pro-market (low values) vs. pro-state ideology (high values). An item example is "The state must guarantee free access to health care." An exploratory factor analysis with a maximum likelihood extraction loaded the 14 items in the expected three factors. The first factor had an eigenvalue of 3.0 and explained 21.4% of the variance, followed by the second factor with an eigenvalue of 2.34 (16.7% explained variance), and then by the third factor with a value of 1.35 (9.6% explained variance). The internal consistency coefficients were .55 (authoritarian vs. democratic ideology; M = 2.58, SD = 1.0), .75 (conservative vs liberal; M = 4.0, SD = .97) and .65 (pro-market vs. pro-state; M = 3.52, SD = .74). The aforementioned mean score of each ideology subscale indicates that the study sample was more liberal and pro-state, and was almost equally split between democratic and authoritarian-oriented individuals. Appendix B shows all items on the political ideology scale.

To measure reflective thinking, we used the Cognitive Reflection Test-2 (CRT-2). This instrument measures an individual´s propensity to override an intuitive, but incorrect, response with a more analytical correct response (see Thomson & Oppenheimer, 2016). CRT-2 questions do not require a high level of mathematical sophistication to generate a correct response.

An example question is "If you are running a race and you pass the person in second place, what place are you in?" The intuitive answer is first, but the correct answer is second. We coded the responses to the four questions with a value of 0 if the response was incorrect and 1 for a correct answer. We added up the number of correct responses in the CRT-2, which yielded a reflective thinking index with a range from 0 to 4 (M = 1.97, SD = 1.04).

To measure digital information skills, we used the 5-item subscale of the Internet Skills Scale (Van Deursen, Helsper & Eynon, 2015), which is a 5-point Likert scale (1 = completely disagree, 5 = completely agree). An example of an item is "Sometimes I end up on websites without knowing how I got there (reversed coded)." The digital information skills index had a satisfactory internal consistency coefficient of .74 (M = 3.98, SD = .76).

Moderator variables

To measure religiousness, participants reported how religious they consider themselves on a scale of 0 to 10 points (M = 4.21, SD = 3.40). We used a subjective income measure as a proxy to measure socioeconomic status. We asked participants whether their monthly income is sufficient to meet their household´s needs. According to the data, 14% of the sample said that their monthly income is not enough and they have great difficulties, 26% said it is enough but they have some difficulties, 34% feel it is enough and they don't have great difficulties, and 26% have enough income and can save.

For analytical purposes, age was included as a continuous moderator and gender as a dichotomous moderator. We created a dummy variable for geographical residence, in which 0 represents the three coastal provinces and 1 the four central provinces. Given the overrepresentation of higher education attainment in our sample, we created a dummy variable in which 0 represents non-university education and 1, university education.

Data analysis

To answer Research Questions 1a, 1b and 2a, 2b we conducted two hierarchical linear regressions using the stepwise method—one for the vaccines theme and another for state pandemic response. In Model 1, we predicted participants' evaluation of the veracity of disinformation messages by gender, age, geographical residence, education, subjective income, and religiosity. In Model 2, we incorporated political ideology, reflective thinking, and digital information skills. For the sake of space in the text, we interpreted the results of the second model to answer research question 1a for each theme. To answer Research Question 1b, Model 3 estimated interaction terms between our predictors and the moderators (socio-demographics,

subjective income, and religiosity). We report only the moderators that had a significant effect on the relationship between the predictors and the dependent variable. For the sake of parsimony, we plotted marginal means to interpret the interaction terms. To answer Research Questions 2a and 2b which address the willingness to share disinformation via WhatsApp, we conducted a regression for each theme using the same hierarchical modeling, predictors, and moderators that we employed for Questions 1a and1b.

Results

Cognitive and ideological predictors of the veracity evaluation of disinformation

The second regression model in Table 2 shows the findings of Research Question 1a: that is, the extent to which political ideology, reflective thinking, and digital information skills predict the evaluation of disinformation messages about COVID-19. We found that believing disinformation about vaccines was more likely among individuals who support authoritarian (β = .10, $p < .01$) and conservative ideologies (β = -.18, $p < .01$). In the case of disinformation about the state pandemic response, supporting authoritarian (β = .15, $p < .01$) and pro-state ideologies (β = .16, $p < .01$) were positively associated with believing disinformation.

Table 2
Hierarchical regressions for evaluation of veracity of disinformation about COVID-19

