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Norm Setting in Times of Crisis: A Time-Series Analysis of the Dynamics Between Media Reporting and Perceived Norms in the Context of the COVID-19 Vaccination Roll-Out

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ABSTRACT

Social norms have great potential for mitigating crisis as people align their prevention behavior with the norms they perceive. However, there is insufficient knowledge of how normative perceptions are formed to exploit this potential. Drawing from agenda-setting theory, the present study examined norm-setting processes of media reporting on perceptions of vaccination norms during the COVID-19 pandemic. It combined data of a continuous content analysis of the salience and valence of the vaccination issue and a weekly repeated cross-sectional survey on perceived descriptive (i.e. perceived prevalence of willingness to get vaccinated) and injunctive vaccination norms (i.e. perceived approval of getting vaccinated) in the Swiss population, from February 2021 to February 2022. Time-series-based regression modeling did not support the hypothesized first-level norm setting—the transfer from issue salience in media to perceived descriptive norms in the population. However, we found evidence for second-level norm setting: Changes in issue valence predicted changes in perceived injunctive norms in the Swiss population. The findings provide unique insights into norm-setting processes and highlight the relevance of monitoring media reporting and public perceptions as a basis for evidence-based crisis communication.

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People orient their behavior toward social norms—that is, perceptions of what others do and approve of (Cialdini et al., 1990; Rimal & Real, 2005). This is especially true during crises, such as the COVID-19 pandemic, because in times of uncertainty, the need for orientation is particularly strong, and others' behavior and behavioral attitudes can provide important guidance (Cialdini & Trost, 1998; Rimal & Storey, 2020). From a strategic perspective, social norms thus have great potential; widespread behavioral changes in the population might be achieved by changing normative perceptions of what others do and approve of (Tankard & Paluck, 2016). However, to exploit this strategic potential of norms, knowledge is needed about how normative perceptions are formed.

Theoretical work has identified media as a crucial factor in the process of norm formation (Mead et al., 2014; Tankard & Paluck, 2016). The basic idea is that media convey information about what others do and approve of and that media users learn about social norms through exposure to this content (Geber & Hefner, 2019). While this idea is connectable and has been empirically supported in different contexts (e.g., formation of adolescents' risk-related peer norms, Siegel et al., 2022), there is a lack of specific theoretical and empirical knowledge on the formation of perceived public norms in a crisis context (Rimal & Storey, 2020). Such knowledge is necessary to provide solid starting points for norms-based crisis communication.

The present study aimed to provide a better understanding of the media's role in perception formation of public norms in crises and therefore examined the process of norm formation through media reporting during the COVID-19 pandemic. Specifically, we asked how news media reporting about the COVID-19 vaccination issue formed perceived vaccination norms in the overall population. The study complements the state of research in theoretical and empirical terms. To theoretically substantiate the role of news media in the process of public norm formation during a crisis, we referred to the tradition of public opinion research (Lippmann, 1922). Specifically, we used agenda-setting theory (McCombs & Shaw, 1972) in combination with the model of presumed influence (Gunther & Storey, 2003) to theorize on how the salience and valence of the COVID-19 vaccination issue set perceptions of public vaccination norms. Alluding to the distinction between first- and second-level agenda setting, we introduced the notions of first-level and second-level norm setting. To test the hypotheses on these norm-setting processes, we followed a longitudinal linkage design (Vreese et al., 2017). We combined data from a content analysis of news media and rolling population survey collected on a weekly basis from February 2021, which was the start of the vaccination campaign for the general population, to February 2022, the end of the second vaccination phase, in Switzerland.

Normative perceptions

Social norms are "rules and standards that are understood by members of a group, and that guide and/or constrain social behaviour" (Cialdini & Trost, 1998, p. 152). To comprehensively capture the meaning of social norms, social norm research differentiates between descriptive and injunctive norms (Cialdini et al., 1990). *Descriptive norms* refer to what is done in a social group—that is, the prevalence of a behavior. *Injunctive norms* pertain to what ought to be done and convey information about the social approval of a behavior (Cialdini et al., 1990). Most often in social norms research, closer social groups, such as peers or friends, are defined as the relevant reference group (Shulman et al., 2017). In a crisis context, however, the overall population can be considered a relevant reference group as well because of the need for collective action and thus widespread compliance with risk mitigation measures in the public (Diekmann, 2022; Schneider & van der Linden, 2023).

