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Social media use and vaccination among Democrats and Republicans: Informational and normative influences

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ABSTRACT

Our objective was to determine whether social media influences vaccination through informational and normative influences among Democrats and Republicans. We use a probability-based longitudinal study of Americans ($N = 1768$) collected between December 2022 and September 2023 to examine the prospective associations between social media use and vaccination as well as informational and normative influence as mediating processes. Greater social media use correlates with more frequent vaccination (cross-lagged coefficients: COVID-19 $= 0.113$, $p < 0.001$; influenza $= 0.123$, $p < 0.001$). The underlying processes, however, vary between Democrats and Republicans. Democrats who use social media more are more likely to vaccinate because they encounter information about new pathogens. In contrast, Republicans who use social media more are more likely to vaccinate because they think that people who are important to them receive the recommended vaccines. Our findings underscore the potential for social media campaigns to promote vaccination, among both Democrats and Republicans by paying attention to the specific processes in each audience.

1. Introduction

When a particular misinformation campaign about the COVID-19 vaccine spread with the hashtag *#diedsuddenly*, ABC News reported that "[t]he campaign causes harm beyond just the internet." The outlet cited an epidemiologist who stated, "[t]he real danger is that [the campaign] ultimately leads to real world actions such as not vaccinating" (Swenson and Fichera, 2023). But, as the world emerges from a pandemic and prepares for others, is consuming social media use actually associated with less or more vaccination? What is the role of epidemiological information and norms in the relation between social media use and vaccination? How does exposure to epidemiological information and norms play out among Democrats, Republicans, and Independents while vaccination remains politically polarized (Bump, 2021; Sparks et al., 2023)?

Along with media outlets, scholars have raised concerns about the negative impact of social media use on vaccination. However, the association between social media use and vaccination uptake is difficult to study and therefore, has not been properly tested. In fact, the past research suggesting negative influences of social media on vaccination involved (a) studies that link social media to misinformation, (b) studies correlating some aspect of information on social media and vaccination but studied at the regional level, (c) studies of misinformation and vaccination hesitancy, and (d) prospective studies correlating either vaccination with the quality of information shared on social media or regional presence of misinformation on social media and vaccination among residents in those regions. The first group of studies has shown that health-related misinformation is not only prevalent but also popular on social media (Wang et al., 2019). Social media misinformation often concerns vaccination and conflates emotional anecdotes with scientific language (Oreskes and Conway, 2011; Suarez-Lledo and Alvarez-Galvez, 2021), leading to frequent *perceptions* that social media misinformation is the root of vaccine distrust and reluctance to vaccinate (Golder et al., 2023; Kluger, 2021). The actual data, however, are scarce. For example, the second type of evidence used to reach conclusions about the impact of social media comes from studies that show parallels in the negative sentiments and frequency of misinformation on social media and monthly vaccination rates in the U.S. (Cooper et al., 2022) and public attitudes toward vaccines (Hussain et al., 2021). Although these comments and analyses raised public interest in vaccine misinformation, such analyses did not assess behavioral changes at the individual level.

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A third kind of research has linked beliefs in misinformation with vaccine hesitancy instead of actual vaccination. Vaccine misinformation comprises sets of erroneous statements and beliefs, which are common and proliferate through the use of vivid imagery, emotional appeals, and the blurring line between credible and incredible sources (Puri et al., 2020). Vaccine hesitancy is typically measured with scales that mix attitudes and beliefs (e.g., (Helmkamp et al., 2021; Shapiro et al., 2018), even though it is defined as a "delay in acceptance or refusal of vaccination despite availability of vaccination services" (MacDonald, 2015). When it comes to relations between social media and either misinformation or vaccination hesitancy, the association suggests possible negative effects. As shown by a cross-sectional study of U.S. adults, when used without referencing reputable sources, social media use is positively associated with vaccine hesitancy (Al-Uqdah et al., 2022). Similarly, when it increases exposure to low-quality information and hyper-conservative accounts, social media use is positively associated with vaccine hesitancy. However, neither beliefs nor vaccination hesitancy directly tap vaccination behavior, which makes these findings tentative when trying to understand the impact of social media use on vaccination.