	Veracity evaluation									
	Vaccines					State response				
Predictors	R^2	F gl	β	SE	95% IC	R^2	F gl	β	SE	95% IC
Modcl 1	.15	15.4** (6,544)				.09	8.79**(6,544)			
Gender			-.17*	.08	-.33, .01			.06	.10	-.12, .25
Age			-.01	.01	-.01, .002			-.01*	.01	-.01, -.001
Geographical residence			-.02	.12	-.25, .21			.17	.14	-.10, .44
Education			-.43**	.10	-.62, -.24			-.46**	.11	-.68, -.24
Subjective income			-.17**	.04	-.25, -.10			-.16**	.04	-.25, -.08
Religiousness			.04**	.01	.01, .06			.01	.01	-.02,.03
Model 2	.19	11.7** (11,539)				.13	7.20**(11,539)			
Gender			-.13	.08	-.29, .03			.11	.10	-.08, .29
Age			-.01*	.01	-.01, -.001			-.01*	.01	-.01, -.007
Geographical residence			.05	.12	-.18, .28			.26	.14	-.01, .52
Education			-.30**	.10	-.50, -.11			-.36**	.11	-.58, -.13
Subjective income			-.12**	.04	-.04, -3.08			-.11*	.05	-.20, -.02
Religiousness			.01	.01	-.01, .04			-.001	.01	-.03, .03
Democratic vs. authoritarian			.10**	.04	.03, .17			.15**	.04	.06, .23
Conservative vs. liberal			-.18**	.04	-.27, -.10			-.07	.05	-.18, .03
Free Market vs. State			.09	.05	-.03, .19			.16**	.06	.04, .27
Reflective thinking			-.04	.03	-.11, -.03			.02	.04	-.06, .10
Digital information skills			-.02	.05	-.12,.08			-.05	.06	-.16, .06

* p < .05. **p < .01
Note: The reference groups for the dummy variables are: gender (female), geographical residence (coastal provinces), education (non-university).
Source: compiled by authors

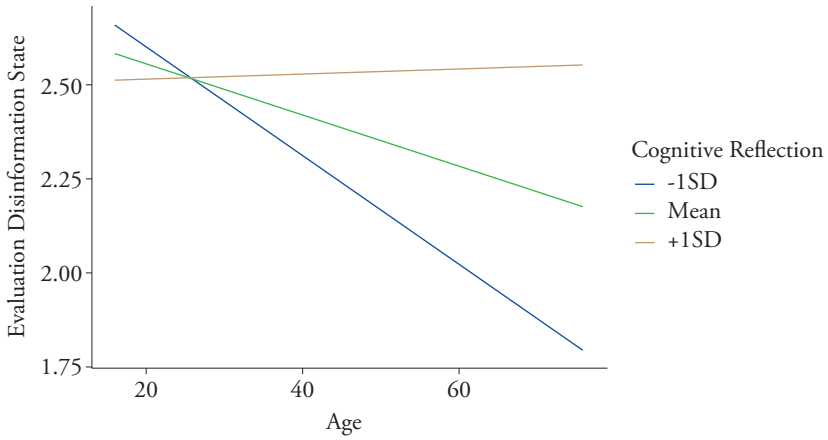
The moderating role of socio-demographics, subjective income, and religiousness on the veracity evaluation of disinformation

Next, we tested whether socio-demographic characteristics, subjective income, and religiousness moderated the effects of cognitive and socio-political factors on the evaluation of disinformation veracity (research question 1b). In the case of vaccines, although the regression model with the

interaction terms was significant, R^2 = .22, F (41,509) = 3.69, p < .01, the results indicated non-significant effects for all the moderators.

Age was the only variable that moderated the relationship between reflective thinking and the evaluation of the veracity of disinformation about the state pandemic response, β = .01, SE = .003, 95 CI 95% = .001 – .01, p = .02; R^2 = .19, F (41,509) = 2.82, p < .01. The plotted marginal means in Figure 1 show that if individuals have lower reflective thinking, more accurate judgements about disinformation will have increased with age (-1 *SD* age, M = 2.54, SE = .15, CI 95% = 2.25 – 2.84; +1 *SD* age, M = 2.16, SE = .14, CI 95% = 1.88 – 2.44).

Figure 1
Moderating effect of age on relationship between reflective thinking and evaluation of disinformation about state response



Source: compiled by authors

Cognitive and ideological predictors of the intention to share disinformation via WhatsApp

We proceeded to answer Research Question 2a, which concerns the extent to which political ideology, reflective thinking, and digital information skills predict the intention to share disinformation about COVID-19 via WhatsApp. The results in Table 3 show that, for the vaccines issue, a willingness to share disinformation was more likely among people who support authoritarian (β = .22, p < .05), are conservative (β = -.62, p < .01), subscribe to pro-state ideologies (β = .37, p < .01), and exhibit lower reflective thinking (β = -.24, p < .01).

Our findings were similar in the case of disinformation about the state's pandemic response. Support for authoritarian (β = .39, p < .01), conservative

(β = -.33, p < .01) and pro-state ideologies (β = .48, p < .01), in addition to lower reflective thinking (β = -.21, p < .05), were positively associated with sharing disinformation via WhatsApp.

Table 3
Hierarchical regressions of the intention to share disinformation about COVID-19 via WhatsApp