Social norms are considered important factors of individual behavior in the focus theory of normative conduct (Cialdini et al., 1990), theory of planned behavior (Ajzen, 1991), and theory of normative social behavior (Rimal & Real, 2005). As these theories aim to explain individual behavior, social norms are referred to as perceived norms (or normative perceptions) in these traditions: perceptions of what is done (i.e., perceived descriptive norm) and what ought to be done (i.e., perceived injunctive norm). Perceptions of descriptive norms influence behavior because they provide an "information-processing advantage" (Cialdini et al., 1990, p. 1015) regarding what may be an effective action, and perceived injunctive norms are behaviorally relevant because of people's intention not to be aberrant and their motivation for affiliation with others (Cialdini et al., 1990). Research in these theoretical traditions has provided cumulative empirical evidence that both perceived descriptive and injunctive norms influence behavior across various domains, including health prevention behaviors (Manning, 2009; Rhodes et al., 2020).

Compared to this well-established research tradition investigating the influences of perceived norms on individual behavior, there is relatively little knowledge about where normative perceptions come from (Geber et al., 2019). Researchers have discussed communication—encompassing mass media, social media, and interpersonal communication—as a crucial process through which the formation of norms occurs (Mead et al., 2014; Rimal & Storey, 2020; Tankard & Paluck, 2016). According to some studies on peer influences on adolescents' risk behaviors, the frequency and valence of interpersonal communication (Hendriks et al., 2021) and frequent exposure to alcohol-related content on social media (Beullens & Vandenbosch, 2016; Geusens et al., 2020; Siegel et al., 2022) are related to young people's

perceived peer norm of risk behavior, such as risky driving, drinking, as well as tobacco and e-cigarette use. It is unclear, however, to what extent the findings of this specific context (i.e., young people's peer norms and risk behavior) are transferrable to formation processes of public norms of risk mitigation.

News media and the setting of normative perceptions

To theoretically approach the process of public norm formation, we drew on the theoretical tradition of public opinion and its fundamental idea that news media are a primary source to create "pictures in our heads" about the world outside (Lippmann, 1922, p. 29). Specifically, we referred to propositions of agenda-setting theory (Shaw, 1977) and combined them with assumptions of presumed influences on third persons (Gunther, 1998).

Agenda setting proposes that the media agenda, that is, how salient the news media make certain issues, determines the public agenda—how much importance the public attaches to these issues (McCombs & Shaw, 1972). More specifically, with the expansion of agenda-setting research, researchers have introduced the differentiation between first- and second-level agenda setting (McCombs & Llamas, 1997; Wu & Coleman, 2009). First-level agenda setting refers to the transmission of issue salience and the idea that media "tells us *what* to think about" (Cohen, 1963, p. 13). Second-level agenda setting is about the transfer of attributes, such as the valence of an issue (i.e., whether the tone is positive, negative, or neutral), and proposes that the media "tells us *how* to think about" a certain issue (Cohen, 1963, p. 13). Thus, the salience and valence of issues in media reporting impacts the public agenda, an aggregate of people's assessment of the importance and evaluation of issues (Huck et al., 2009). Notably, agenda-setting research considered also behavioral outcomes, with the theoretical idea that the salience of an issue in the media underscores its importance and thus exerts pressure to engage in behaviors related to this issue. For instance, it was found that the salience of an election in media reporting affected the amount of votes (Roberts, 1992) and the salience of airplane crashes was related with decreased sale tickets (McCombs & Shaw, 1974).