A fourth set of studies have analyzed the relation between information consumed on social media and vaccination behavior but these analyses have either not concerned social media use or have involved some regional information. In an individual-level study of information sharing, being vaccinated (vs. not) is positively associated with sharing higher-quality information (Rathje et al., 2022). In a prospective study that included a mix of individual and regional measures, county-level prevalence of misinformation on social media had some positive and significant correlations with individual vaccination later (Chan et al., 2020).

A systematic review of social media on HPV vaccine behaviors summarized that some studies showed social media use increases knowledge, attitudes, and awareness about HPV, but has no impact on HPV vaccination uptake. Furthermore, the review concluded that the literature lacks rigorous research sufficient to draw strong conclusions about these relations (Ortiz et al., 2019). Ortiz et al. (2019) found that "[o]nly one study surveyed participants from a probability-based sample of U.S. households (Margolis et al., 2019). Only one experimental or intervention study included the use of a true control comparison group (Ortiz et al., 2018), and only three included a pre- and post-test assessment of the outcome measures (Lai et al., 2015; Lyson et al., 2019; Ortiz et al., 2018)." As reviewed here, most of the research on this topic is based on qualitative data, content analysis, and correlations while very few measure behavior prospectively.

In contrast to the possibility that social media use increases negative dispositions toward vaccination, social media could also increase vaccination uptake (Steffens et al., 2020). Here, some of the evidence is cross-sectional. For example, in a cross-sectional study of white and African American adults in the US, social media followers of health agencies or organizations promoting vaccinations were more likely to be vaccinated than those who did not follow those accounts (Ahmed et al., 2018). Other evidence investigating social media, however, is experimental. For instance, influencer-campaign interventions studied with a quasi-experimental design seemed to cause increases in knowledge and positive attitudes toward vaccination in geographic regions where the campaign was disseminated (Bonnevie et al., 2020), and a web intervention studied experimentally increased parental vaccination acceptance and pediatric vaccine uptake (Glanz et al., 2017). Considering experiments that specifically concerned social media posts about vaccination, reports of vaccine safety on social media increased safety perceptions and decreased vaccine hesitancy (Zhang et al., 2023); social media campaigns in Nigeria decreased vaccine hesitancy and increased vaccine uptake, albeit not directly (Evans et al., 2023b; see Evans et al., 2023a for more on a new social media collection and measurement); and social media messages emphasizing personal experiences and social pressure increased positive attitudes toward vaccination and strengthened vaccination intentions (Ahmad Rizal et al., 2022). Thus, despite a high level of interest in these issues, no study has examined the impact of exposure to the naturally occurring social media use on vaccination uptake. The present study thus examines the association between individual-level change in social media use and uptake of influenza and COVID-19 vaccines, using a probability panel of United States residents measured 4 times over a period of 10 months.

1.1. Political identification and mechanisms of social media influence

In addition to the possibility of either negative or positive influences of social media use on vaccination, social media use could have different effects depending on the political party with which Americans identify. For example, social media algorithms can polarize political viewpoints by boosting congenial information (Barberá, 2020; Berman and Katona, 2020; Bruns, 2019; Harris et al., 2023; Sunstein, 2018; Zuiderveen Borgesius et al., 2016) that users often actively seek. Thus, given the polarization surrounding vaccination, the social media networks of Republicans may decrease vaccination by promoting vaccine misinformation. Accordingly, the social media networks of Democrats may display pro-vaccination content, ultimately increasing vaccination among users. However, introducing actual changes to social media content (e.g., reducing posts from like-minded co-partisans, making the social media feed chronological, and removing reshared posts) revealed no statistically significant impacts on polarization or attitudes and opinions (Guess et al., 2023a, 2023b; Nyhan et al., 2023).