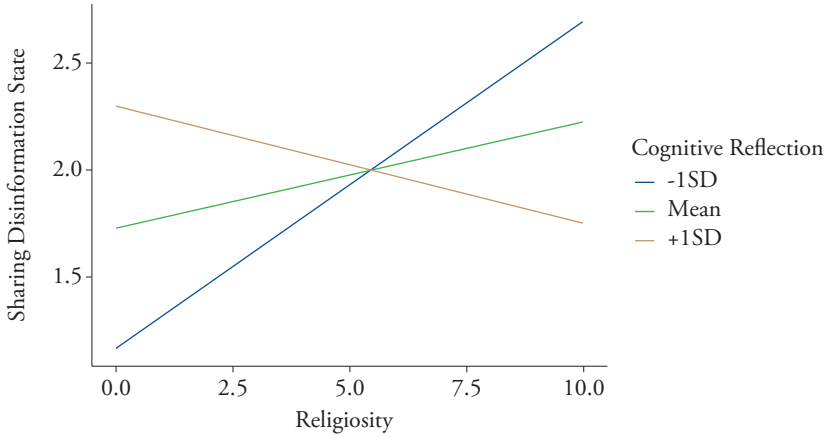
	Sharing intention									
	Vaccines					State response				
Predictors	R^2	F gl	β	SE	95% IC	R^2	F gl	β	SE	95% IC
Modcl 1	.20	23.1** (6,544)				.18	20.0**(6,544)			
Gender			-.40*	.20	-.80, -.01			-.05	.22	-.49, .39
Age			-.002	.01	-.02, .01			-.003	.01	-.01, .02
Geographic residence			-.23	.29	-80, .33			-.19	.32	-.83, .44
Education			-1.31**	.24	-1.77, -.84			-1.50**	.27	-2.03 -.98
Subjective income			-.51**	.09	-.69, -.33			-.54**	.10	-.75, -.34
Religiousness			.11**	.02	.05, .16			.10**	.3	.04, .15
Model 2	.29	20.3** (11,539)				.25	16.4**(11,539)			
Gender			-.22	.19	-.59, .16			.15	.22	-.28, .58
Age			-.01*	.01	-.03, -.002			-.008	.01	-.02, .01
Geographic residence			.02	.28	-.52, .56			.05	.32	-.57, .67
Education			-.82**	.23	-1.28, -.37			-1.07**	.26	-1.59, -.55
Subjective income			-.31**	.09	-.49, -.13			-.34**	.10	-.55, -.14
Religiousness			.03	.03	-.03, .09			.05	.03	-.01, .12
Democratic vs. Authoritarian			.22*	.09	.05,.39			.39**	.10	.20, .58
Conservative vs. Liberal			-.62**	.11	-.83, -.41			-.33**	.12	-.57, -.09
Free Market vs. State			.37**	.12	.14, .60			.48**	.13	.22, .74
Reflective thinking			-.24**	.08	-.40,-.08			-.21*	.09	-.39, -.02
Digital information skills			-.19	.12	-.41, .04			-.20	.13	-.46, .06

* p < .05. **p < .01
Note: The reference groups for the dummy variables are: gender (female), geographic residence (coastal provinces), education (non-university).
Source: compiled by authors

The moderating effects of socio-demographics, subjective income, and religiousness on the intention to share disinformation

Finally, we tested whether the same moderators influenced the associations between the predictors of interest and the willingness to share disinformation about COVID-19 via WhatsApp (research question 2b). Religiousness was the only variable that moderated the association between reflective thinking and sharing disinformation about the state's pandemic response, β = -.10, *SE* = .03, CI 95% = -.16 – -.05, $p < .01$; R^2 = .30, F (41,509) = 5.76, $p < .01$. Figure 2 shows that, for people with lower reflective thinking, disinformation sharing was greater among more religious individuals (-1 *SD* religiousness, *M* = 1.29, *SE* = .33, CI 95% = .63 – 1.94; +1 *SD* religiousness, *M* = 2.34, *SE* = .32, CI 95% = 1.72 – 2.96). Conversely, among individuals with high reflective thinking, the more religious were less prone to share disinformation (-1 *SD*, *M* = 2.25, *SE* = .31, CI 95% = 1.64 – 2.87; +1 *SD*, *M* = 1.88, *SE* = .30, CI 95% = 1.30 – 2.46).

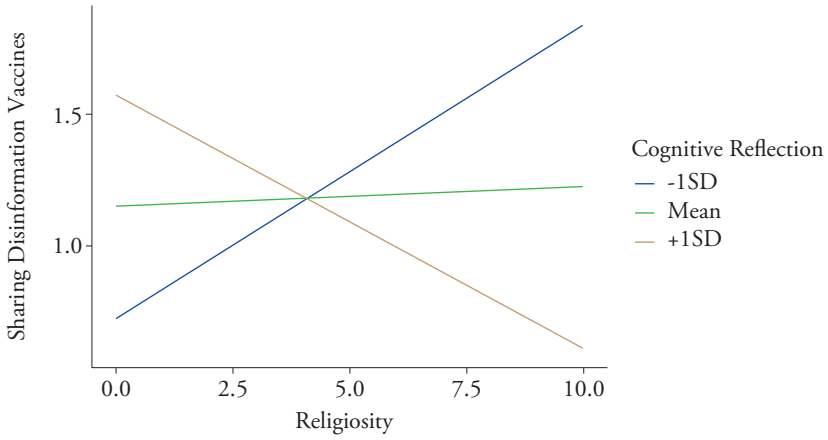
Figure 2
Moderating effect of religiousness on relationship between reflective thinking and sharing disinformation about state response



Source: self-elaboration

These results were the same when it came to sharing disinformation about vaccines, β = -.10, *SE* = .02, CI 95% = -.15 – -.05, $p < .01$; R^2 = .42, F (41,509) = 9.17, $p < .01$. Figure 3 shows that, among people with high reflective thinking, more religious individuals were less likely to share disinformation (-1 *SD* religiousness, *M* = 1.50, *SE* = .26, CI 95% = .98 – 2.02; +1 *SD* religiousness, *M* = .83, *SE* = .25, CI 95% = .34 – 1.33).