To theorize on how agenda-setting processes translate into norm-setting processes, we particularly considered the behavioral dimension of agenda-setting and linked it with the model of presumed influence (Gunther & Storey, 2003). The behavioral dimension of agenda-setting resonates with the fact that social norms, as behavioral rules, refer to behaviors, and the model of presumed influence aligns with the aspect that social norms are perceptions of others' behavior and behavioral approval. Specifically, the model of presumed influence proposes that parts of media effects are due to media users' presumptions about media influences on others and thus are

reflected in their perceptions about others (Gunther & Storey, 2003). Following these ideas, agenda setting is likely to not only affect the perceived issue's importance, evaluation, and behavior of the media user him/herself, but also his/her perceptions of how others assess the issue's importance, evaluate the issue, as well as adopt their behaviors (Huck et al., 2009; Jeffres et al., 2008). Therefore, we derived propositions on first- and second-level norm-setting processes. The first-level process refers to the transfer of issue salience to perceived norms of the prevalence of a behavior in the public (i.e., perceived descriptive norm): As an issue becomes more salient, news users perceive that others attach more importance to that issue, and consequently they perceive that others are more willing to engage in issue-related behaviors. Second-level norm setting is about the impact of issue valence on perceived injunctive norms: The more positively an issue is discussed in the media, the more the news users expect others to hold positive attitudes toward that issue and, thus, to approve of issue-related behaviors. Given that the need for orientation has been discussed as a relevant factor in agenda setting (McCombs & Stroud, 2014) and in normative influences (Rimal & Storey, 2020), these norm-setting processes are expected to be particularly pronounced during crises, such as the COVID-19 pandemic.

The present study: COVID-19 context and hypotheses

The COVID-19 pandemic is a public health crisis of tremendous scale. It started in December 2019 in China, and 1 year later, the first COVID-19 mRNA vaccine (i.e., BNT162b2 from BioNTech/Pfizer) received emergency-use authorization from the World Health Organization (WHO) and several national regulatory authorities worldwide, including Switzerland, where the present study was situated. After a brief period during which vulnerable groups received priority, the entire Swiss population was called to be vaccinated against the virus in early 2021. Due to the novelty of the pandemic and the evolving science behind the virus and the vaccines, this was a time of uncertainty (Rimal & Storey, 2020). At the same time, the public discourse discussed the COVID-19 vaccination campaign as a collective action, as reflected in the term "herd immunity"(Aschwanden, 2021). The combination of high uncertainty and the need for collective action makes the above-derived propositions on norm setting through media reporting likely in this crisis context.

Following the distinction between first- and second-level norm setting, we hypothesized, first, that an increase in the salience of media reporting on the vaccination issue would translate into an increase in perceptions of the importance others ascribe to the vaccination issue and, thus, others' willingness to get vaccinated (i.e., public's descriptive vaccination norms).

Second, we hypothesized that a change in the valence of the vaccination issue toward more positive reporting would lead to an increase in perceptions of the approval of the issue-related behavior, that is, getting vaccinated, in the Swiss population (i.e., public injunctive norms of vaccination). The hypotheses were as follows:

H1: Changes in the salience of the COVID-19 vaccination issue in the news media influence changes in the perceptions of the descriptive vaccination norm in the population, with an increase in the salience leading to an increase in descriptive normative perceptions (i.e., first-level norm-setting).

H2: Changes in the valence of the COVID-19 vaccination issue in the news media influence changes in the perceptions of the injunctive vaccination norm in the population, with increasingly positive reporting leading to an increase in injunctive normative perceptions (i.e., second-level norm-setting).

A necessary condition for news' norm-setting effects is exposure to the news media agenda. Consequently, we expected direct influences on normative perceptions of non-regular news media users less likely to occur (compared to regular news media users). Nevertheless, since non-regular news media users are also part of the cumulative information environment the news media creates, there might be indirect, environmental media effects on them (Jerit et al., 2006). We therefore compared the effects on regular and non-regular news media users. Differences in effects could relate to the size and temporal immediacy of effects, and we therefore formulated the research question regarding which differences in media influences between media regular and non-regular news users become apparent.

RQ1: Which differences between regular and non-regular news media users in the influences of the valence and salience of media reporting on normative perceptions become apparent?