Social psychological theories about informational and normative influences (Deutsch and Gerard, 1955) can help us understand two potential pathways that may explain the effect of social media on vaccination. On one hand, people may be more likely to trust information when it comes from sources they trust, leading to greater impact of the information they encounter. Democrats may be more likely to vaccinate given exposure to such information because the party platform typically places greater emphasis on trusting scientific information (Lee, 2021). On the other hand, some may feel the need to conform with the group and adopt behaviors based on the behaviors of others within the group. Republicans who seek greater group conformity may be more likely to adopt behaviors that they believe their group expects of them, irrespective of whether they privately agree with vaccination (Panagopoulos and van der Linden, 2016). Given these party dynamics, social media may have similar impacts on behavior, but the pathways may be different. We also acknowledge considerable heterogeneity among Democrats and Republicans (e.g., Barnes and Cassese, 2017; Brown and Brown, 2015), which suggests caution when making general predictions. For example, ideology may be important in addition to political party.

1.2. This study

Prior research has considered questions relevant to our research. However, it has not rigorously examined the influence of social media on vaccination or considered differences between Democrats and Republicans or mediating processes. Therefore, in 2022 and 2023, we conducted a longitudinal survey of a probability sample of Americans assessing COVID-19 vaccination, influenza vaccination, social media use, goals of social media use (i.e., health or political information seeking), encountering epidemiological information about pathogens and pandemics, and vaccination norms. Leveraging four waves of data with longitudinal analyses, we estimated the associations between social media use, exposure to information about pathogens and pandemics, norms, and influenza and COVID-19 vaccination. All analyses were conducted among Republicans, Democrats, and Independents.

Sample. We collected information from a group of 1768 individuals residing in the United States through SSRS, a firm that runs a probability panel that reaches respondents via both phone and internet surveys. Specifically, respondents were recruited randomly based on a nationally

representative Address Based Sample design. Respondents were randomly sampled through the U.S. Postal Service's Computerized Delivery Sequence File, a regularly updated listing of all known addresses in the U.S. To maximize responses, each respondent was contacted up to five times per wave. We used the 3rd (Time 1, n = 1768), 4th (Time 2, n = 1746), 5th (Time 3, n = 1686), and 6th (Time 4, n = 1665) waves to demonstrate temporal precedence using cross-lagged panel models. Our variables of interest did not appear in the first two waves of data. These data were collected from December 7 to 21, 2022, March 8 to 23, 2023, June 7 to 21, 2023, and September 6 to 20, 2023, respectively.

Our sample of respondents ranged from 18 to 99 years old. The sample was 51.4% female, 47.1% male, 0.9% another gender, and 0.5% were unsure or preferred to answer. With respect to political affiliation, 35.1% of the sample were Democrats, 30.2% were Republicans, and 28.5% were Independents. Our sample was racially diverse, with 60.4% white non-Hispanic, 11.4% Black non-Hispanic, 12.4% white Hispanic, 0.6% Black Hispanic, 7.6% Hispanic alone, 5.5% Asian, 0.2% Native American or Alaska Native, 0.6% more than one race, and 0.2% respondents of another race. In terms of the highest level of education completed, 4.6% of the sample earned less than a high school diploma, 29.6% earned a high school diploma, 20.0% completed some college but did not earn a degree, 9.7% earned an associate degree, 16.3% a bachelor's degree, 4.9% completed some graduate school but did not earn a degree, and 14.8% earned a graduate degree. The median income for our respondents was "$50,000 but less than $75,000." Averages, standard deviations, and percentages for demographic information are presented in Table A1 of the Supplemental Information.

Measures. COVID-19 and Influenza Vaccination were measured by asking participants, "In the past 3 months, have you gotten either a COVID-19 vaccine or a flu vaccine?" Separate items were constructed for COVID-19 Vaccination and Influenza Vaccination using the responses: "Both" (recoded as 1 for both vaccination types), "Only the COVID vaccine" (recoded as 1 for COVID-19 vaccination), "Only the flu vaccine" (recoded as 1 for influenza vaccination), "Neither" (recoded as 0 for both vaccination types).

Social media use was measured in three ways (a) "To what extent do you use social media to get information?", (b) "To what extent do you use social media to get health-related information?", and (c) "To what extent do you use social media to get political information?" Each of these variables used a 7-point scale ranging from "Not at all" (0) to "All the time" (1). We analyzed each of these measures separately in our first analysis, and, as explained presently, we used "To what extent do you use social media to get health-related information?" for all further analyses.