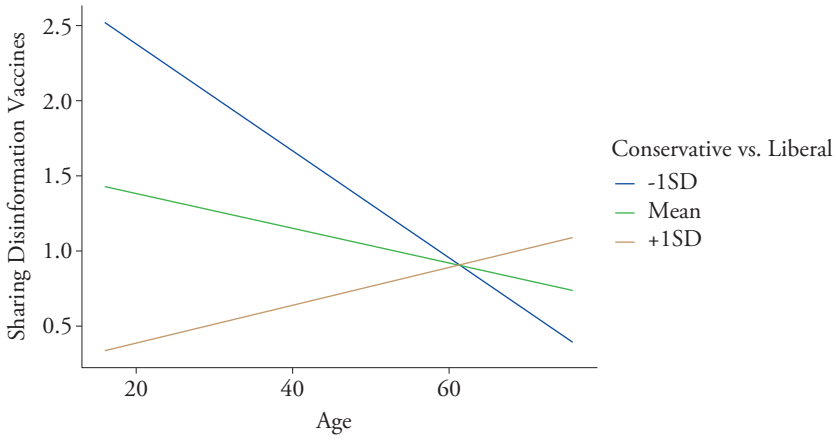
Figure 3
Moderating effect of religiousness on relationship between reflective thinking and disinformation sharing about vaccines



Source: compiled by authors

The relationship between conservative vs. liberal ideology and sharing disinformation about vaccines was moderated by age (β = .03, *SE* = .01, CI 95% = .01 – .04, p < .01), geographical residence (β = -.59, *SE* = .25, CI 95% = -1.09 – -.08, p < .05), and education (β = .75, *SE* = .22, CI 95% = .31 – 1.20, p < .01). Figure 4 shows that among conservative-oriented individuals, younger people were more likely to share disinformation (-1 *SD* age, *M* = 2.23, *SE* = .24, CI 95% = 1.74 – 2.71; +1 *SD* age, *M* = 1.29, *SE* = .24, CI 95% = .80 – 1.78).

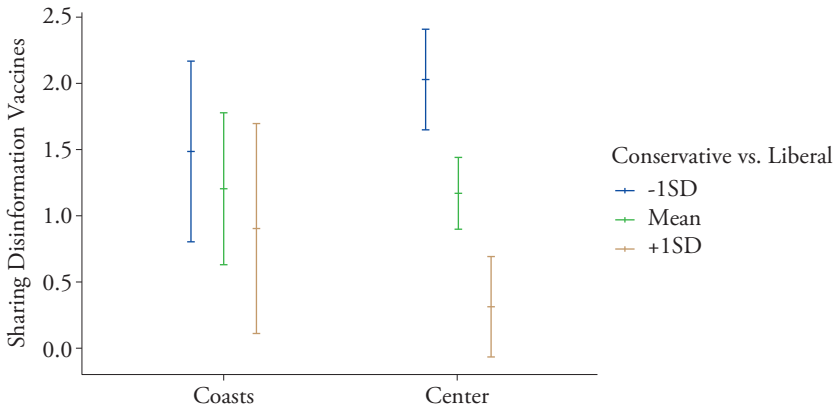
Figure 4
Moderating effect of age on relationship between conservative vs. liberal ideology and sharing disinformation about vaccines



Source: compiled by authors

Figure 5 shows that the effect of conservative vs. liberal ideology on sharing disinformation matters more in the central provinces of Costa Rica than it does in the coastal ones. Among people who reside in the central region, conservatives were more prone to sharing disinformation than liberals (-1 *SD* ideology, *M* = 2.03, *SE* = .19, CI 95% = 1.65 – 2.41; +1 *SD* ideology, *M* = .31, *SE* = .19, CI 95% = .03 – .69).

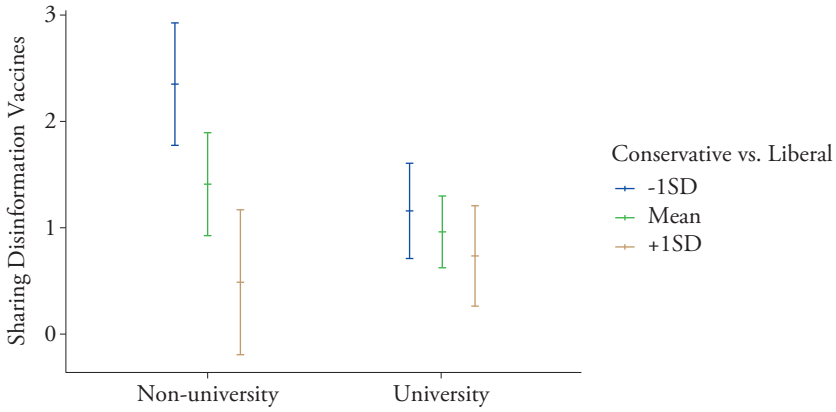
Figure 5
Moderating effect of geographical residence on relationship between conservative vs. liberal ideology and sharing disinformation about vaccines



Source: self-elaboration

Next, liberals and conservatives with higher education exhibited similar tendencies to share disinformation (see Figure 6). However, among people with non-university education, conservatives showed a greater willingness to share disinformation (-1 *SD* ideology, *M* = 2.36, *SE* = .29, CI 95% = 1.78 – 2.94; +1 *SD* ideology, *M* = .48, *SE* = .34, CI 95% = .02 – 1.16).