Method

The hypotheses testing was based on data collected from February 2021 (week 6) to February 2022 (week 5) via a continuous content analysis and a weekly repeated cross-sectional survey in Switzerland. This period marks the beginning of the vaccination campaign for the general population and the end of the second vaccination phase in Switzerland. The data are part of a larger project that monitored the public discourse about key COVID-19

prevention measures (e.g., mask wearing, social distancing, getting vaccinated) and social norms over the course of the pandemic. The purpose of both the content analysis and the survey was to investigate the three main language regions in Switzerland: the German-speaking region, which is the largest, with 71% of the population; the French-speaking region comprising 24% of the population; and the Italian-speaking region comprising 4% (Federal Statistical Office, 2022).

Content analysis

The sample of the content analysis was based on 21 Swiss online news media outlets and five Sunday newspapers with the highest reach per language region. Table 1 reports the sampled news media. The sample consisted of all articles in these outlets that were published between February 8, 2021, and February 4, 2022. We accessed online articles for the analysis through continuous web scraping of the analyzed outlets. Throughout the project, we scraped all articles published on the front page of the outlets ($n = 519{,}690$) once a day at 10 a.m. and stored them in a database. We accessed articles from the Sunday newspapers ($n = 18{,}149$) through the Swiss Media Database. In total, we obtained 537,839 articles as a starting point. We automatically identified the articles mentioning COVID-19 and vaccination with a keyword search: (″*corona*″ OR ″*covid*″) AND (″*impfen*″ OR ″*impfung*″ OR ″*impf*″ OR ″*vaccin*″ OR ″*vakzin*″). This resulted in a dataset of 34,461 articles.

Table 1. Overview of media sample.

Outlet	Language	Coded Articles
20minuten.ch	German	417
20minutes.ch	French	311
24heures.ch	French	193
aargauerzeitung.ch	German	294
blick.ch	German	644
cdt.ch	Italian	392
Le Matin Dimanche	French	37
lematin.ch	French	281
lenouvelliste.ch	French	73
letemps.ch	French	232
NZZ am Sonntag	German	70
nzz.ch	German	206
rsi.ch	Italian	144
rts.ch	French	104
SonntagsBlick	German	33
SonntagsZeitung	German	65
srf.ch	German	168
tagesanzeiger.ch	German	385
tio.ch	Italian	358
watson.ch	German	179
Weltwoche	German	39

$N = 4{,}625$ cases (over $T = 52$ weeks).

Three coders manually coded a random sample of 30% of the articles (n = 10,505 articles) and identified all articles that had at least two coherent sentences on the topic of COVID-19 vaccination (selection criterion). It is important to note that vaccination did not have to be explicitly mentioned in the two sentences (i.e., the word vaccination was not required). The coders therefore had to assess whether a sentence (implicitly) referred to vaccination or not.[1]

This procedure yielded a dataset of 4,625 articles. For all these articles, the coders then had to determine the dominant evaluation of the COVID-19 vaccination in the articles by distinguishing between positive, negative, and neutral/ambivalent evaluations (valence assessment). Before we started the coding, we tested our codebook. Based on the three coders' coding of 98 unique articles, we determined intercoder reliability measured with Krippendorff's alpha, which was .72 for the selection criterion and .81 for valence assessment.

Survey

The sample of the online survey comprised about 425 Swiss residents weekly, drawn every week from the LINK Internet panel. LINK adheres to the Esomar Code on Market and Social Research and is part of YouGov (LINK, 2022). The LINK Internet panelists received invitations to participate in the survey by e-mail each week. To ensure sufficient cases from all regions at the week level, we opted for a disproportionate sampling approach and targeted 100 respondents from the Italian-speaking region (which is an overrepresentation), 125 from the French-speaking region, and 200 from the German-speaking region. Within each language region, we set quotas for age and gender. We corrected differences between the achieved weekly sample and the sample quotas by survey weights.[2] Thus, the weekly surveys can be considered representative of people between the ages of 15 and 79 years old who lived in Switzerland, used the internet at least once a week for personal purposes, and were able to complete a survey in German, French, or Italian.

[1] An example: An article has the title "Study shows: protective measures in hospitals work" and mentions the vaccination strategy of Switzerland at the end of the article. In this case, the coders had to determine if the vaccination is part of the protective measures mentioned in the title as the article did not explicitly make this link.

[2] The calculation of individual weights was based on an iterative raking procedure (implemented in the R package "iterake") using the combination of language region, gender, and age.