Encounter with pathogen and pandemic-related information was measured by asking participants "In the past 3 months, how frequently, if at all, have you encountered information about new pathogens like COVID-19 producing outbreaks and pandemics in the media?" The variable is a 5-point scale ranging from "Not encountered at all" (1) to "Encountered a lot" (5).

Vaccination norms were measured by asking participants, "How much do you agree or disagree with the following statements? People who are important to me take all recommended vaccines." and responses ranged from "Strongly disagree" (1) to "Strongly agree" (5).

Political party was measured by asking participants whether they identified as a Democrat, a Republican, or an Independent. The Supplement includes all descriptive statistics for the items of interest in this study. *Ideology* was measured on a 5-point scale ranging from "Very conservative" (1) to "Very liberal" (5).

Demographic controls. Participants indicated their sex, which was then dichotomized into female (1) or other (0). Age was captured as age in years and used as a numeric variable. Race was dichotomized as white (0) or person or color (1). Education was dichotomized as (0) having obtained a high school diploma or less and (1) having at least some college education. Income was also dichotomized as (0) less than $100,000 per year or high-income (1) $100,000 per year or greater. However, introducing education and income controls as numeric variables did not alter the pattern of results.

2. Results

To start, we examined the relation of social media use for seeking out different kinds of information with COVID-19 vaccination and influenza vaccination using four waves of data from our full sample ($N = 1768$; for descriptive statistics see Supplemental Table S1). Specifically, using cross-lagged panel models (CLPM), we analyzed COVID-19 and influenza vaccination as functions of consumption of social media to seek out general information, health information, and political information. The models first tested the effect of social media use on vaccination, which represents an actual impact of social media. They were then retested with vaccination as the predictor of social media use, which represents a selection of information on the basis of one's current behavior. These analyses were conducted using R version 4.3.2 and the *lavaan* package (Rosseel, 2012). Results from these influence and selection models appear in Table 1. They show that social media use, particularly when seeking health information, correlated with increases in COVID-19 and influenza vaccination, and this correlation was positive in all cases. They also show that the selection models in which participants' vaccination guides their social media use were generally not significant, thus ruling out the possibility that any association between social media use and vaccination is incidental rather than causal.

Next, we considered the differences among respondents from different political parties. Consistent with prior findings (Albrecht, 2022), Republicans engaged in COVID-19 vaccination (unstandardized $b = -0.170$, $p < 0.001$) and influenza vaccination (unstandardized $b = -0.138$, $p < 0.001$) less than Democrats modeled using all four waves of data with individual respondents as random effects and age, sex, race, education, and income as controls.

Next, we retested the cross-lagged panel models with social media use for health information seeking (see Table 1), but we stratified them by party. These results are shown in Table 2. As before, these analyses showed no negative associations and generally positive and significant correlations between social media use and vaccination for each party. The influence of social media on the vaccination seemed stronger for Democrats. However, when we retested the basic model of these associations and entered party and interactions with social media use, the interactions were not significant. The interaction between party (Democrat or Republican) and lagged social media use on COVID-19 vaccination was 0.016 ($p = 0.721$), and the interaction in the influenza vaccination model was −0.087 ($p = 0.078$). These estimates were obtained using a basic mixed effects model as described previously, which controls for all demographic factors and includes random effects for individuals. These models also include lagged COVID-19 and influenza vaccination, respectively.

Given that social media use for health information was associated with increased vaccination among Republicans, Democrats, and Independents, we next examined receiving information about pathogens and vaccination norms as two possible processes underlying these influences. This analysis, which was conducted with the measure of social media to seek health information, examined the mediating effects of encountering information about new pathogens in the media and vaccination norms. We used a structural equation model that reproduced the earlier analyses in which social media use influences vaccination, but we added receiving information about pathogens and norms as mediators. The results, which appear in Table 3, included analyses of the whole sample as well as by political party. As shown, the overall sample suggested that both information reception and norms mediated the effect of social media on vaccination. However, the stratified results showed a more nuanced pattern such that social media use increased vaccination by changing norms among Republicans but by increasing information reception among Democrats. An additional analysis included political party as a moderator of the indirect effect, which

Table 1
Associations of social media use and vaccination.