Figure 6
Moderating effect of education on relationship between conservative vs. liberal ideology and sharing disinformation about vaccines



Source: compiled by authors

Finally, we summarize the findings of our study in Table 4.

Table 4
Overview of findings

Research Questions	Findings
1a. To what extent do ideology, reflective thinking and digital information skills predict the evaluation of disinformation?	a. Believing disinformation about vaccines: greater among authoritarian and conservative-minded people. b. Believing disinformation about state pandemic response: greater among authoritarian and pro-state-minded people. c. Reflective thinking and digital information skills were statistically non-significant predictors.
1b. To what extent are the associations in RQ1a moderated by sociodemographics, subjective income, and religiousness?	a. No moderation effects detected for the vaccines issue. b. State pandemic response: among less reflective thinkers, disinformation detection increased with age.

2a. To what extent do ideology, reflective thinking, and digital information skills predict disinformation sharing intentions?	a. Sharing disinformation about vaccines: greater among authoritarian, pro-state and conservative-minded people, in addition to less reflective thinkers. b. Sharing disinformation about state pandemic response: same findings as for vaccines. c. Digital information skills were a non-significant predictor.
2b. To what extent are the associations in RQ2a moderated by sociodemographics, subjective income, and religiousness?	a. State pandemic response: among less reflective thinkers, disinformation sharing increased with greater religiousness. b. Vaccines: b.1. Again, among less reflective thinkers, disinformation sharing increased with greater religiousness. b.2. Among the ideologically conservative, younger people, those residing in Costa Rica's central provinces, and individuals with non-university education were more likely to share disinformation.

Discussion

Disinformation is a dangerous force in this era of digital and global communication in which false information can quickly spread to many vulnerable people. As humanity faces a historical pandemic in tandem with a disinformation infodemic, evaluating false content is key to limiting the spread. Our study contributes to the disinformation literature, especially in the context of the ongoing COVID-19 crisis, by examining cognitive, ideological, and socio-demographic factors that can influence whether people believe disinformation about the pandemic, and, in turn, whether they enable or mitigate the spread of disinformation via WhatsApp.

Our first set of key findings concern the associations between political ideology and the evaluation and sharing of disinformation about COVID-19 via WhatsApp. Consistent with prior studies, we found that conservatives and authoritarian-minded individuals are more prone to accepting and disseminating disinformation (e.g., Freelon, Marwick & Kreiss, 2020; Pennycook & Rand, 2019). Another result is that people who support a pro-state ideology—that which champions state action in the economic life of society—are more likely to accept and share disinformation. Because this ideological dimension has been understudied in the disinformation literature, prior research provides little evidence from which to draw an explanation. However, we speculate that pro-state individuals strongly value and defend the state and its functions in society, and therefore demand adequate performance from public institutions. Of course, it is possible that such beliefs and attitudes make these people susceptible to anti-state disinformation—precisely because they hold the state and its functions to high standards.

Collectively, our findings on political ideology and disinformation make several contributions. First, most studies on this domain is produces in countries of the Global North, and focuses mostly on conservatism or left wing vs. right wing orientations (e.g., Bronstein et al., 2019; Ecker et al., 2022). We provide evidence from the Global South—specifically, from the Latin American country with the highest relative number of WhatsApp users (Latinobarómetro, 2018)—that supports some of the wider findings in the literature. Second, we add to the literature by showing that, in addition to conservatism or authoritarianism, other ideologies (e.g., being pro-state minded) also influence the acceptance and subsequent sharing of disinformation. Third, our findings are relevant beyond the Costa Rican context, as the multidimensional perspective of ideology from which we draw was originally proposed for Latin America. This ideological model posits that political parties and systems across the region share common characteristics and orientations, configuring differentiated ideological families that transcend the national borders of any given Latin American country (see Altman et al., 2009). Fourth, most research has centered on political issues and events. We look beyond these phenomenon to show that political ideology also plays an important role in the belief and dissemination of disinformation about COVID-19.

Our second key finding is that reflective thinking does not predict the detection of disinformation. Rather, other variables (e.g., political ideology) appear to have greater weight. According to research in deliberative contexts, reflexivity favors the detection of veracity in messages but does not diminish the influence of political ideology on how people evaluate content (Bago et al., 2020). In our study, it is possible that disinformation detection was strongly driven by ideology, which in turn overrode reflective thinking activity. Another possible explanation is that other cognitive mechanisms, such as the illusory truth bias, trumps or reduces reflexive thinking. Such hypotheses require further research to examine how illusory thinking—and other information processing biases (e.g., confirmation and disconfirmation)—affect reflective thinking capacity in the context of disinformation evaluation.

However, reflective thinking reduces the intention to share disinformation via WhatsApp. We speculate that sharing behavior does not depend solely on deciding whether a message is true but also requires a decision to be made on whether a message can or should be sent, and to whom. These decisions would lead one to suppose that sharing behavior requires a greater cognitive effort—which is precisely what promotes reflective thinking.