Participants completed the online survey in either German, French, or Italian. The survey included, for each preventive measure under study (among others, getting vaccinated), a series of questions and items including respondents' normative perceptions. To administer the survey on a weekly basis, all constructs were measured with a single question or item. On average, the completion of the questionnaire took less than 5 minutes. Participants received points that they could exchange for vouchers for gift cards, digital cash credit, or charity donations. After the completion of a checklist provided by the Ethics Committee of the Faculty of Art and Social Sciences at the University of Zurich, the study received an exemption from full review of the ethics committee. LINK panelists give general consent to voluntarily take part in research and for the storage of personal data when they join the LINK panel.

Over the 52 weeks, the survey data included 23,583 cases in sum. Table 2 on the sample's demographic characteristics reveals that the categories with the most cases in terms of language, age, gender, and education are as follows: German-speaking, 45–64 years old, female, and medium to high education. These distributions align with those of the recent official national statistics (Federal Statistical Office, 2022).

Table 2. Overview of survey sample (weighted).

Variable	Percentage
Age	
18–29	24
30–44	24
45–64	34
65 and over	18
Sex	
Female	51
Male	49
Language Region	
German	72
French	24
Italian	4
Education	
Low	6
Medium	45
High	46
Not reported	(3)
Regular Newspaper Readers	
Yes	59
No	41

$N = 23{,}583$ cases (over $T = 52$ weeks). *Education*. Highest level of education achieved was grouped into low (compulsory school, including secondary level I [or lower secondary level], primary level, and kindergarten), medium (secondary level II or upper-secondary level, i.e., high school or vocational training), high (tertiary education, i.e., university, university of applied science), and no answer/refused.

Measurements

Key variables

The key variables of the present paper are, in line with agenda-setting research (McCombs, 2005; Vreese et al., 2017), the salience and valence of the media reporting on COVID-19 vaccination and, following norms research (Shulman et al., 2017), the perceived descriptive and injunctive norms in the population. All variables were measured at or transformed to the week level. The content analysis categories and survey questions are available as supplementary material: https://researchbox.org/1063.

Salience of reporting was measured by the number of articles per week in which the issue of COVID-19 vaccination was discussed centrally (see also Vreese et al., 2017). Concretely, for this variable, we counted articles of the randomly sampled dataset if at least two sentences concerned the topic of COVID-19 vaccination (selection criterion). On average, the study's sample counted four articles per news outlet and per week that discussed the issue of COVID-19 vaccination and met the selection criterion ($M = 4.17$, $SD = 1.19$).

Valence of reporting refers to the dominant evaluation of the COVID-19 vaccination in the articles (see also Vreese et al., 2017), the affective dimension in agenda-setting research (Wu & Coleman, 2009). We distinguished between 1 (*positive*), 0 (*neutral/ambivalent*), and − 1 (*negative evaluations*). On average, the valence of articles in the sample and throughout the study period was neither clearly positive nor negative ($M = -0.05$, $SD = 0.63$). We averaged the variable over all articles of the random sample per week and weighted the value by the mean's standard deviation to measure the valence of the articles independently of the article count and to reflect the heterogeneity of the issue's valence across the articles ($M = -0.06$, $SD = 0.16$).

Perceived descriptive norm on vaccination in the population was surveyed with the question "According to you, what proportion of the Swiss population will get vaccinated against the coronavirus?" on a slider ranging from 0% to 100%. This item has been applied before, for instance, in the context of COVID-19 preventive measures, such as the contact-tracing app (Geber & Friemel, 2022), or in the context of other health preventive measures, such as the intake of iron supplements to reduce anemia (Sedlander et al., 2021). Across the sample and study period, participants perceived, on average, that 62% of the Swiss population would get vaccinated ($M = 61.56$, $SD = 13.87$). We used the mean function to aggregate the variable at the week level ($M = 61.56$, $SD = 4.23$).

Perceived injunctive norm was surveyed with the question "According to you, how important is it in the view of the Swiss population to be vaccinated against the coronavirus?" using a 5-point scale ranging from 1 = *not at all*

important to 5 = *very important*. This item has been used in previous studies in different contexts (e.g., Friemel & Geber, 2021; Rimal & Real, 2005). Participants perceived, on average, that getting vaccinated was rather important to the Swiss population ($M = 3.67$, $SD = 0.84$). We aggregated the variable at the week level by calculating mean values ($M = 3.65$, $SD = 0.11$).