	Seeking Health Information		Seeking General Information		Seeking Political Information	
	Cross-lagged direction		Cross-lagged direction		Cross-lagged direction	
	Influence	Selection	Influence	Selection	Influence	Selection
COVID-19 vaccination	**0.113 ($p < 0.001$)**	**0.000 (p =0.990)**	**0.044 ($p = 0.041$)**	**0.002 ($p = 0.784$)**	**0.074 ($p < 0.001$)**	**0.006 ($p = 0.457$)**
Female	−0.011 ($p = 0.218$)	0.018 ($p = 0.002$)	−0.008 ($p = 0.354$)	0.012 ($p = 0.035$)	−0.006 ($p = 0.480$)	−0.006 ($p = 0.295$)
Age	0.001 ($p = 0.007$)	−0.001 ($p < 0.000$)	0.001 ($p = 0.013$)	−0.002 ($p < 0.001$)	0.000 ($p = 0.081$)	−0.002 ($p < 0.000$)
Race	0.053 ($p < 0.001$)	0.035 (p < 0.001)	0.058 ($p < 0.001$)	0.017 ($p = 0.003$)	0.058 ($p < 0.001$)	0.017 ($p = 0.003$)
Education	0.011 ($p = 0.275$)	−0.006 ($p = 0.347$)	0.010 ($p = 0.317$)	0.006 ($p = 0.340$)	0.009 ($p = 0.360$)	0.009 ($p = 0.117$)
Income	−0.008 ($p = 0.275$)	−0.031 ($p < 0.001$)	−0.012 ($p = 0.223$)	−0.025 ($p < 0.001$)	−0.011 ($p = 0.249$)	−0.021 ($p = 0.001$)
Influenza vaccination	**0.123 ($p < 0.001$)**	**0.007 ($p = 0.304$)**	**0.058 ($p = 0.013$)**	**0.001 ($p = 0.881$)**	**0.065 ($p = 0.004$)**	**−0.000 ($p = 0.952$)**
Female	−0.020 ($p = 0.031$)	0.018 ($p = 0.002$)	−0.017 ($p = 0.063$)	0.012 ($p = 0.035$)	−0.015 ($p = 0.106$)	−0.006 ($p = 0.295$)
Age	0.001 ($p < 0.001$)	−0.001 ($p < 0.000$)	0.001 ($p = 0.001$)	−0.002 ($p < 0.001$)	0.001 ($p < 0.001$)	−0.002 ($p < 0.000$)
Race	0.041 ($p < 0.001$)	0.035 ($p < 0.001$)	0.047 ($p < 0.001$)	0.017 ($p = 0.003$)	0.047 ($p < 0.000$)	0.017 ($p = 0.003$)
Education	0.004 ($p = 0.699$)	−0.006 ($p = 0.347$)	0.003 ($p = 0.776$)	0.006 ($p = 0.340$)	0.002 ($p = 0.813$)	0.009 ($p = 0.117$)
Income	−0.003 ($p = 0.772$)	−0.031 ($p < 0.001$)	−0.007 ($p = 0.530$)	−0.025 ($p < 0.001$)	−0.007 ($p = 0.506$)	−0.021 ($p = 0.001$)

Note: The table above includes the results of a single cross-lagged panel model including demographic covariates and clustering on individuals. The results of our expected relationships are included under the "**Influence**") column. That is, these are the effects of lagged social media (and demographic covariates) on vaccination. The reciprocal effects are shown under the "**Selection**" column. These are the effects of lagged vaccination (and demographic covariates) on social media, in other words, the opposite direction to the relation that we theorized.

Table 2
Associations of social media use for seeking health information and vaccination by political party.