We did not find associations between digital information skills and the detection and intention to share disinformation via WhatsApp. This finding runs counter to our expectations, as prior research has considered digital skills relevant in helping people identify, process, and evaluate disinformation (Beauvais, 2022; Jones-Jang, Mortensen & Liu, 2021; Van Deursen & Van Dijk, 2014). The lack of associations in our study could be due to characteristics of the measure we used—which focused on general digital information capacities. It is important that future studies employ an alternative measure that taps into the specific skills—such as critical thinking digital skills—required for discerning disinformation from truthful content (see, e.g., Carmi et al., 2020).

Our final set of findings concern the moderating role of socio-demographics, religiosity, and subjective income in shaping the effects of socio-political and cognitive factors on disinformation detection and sharing in relation to COVID-19. With regard to disinformation detection, we found that age did not play a factor among people with high reflective thinking. However, among low reflective thinkers, the likelihood of detecting disinformation increased with age.

In the case of disinformation sharing , the effect of reflective thinking was moderated by religiousness, in that individuals with low reflective thinking and high religiousness were more willing to share disinformation via WhatsApp. This result is unsurprising in the light of our finding for Research Question 2a that low reflexivity encourages disinformation sharing. In addition, high religiousness has been linked with less analytical and open-minded thinking (Bronstein et al., 2019)—both of which are important cognitive abilities for reflective thinking capacity.

Finally, as mentioned above, several studies have associated conservatism with accepting and disseminating disinformation. In addition to confirming these findings, our study provides additional context and nuance by unpacking how the impact of conservative ideology on disinformation sharing is contingent on socio-demographic characteristics. In the Costa Rican case, there were three important findings in this regard. First, younger conservatives were more willing to share disinformation than older ones. Second, for Costa Ricans who reside in the more developed regions of the country, conservatives were more inclined to share than were liberals. Third, among people with no university education, conservatives—not liberals—were more disposed to disseminate disinformation, whereas ideology mattered little when people had a university education. It is relevant to inquire whether these findings can be replicated with representative samples and in other Latin American contexts.

Unexpectedly, the moderators we studied played a more important role in sharing disinformation via WhatsApp than in detection. It could be that detecting disinformation depends more on cognitive processes and motivations oriented towards developing judgments about veracity. Conversely, because disinformation sharing involves making a decision about what to share and with whom, it requires different information processing and communication conditions. For example, variables associated with social identity and third-person effects may be important for information sharing (e.g., social acceptance and identification, status, influencing group dynamics, persuading others, and reinforcing social identity). From a socio-cognitive and communication perspectives, we have only just begun to understand the processing, evaluation, and decision-making mechanisms of interpersonal or inter-group digital communication—through messaging via digital social networks —that are associated with disinformation sharing. We recommend that future scholarship continue pursuing research agendas along this avenue.

We studied disinformation related to two COVID-19 related issues. Except for a few nuances, the results concerning the evaluation and sharing of disinformation about the two issues were largely similar. It is possible that our findings about the state's pandemic response are more relevant for countries with a similar political culture and context to Costa Rica. In the case of vaccines, it has been argued that the dissemination of disinformation about vaccines fuels hesitancy (e.g., McKee & Middleton, 2019). Moreover, in the case of COVID-19, susceptibility to disinformation may cause people to be less willing to get vaccinated, or to recommend vaccination to others (Roozenbeek et al., 2020). In our view, the evidence we present concerning vaccine disinformation that, although specific to the Costa Rican context, has broader implications for how other regions deal with different expressions of hesitancy towards COVID-19 vaccines.

It is important to note some of the limitations of our research. One shortcoming is the focus on written forms of disinformation. We specifically considered infographics, images, and texts. As mentioned above, because most of the fact-checked messages that we collected two months before beginning our study were text-based—while only a minimal proportion consisted of audio or video formats—our stimuli consisted of textual disinformation. However, this focus on some of the most prevalent forms of disinformation precluded us from analyzing audio and video, which can also proliferate in the multimodal technological context of WhatsApp (Author, 2021).

Another limitation concerns our research design. A representative sample would have offered a clearer basis of comparison and inference; relying on

Facebook to recruit convenience samples resulted in an over-representation of certain demographic groups (e.g., age and education), despite our efforts to recruit under-represented populations. Currently, mobile phone and in-person surveys are the only methods in Costa Rica that make it possible to draw representative samples. We did not have sufficient resources for either of these methods. As mentioned, our sample was younger, more educated, and more female relative to the Costa Rican population overall. Hence, an important implication is that we are unable identify any parameters that can be generalized to the national population. However, in scientific terms, our findings do contribute to a better understanding of the role of individual characteristics in disinformation detection and sharing intentions . Finally, leading on from our findings, we recommend that future studies conduct a confirmatory factor analysis of the political ideology measure.

Despite the caveats, the results presented here open up important directions for future research. For one, more work is needed to further understand the singularities of disinformation spread via WhatsApp. For example, it is important to identify whether specific variables mediate the relationships between disinformation detection and sharing. We also note that motivation influences the cognitive strategies people use to evaluate information; motivated reasoning theory can be valuable to understand how people react to disinformation they want to believe.