Moderator and control variables

News media use was included as moderator and drawn from the standard variables which LINK collects from their panelists and is updated once a year. Newspaper readership was assessed with the question "Which of the following newspapers do you read regularly—that is, usually at least three out of six consecutive issues?" and participants were asked to select newspapers from a presented list of titles with the greatest reach in each language region. We defined regular news readership as reading at least three of six consecutive issues of one newspaper. Of the overall sample, 59% were regular news readers.

Pandemic-related variables were included as control variables. We included the duration of the pandemic in days and new vaccinations per week because they cover the most crucial developments of the pandemic in general and the vaccination campaign in particular; we obtained both variables from the R package tidycovid19 (Gassen, 2021).[3]

Data analysis

In line with agenda-setting research (Krause & Fretwurst, 2007; Luo et al., 2019; Wanta & Ghanem, 2007), we used a time-series regression approach to examine our hypotheses regarding the impact of the media coverage on the perceived norms. We constructed time series for all variables across the main vaccination period in Switzerland, February 8, 2021 to February 4, 2022, which encompassed 52 weeks (Figure 1). Based on the time series, we built regression models with ARIMA errors (Hyndman & Athanasopoulos, 2021)—a combination of linear regression and autoregressive integrated moving average (ARIMA). The regression allowed us to analyze the effects of the independent variables (the salience and valence of media reporting) on dependent variables (perceived descriptive and injunctive norms), and the ARIMA considered the temporal structure of the data and estimated the extent to which values of dependent variables are a linear function of a series of past observations (autoregressive effect). To test the assumption of stationarity (i.e., that the time-series do not inhibit a trend), we inspected

[3]As the model refers to the population and not the individual level, we did not include individual-level controls, such as socio-demographic characteristics or political beliefs.

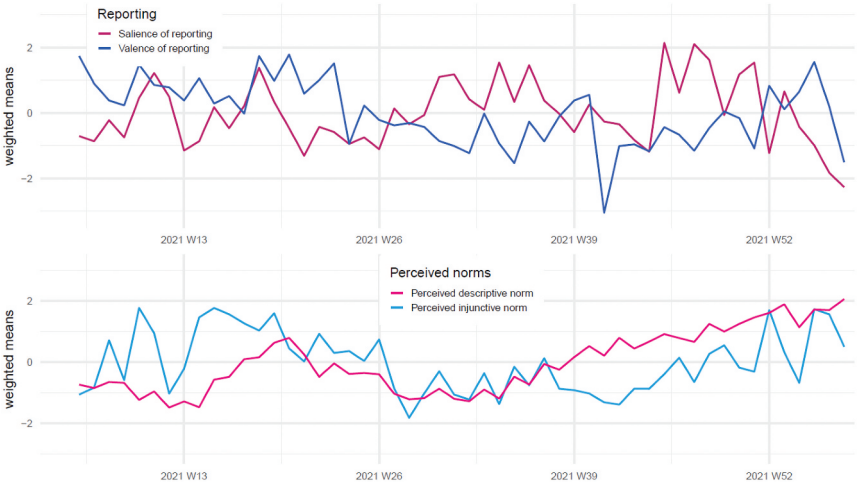

Figure 1. Time series of media reporting and perceived norms on covid-19 vaccination. Time series of the standardized key variables on a weekly basis from February 8, 2021, to February 4, 2022 ($T = 52$ weeks).

the Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF), used Seasonal and Trend decomposition using Loess (STL decomposition), and conducted the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root tests (the analyses are documented in the appendix, accessible here: https://researchbox.org/1063). These analyses indicated that the time-series of the perceived descriptive norm had a positive trend and was not stationary. For detrending, the variable duration of the pandemic was included as an exogenous variable in all models, partialling out any potential trends. After detrending, we had no significant stationarities in the KPSS unit root tests. All time-series were z-transformed so that the effects are interpretable as standardized regression coefficients.