	Republicans		Democrats		Independents	
	Influence	**Selection**	**Influence**	**Selection**	**Influence**	**Selection**
COVID-19 vaccination	**0.103 ($p < 0.001$)**	**0.012 ($p = 0.486$)**	**0.141 ($p = 0.002$)**	**−0.001 ($p = 0.901$)**	**0.098 ($p = 0.010$)**	**0.015 ($p = 0.274$)**
Female	−0.027 ($p = 0.030$)	0.026 ($p = 0.011$)	−0.009 ($p = 0.640$)	0.007 ($p = 0.513$)	−0.010 ($p = 0.524$)	0.014 ($p = 0.208$)
Age	0.001 ($p = 0.192$)	−0.001 ($p = 0.001$)	0.001 ($p = 0.027$)	−0.002 ($p < 0.001$)	0.001 ($p = 0.138$)	−0.001 ($p = 0.008$)
Race	0.070 ($p < 0.001$)	0.025 ($p = 0.084$)	0.003 ($p = 0.859$)	0.032 ($p = 0.002$)	0.035 ($p = 0.042$)	0.041 ($p < 0.001$)
Education	−0.019 ($p = 0.178$)	−0.003 ($p = 0.787$)	0.041 ($p = 0.052$)	−0.011 ($p = 0.306$)	−0.002 ($p = 0.897$)	−0.001 ($p = 0.935$)
Income	−0.009 ($p = 0.503$)	−0.021 ($p = 0.053$)	0.002 ($p = 0.925$)	0.058 ($p < 0.001$)	0.011 ($p = 0.592$)	0.019 ($p = 0.114$)
Influenza vaccination	**0.059 ($p = 0.192$)**	**0.011 ($p = 0.417$)**	**0.166 ($p < 0.001$)**	**−0.004 ($p = 0.430$)**	**0.087 ($p = 0.037$)**	**−0.008 ($p = 0.574$)**
Female	−0.011 ($p = 0.454$)	0.026 ($p = 0.011$)	−0.044 ($p = 0.018$)	0.007 ($p = 0.513$)	−0.023 ($p = 0.152$)	0.014 ($p = 0.208$)
Age	0.002 ($p = 0.002$)	−0.001 ($p = 0.001$)	0.001 ($p = 0.059$)	−0.002 ($p < 0.001$)	0.001 ($p = 0.010$)	−0.001 ($p = 0.008$)
Race	0.038 ($p = 0.087$)	0.025 ($p = 0.084$)	0.037 ($p = 0.051$)	0.032 ($p = 0.002$)	0.005 ($p = 0.771$)	0.041 ($p < 0.001$)
Education	0.011 ($p = 0.508$)	−0.003 ($p = 0.787$)	−0.040 ($p = 0.054$)	−0.011 ($p = 0.306$)	0.024 ($p = 0.139$)	−0.001 ($p = 0.935$)
Income	0.001 ($p = 0.960$)	−0.021 ($p = 0.053$)	0.002 ($p = 0.917$)	0.058 ($p < 0.001$)	0.005 ($p = 0.792$)	0.019 ($p = 0.114$)

Note: The table above includes the results of cross-lagged panel models including demographic covariates and clustering on individuals. The results of our expected relationships are included under the "**Influence**") column. That is, these are the effects of lagged social media (and demographic covariates) on vaccination. The reciprocal effects are shown under the "**Selection**" column. These are the effects of lagged vaccination (and demographic covariates) on social media, in other words, the opposite direction to the relation that we theorized.

Table 3
Cross-Lagged Panel Model estimated indirect effects of social media use on vaccination through perceptions of vaccination norms and information about pathogens.

Norms				
Full Sample		**Republicans**	**Democrats**	**Independents**
COVID-19 vaccination	0.004 ($p = 0.003$)	0.008 ($p = 0.011$)	0.001 ($p = 0.362$)	0.002 ($p = 0.231$)
Influenza vaccination	0.003 ($p = 0.006$)	0.008 ($p = 0.018$)	0.001 ($p = 0.503$)	0.002 ($p = 0.212$)
Information about pathogens				
Full Sample		**Republicans**	**Democrats**	**Independents**
COVID-19 vaccination	0.010 ($p < 0.001$)	0.003 ($p = 0.118$)	0.020 ($p = 0.003$)	0.004 ($p = 0.220$)
Influenza vaccination	0.012 ($p < 0.001$)	0.006 ($p = 0.162$)	0.019 ($p = 0.003$)	0.004 ($p = 0.217$)

Note: The table above includes the indirect effects of social media use for seeking health information on vaccination, accounting for cross-lagged effects, demographic covariates, and clustering on the individual.

produced statistically significant indices of moderated mediation for both exposure to epidemiological information and norms (IMM information on COVID-19 vaccination = −0.012, $p = 0.001$; IMM information on influenza vaccination = 0.014, $p < 0.001$; IMM norms on COVID-19 vaccination = - 0.017, $p < 0.001$; IMM norms on influenza vaccination = 0.011, $p = 0.001$).