Conclusions

What are the main implications of this study? First, it is among the first to examine the detection and spread of COVID-19 disinformation within the cultural specificity of the Global South. This is key in further situating issues of disinformation within the particular political and mediated cultures in which this phenomenon unfolds. Second, this study identifies individual-level characteristics associated with the belief and dissemination of disinformation about vaccines. Although our findings cannot be generalized to other countries with different socio-cultural and political contexts, we caution that exposure to disinformation about vaccines can potentially influence reactance among certain people. Although this study should be replicated in other settings and populations, our findings can inform health policies and strategies that promote vaccination willingness among hesitant individuals.

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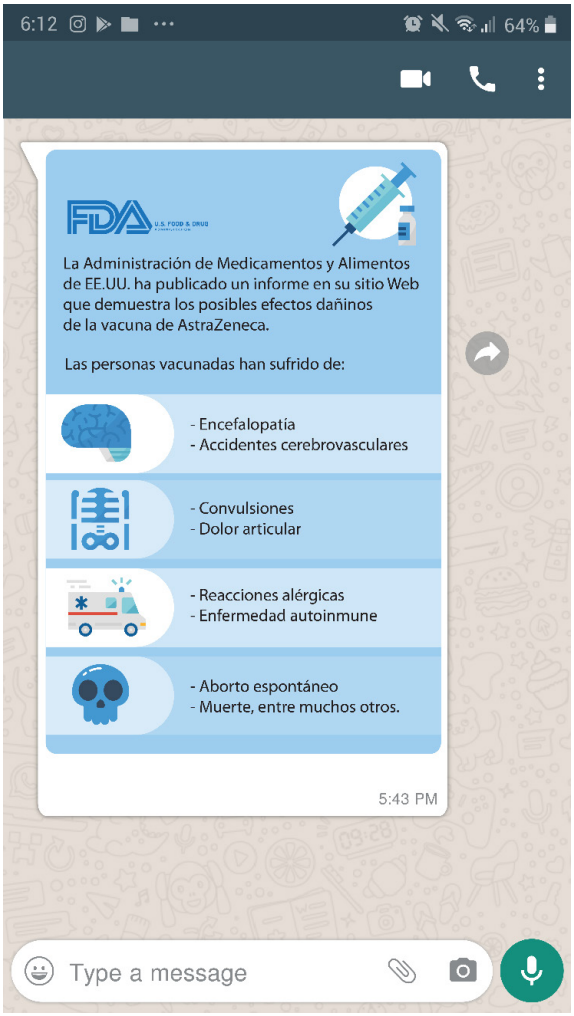
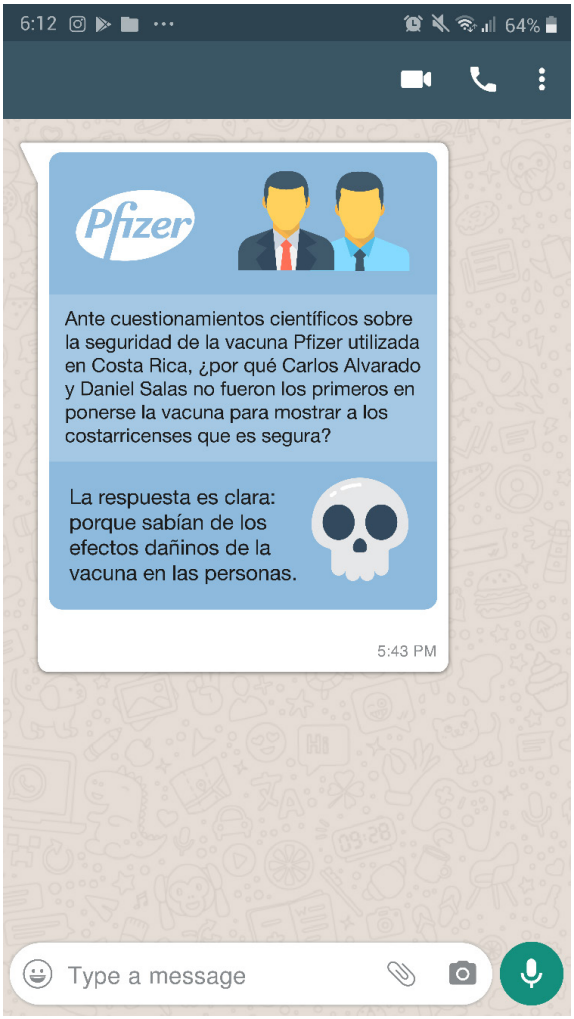
Appendix A. Stimulus materials (original design in Spanish and English translation)