To test H1 and H2 on first- and second-level norm setting, we estimated dynamic regression models with ARIMA errors, one for perceived descriptive vaccination norm and one for perceived injunctive vaccination norm. In addition to salience and valence of vaccination reporting as predictors and the autoregressive effects, the models included the respective other perceived norm (i.e., perceived descriptive/injunctive norm), the duration of the pandemic for overall linear trends (see above) and control variables (i.e., new vaccinations). To examine RQ1 and thus the question of differences in media influences between regular and non-regular news media users, we ran the models separately for both subsamples.

To examine the underlying idea of causality between the salience and valence of the vaccination issue and perceived vaccination norms in the public, we included time-lagged time series of the salience and valence in

the models in addition to the contemporaneous time series. This follows the principle that causes process over time to exert their effects, and therefore the changes in an endogenous variable can only be caused by a retrospective process through change in the exogenous variables (Coleman, 1968). Authors have discussed the issue of appropriate lag length in the context of agenda-setting research specifically (Luo et al., 2019) and methodological discussion about time-series analysis in communication science in general (Wells et al., 2019)—with no clear conclusion. Given the lack of theoretical indication and empirical evidence, we approached the question of lag length empirically. We followed Hyndman and Athanasopoulos's (2021) recommendations and included several time lags of the predictors and determined the appropriate lag length on the Corrected Akaike's Information Criterion (AICc), an estimator of prediction error and thus the relative quality of statistical models. We considered up to four time lags in our models, capturing more short-term effects on a weekly basis and more long-term effects on a monthly basis (Hyndman & Athanasopoulos, 2021). The best-fitting models, those with the smallest AICc value, varied in the number of predictors' time lags, ranging from one to four lags (Table 3). To estimate the final models, we included as many lags of the salience and valence of media reporting as the AICc suggested (marked bold in Table 3).

We conducted all analyses in the R environment (R Core Team, 2022) and performed the time-series analyses with the R packages feasts and fable (O'Hara-Wild et al., 2022). Codes, datasets, and appendices are available as supplementary material: https://researchbox.org/1063.

Table 3. Comparison of the corrected Akaike's information criterion (AICc) for models with different numbers of lags of salience and valence of reporting.

	Perceived Descriptive Norm	Perceived Injunctive Norm	Perceived Descriptive Norm		Perceived Injunctive Norm	
	Overall Sample		Regular Newspaper Readers	Non-regular Newspaper Readers	Regular Newspaper Readers	Non-regular Newspaper Readers
Salience of Reporting						
−1 lag	**53.2**	136	**80.9**	91.1	143	142
−2 lags	55.0	134	82.9	94.8	143	141
−3 lags	58.4	**128**	83.8	88.5	144	142
−4 lags	56.8	130	86.0	**86.8**	**141**	**138**
Valence of Reporting						
−1 lag	**52.8**	128	80.0	89.4	141	129
−2 lags	54.2	124	81.6	92.4	139	**126**
−3 lags	56.0	126	**78.9**	85.9	141	127
−4 lags	56.9	**117**	83.6	**83.5**	**137**	126

A lower AICc indicates a better fit; lowest values are marked bold.

Results

Figure 1 reports the time series of the standardized key variables on a weekly basis from February 2021 to February 2022. To determine the extent to which the issue dynamics correlated with the dynamics of normative perceptions, we refer to the results of the time series-based regression analysis.

We find no effects of the salience of the COVID-19 vaccination issue on perceived descriptive norms and thus no support for H1 on first-level norm setting. In addition to the hypothesis test, this model shows that changes in the perceptions of the descriptive norm were correlated with changes in the perceived injunctive norm, reflecting the relationship between both series that also becomes visible in the time-series plots (Figure 1). With respect to the control variables, the duration of the pandemic was positively correlated with the perceived descriptive norm. The longer the pandemic lasted, the higher was the perceived descriptive vaccination norm.

Turning to H2 on second-level norm setting, the model shows positive influences of the valence of the vaccination issue on the perceived injunctive norm in the public—one concurrent and one time-lagged effect. The time-lagged effect indicates that changes toward more positive reporting about the COVID-19 vaccination 1 month ahead led to an increase in social approval perceptions of vaccination in the population, which is in line with H2. Further, the perceived injunctive norm was highly dependent on the perceived descriptive norm, more so than the descriptive norm on the injunctive norm in the perceived descriptive norm model.