Next, we assessed the sensitivity of the relation between social media and vaccination by further considering differences in political ideology (measured on a 5-point scale ranging from "Very conservative" [1] to "Very liberal" [5]). In the analyses detailed above, we broke down the relation between Democrats and Republicans, but here we explored the relation along different points of the ideological spectrum. Using the same CLPMs to estimate the relation between social media use for health and vaccination, we now stratify the analysis by ideology. The relation was positive but not statistically significant among very conservative (COVID: 0.033, $p = 0.525$; influenza: 0.085, $p = 0.261$) and somewhat conservative (COVID: 0.075, $p = 0.085$; influenza: 0.058, $p = 0.239$) respondents. In contrast, the relation was positive and statistically

significant among moderate liberal participants (COVID: 0.118, $p = 0.002$; influenza: 0.121, $p = 0.002$) and very liberal (COVID: 0.261, $p < 0.001$; influenza: 0.233, $p = 0.001$) participants, and positive but mixed in statistical significance among somewhat liberal participants (COVID: 0.115, $p = 0.087$; influenza: 0.159, $p = 0.013$). Despite this variability, adding political party and ideology to the analyses in Table 1 did not alter the positive relation between social media use and vaccination. These analyses appear in Supplemental Table S2. This result highlights the potential of social media as a tool for increasing vaccination rates across parties, as well as its limitations in reaching the most conservative populations.

As a robustness check, we swapped our high-income covariate with a covariate that captures the median split on income with bins coded at or under $50,000 but less than $75,000 (0) or above $50,000 but less than $75,000 (1). We then re-ran our analyses and found no meaningful differences from our primary results. These analyses appear as Tables S3, S4, and S5 of the Supplemental Information and mirror the tables presented in the main text (i.e., Tables 1–3). Finally, we conduct exploratory analyses based on respondents' geographical region of residence. Our data includes participants in the South, Northeast, West, and North Central regions of the United States. We did not have prior expectations about possible differences between these groups because social media extends beyond physical geography. However, potential differences exist, given that cultural and health-service variation across the United States. Overall, we found similar patterns across regions, with slight variations for the different vaccines. For instance, for influenza vaccination, we found a positive and statistically significant influence of social media use on influenza vaccination in each region ($p < 0.05$). For COVID-19 vaccination, we found a positive and statistically significant influence of social media use in the South and Northeast ($p < 0.01$), a marginally significant influence in the North Central region ($p = 0.051$), and no influence in the West ($p = 0.239$). These results appear in Table S6 in the Supplemental Information. We also include an expanded discussion section given certain statistically significant relations in our selection models.

3. Discussion

pOur longitudinal study with a total sample size of 1768 Americans provided evidence of a consistent positive relation between social media use and vaccination across all major party affiliations. We also found that the relation between social media use and vaccination was not reciprocal such that vaccination did not drive social media use. These results reveal possible successes by public health officials and those engaging in medical communication in increasing vaccination through social media campaigns. They also reveal opportunities for greater use of social media to reach and encourage vaccination regardless of political party. The strengths of our findings are the size and quality of our sample and the robust statistical evidence we provided. Despite these strengths, the work we presented here is not experimental, and we cannot rule out the possibility of unmeasured third variable effects. Another limitation of this work is that it does not use measures of actual social media use but, instead, uses self-reported measures of media consumption. Therefore, the potential for error is present as people may not always recall information perfectly.