Disinformation about COVID-19 vaccines

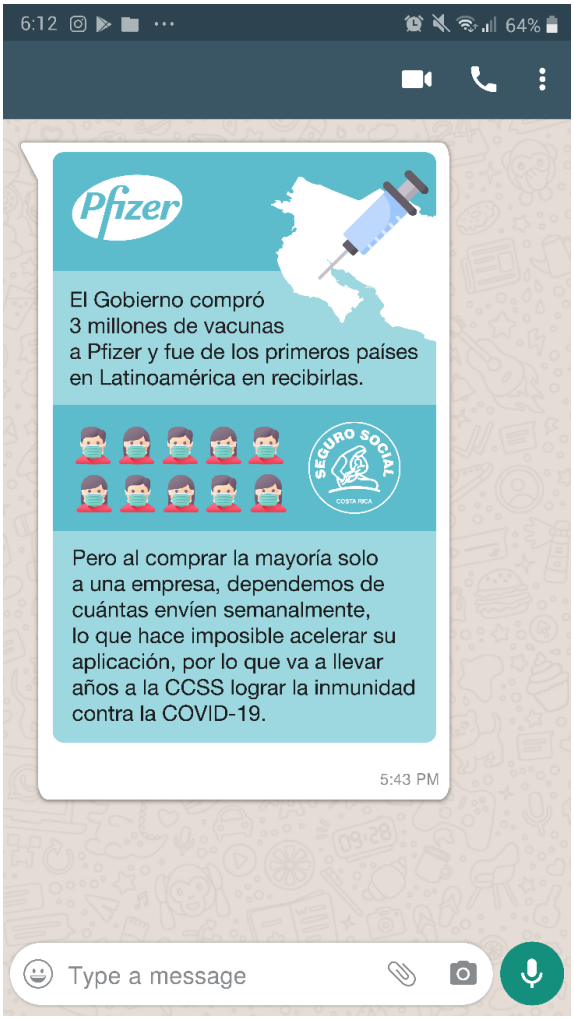


The U.S. Food and Drug Administration has published a report on its website that shows the possible harmful effects of the AstraZeneca vaccine. Vaccinated individuals have experienced: encephalopathy, cerebrovascular accidents, convulsions, joint pain, allergic reactions, autoimmune disease, miscarriages, death, among many others.

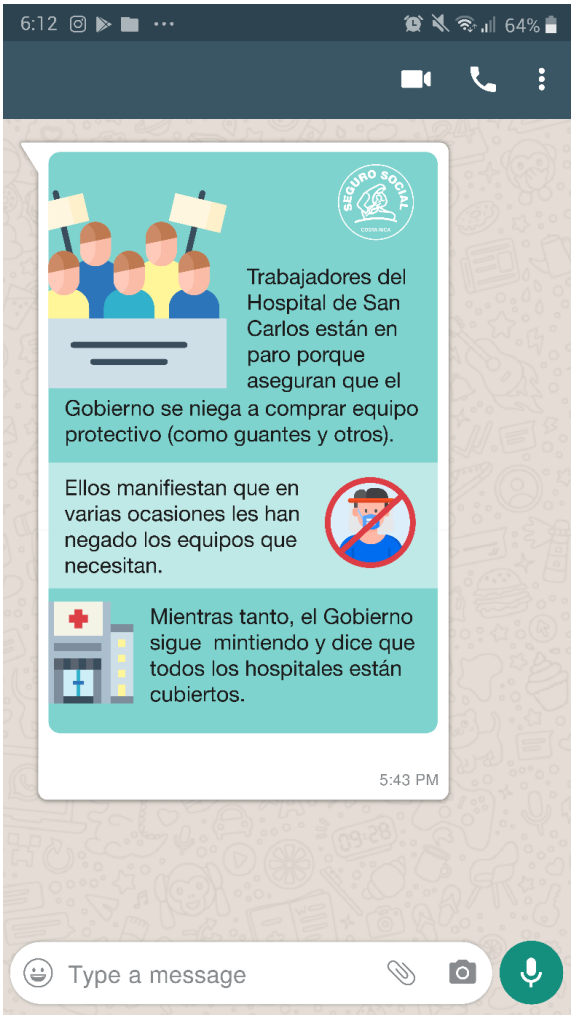


After scientific questioning about the safety of the Pfizer vaccine used in Costa Rica, why were Carlos Alvarado and Daniel Salas [the then president and minister of public health, respectively] not the first people to get vaccinated to show Costa Ricans that the vaccine is safe? The answer is clear: because they knew about the harmful effects of the vaccine on people.

Disinformation about the state response to COVID-19



The government purchased 3 million doses of the Pfizer vaccine and [Costa Rica] was one of the first countries in Latin America to receive the vaccine. But because the majority of doses were bought from a single company, we are dependent on how many doses Pfizer send us every week, which makes it impossible to accelerate vaccination, and so it will take years for the state health sector to achieve [herd] immunity against COVID-19.



Workers at the San Carlos Hospital are on strike because they argue that the government refuses to provide them with protective equipment (such as gloves and others). They say that their requests for the equipment they need have repeatedly been denied. Meanwhile, the government keeps lying and says that all hospitals are covered.

Appendix B. Political ideology items

Democracy-Authoritarian
• The state should increase penalties to improve public safety.
• The state should regulate the media and the internet.
• The state should restrict the entry into the country of foreign nationals in search of work.
• The state should guarantee the right of all workers to join a labor union *(reverse item).*
Conservative-Liberal
• The state should preserve the official status of the Catholic faith (*inverse item*).
• The state should permit the use and distribution of cannabis.
• The state should restrict the operations of companies that damage the environment.
• I agree with in vitro fertilization.
• I agree with same-sex civil marriage.
Pro-market – Pro-state
• The state should guarantee free public access to healthcare and education.
• The state should have primary responsible for reducing the gap between the rich and poor.
• The state should regulate private companies.
• The state should own the major companies and industries in the country.
• The state should limit the entry of foreign producers to protect national producers.