Future research in this vein should prioritize experiments that randomly assign Democrats and Republicans to use or not use social media over a time period, thus uncovering causal impacts on encounters with more information about pathogens and pandemics, perceptions of norms, and subsequently, health behaviors (Broockman and Kalla, 2022). Beyond experimental designs, future work should explore what individual differences moderate the relation between social media use and vaccination, especially among Democrats and Republicans with different religious or educational backgrounds. This research focused on adults in the U.S. in general, as well as large groups of Democrats and Republicans. However, a great amount of demographic, political, religious, and racial heterogeneity is present within these groups (Kuru et al., 2022). This work does not speak to the behavior of specific smaller groups within the general populations of Democrats, Republicans, and Independents. Future studies should also capture actual rates of social media use rather than self-reported use, with close attention to the types of platforms used. However, at a time of great pessimism when it comes to vaccination among Republicans, our findings suggest ways of curbing political polarization in a domain where polarization should not exist.

3.1. Public health implications

In the U.S., an estimated 103.4 million reported cases and 1.2 million deaths have been caused by COVID-19 since the beginning of the pandemic (World Health Organization, n.d., 2024). The CDC estimates that between 33 and 60 million cases and 23,000–66,000 deaths related to influenza in this season (October 1st, 2023 to April 6th, 2024) alone (Center for Disease Control and Prevention, 2024a). Federal programs make COVID-19 vaccination free for adults (Centers for Disease Control and Prevention, 2024c). Similarly, annual influenza vaccination is typically free or inexpensive regardless of insurance. Yet, the COVID-19 and influenza vaccination rate for adults and children alike remains low. Only 14.1% of Americans received the latest version of the COVID-19 vaccine, and only 53% of Americans received the influenza vaccine (Center for Disease Control and Prevention, 2024b). Our results show that social media can be a powerful tool in increasing vaccination uptake. Understanding the processes through which this happens is also critical to medical communication.

According to our findings, Republicans who use social media more are also more likely to think that people who are important to them receive all the recommended vaccines, and in turn, this normative belief predicts greater COVID-19 and influenza vaccination uptake. Meanwhile, Democrats who use social media more are more likely to encounter media information about new pathogens (like COVID-19) and outbreaks, and in turn, this exposure predicts greater influenza and COVID-19 vaccination uptake. This set of findings thus suggests that while social media can improve healthy behavior, the pathways of influence may vary based on party lines.

Moreover, our findings do not necessarily imply that time on social media is *always* positively associated with greater vaccination among Republicans. For example, Republican social media users who follow only conservative friends who do not vaccinate or may even promote anti-vaccination attitudes may receive less benefit from social media. Also, the quality of information in the social media ecosystem will likely influence the strength and direction of the effects documented for Democrats. For instance, a social media platform overrun by misinformation due to a lack of content moderation (Allcott et al., 2019) may not boost health behaviors. Additionally, as indicated by our sensitivity analysis, political ideology plays a moderating role in these associations. For Republicans or Democrats who consume mostly conservative media or whose networks are mainly conservative, social media will likely not result in greater vaccination. Different social media platforms use different algorithms and, therefore, may show users more or less media concerning the behaviors of others or information about pathogens and pandemics. Another open question is which social media platforms are driving the relations found in this paper. All in all, this type of heterogeneity should be examined in the future.

Our findings suggest that social media are not merely reflections of existing health behaviors but rather actively contribute to shaping them. Given the critical role of vaccination for public health, especially in the context of future pandemics, understanding these pathways can inform strategies to effectively use social media for health promotion interventions. It may also simultaneously reveal that the strategies being used on social media by public health officials, healthcare professionals, and others engaging in medical communication may be effective. However, given the limited relation between social media and vaccination among the most conservative, our study can inform future work

in medical communication by either investing in conservative social media, or using other means to reach this population. Our findings not only underscore the positive potential for social media but also reiterate the importance of tailoring messages to specific audiences as a way of improving their health outcomes (DeMora et al., 2021; Feinberg and Willer, 2019).

CRediT authorship contribution statement

Stephanie L. DeMora: Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **Javier A. Granados Samayoa:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Dolores Albarracín:** Writing – review & editing, Methodology, Investigation, Data curation.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2024.117031.

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