Regarding RQ1, the results in Table 4 indicate differences between regular and non-regular newspaper readers in norm-setting processes, manifested in the size and lag of effects. First, we find a time-lagged positive effect of the valence of media reporting on perceived descriptive norm in the sample of regular newspaper readers but not in the sample of non-regular newspaper readers. Changes in the media reporting toward a more positive evaluation of the vaccination campaign led to a higher perceived descriptive norm among regular newspaper readers. Regarding the formation process of perceived injunctive norms, there were differences between regular and non-regular newspaper readers as well. Among regular newspaper readers (but not among non-regular readers), the salience of the vaccination reporting had positive effects on approval perceptions in both concurrent as well as lagged models, indicating that changes toward a higher salience of the vaccination issue in the media led to a higher injunctive norm perception. The valence of media reporting positively influenced the perceived injunctive norm among regular and non-regular readers, but we find time-lagged effects only among regular readers—that is,

Table 4. Time series-based regression models.

	Perceived Descriptive Norm		Perceived Injunctive Norm		Perceived Descriptive Norm				Perceived Injunctive Norm			
	Overall Sample				Regular Newspaper Readers		Non-regular Newspaper Readers		Regular Newspaper Readers		Non-regular Newspaper Readers	
ARIMA(p,d,q)	(2, 0, 0)		(1, 0, 0)		(1, 0, 0)		(1, 0, 0)		(0, 0, 0)		(1, 0, 0)	
	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*
Noise Terms												
ar1	.53	<.001	.42	.014	.62	<.001	.47	.002	–	–	.38	.021
ar2	.29	.038	–	–	–	–	–	–	–	–	–	–
Perceived inj/desc norms	.12	.042	.76	.002	.26	<.001	.27	.002	.85	<.001	.64	.003
Salience of Reporting												
Concurrent	−.01	.837	−.01	.957	.00	.943	.01	.918	.29	.014	−.10	.378
−1 lag	−.01	.871	.12	.252	.01	.869	−.05	.523	.22	.034	−.04	.720
−2 lags	–	–	.01	.940	–	–	.00	.992	.02	.819	−.15	.204
−3 lags	–	–	−.08	.420	–	–	−.01	.919	−.04	.710	−.07	.540
−4 lags	–	–	–	–	–	–	−.04	.586	.25	.023	.10	.387
Valence of Reporting												
Concurrent	.00	.978	.25	.039	.05	.485	.00	.982	.04	.724	.41	.002
−1 lag	.03	.659	.12	.335	.04	.630	.14	.130	.00	.976	.15	.272
−2 lags	–	–	−.09	.464	.05	.509	.13	.147	.09	.410	−.21	.108
−3 lags	–	–	.24	.078	.20	.008	−.02	.832	.30	.025	–	–
−4 lags	–	–	.37	.009	–	–	−.09	.358	.61	<.001	–	–
Control Variables												
New vaccinations	.12	.313	−.27	.129	.08	.553	.20	.119	−.13	.261	−.15	.388
Duration of the pandemic	.08	<.001	−.05	.184	.09	<.001	.10	<.001	−.02	.298	−.05	.078

(p,d,q) = ARIMA model specification with *p* = number of autoregressive terms, d = number of nonseasonal differences, q = number of lagged forecast errors; ar1 = first-order autoregressive effect; ar2 = second-order autoregressive effect; – = factor was not included in the model as recommended by the AICc; the variable duration of the pandemic incorporates a linear time trend into the model (with this detrending, all time series are stationary); β: for the sake of readability, z-transformed variables were used to standardize the coefficients (even though this is not the same as standardized betas of ordinary least squares regression).

increasing positive reporting translated into higher social approval perceptions among newspaper readers with a lag of 1 month.

Taken together, we find no support for H1 (i.e., first-level norm setting) that the salience of media reporting on the COVID-19 vaccination influenced perceptions of descriptive norms, but the results do show that the valence of media reporting influenced perceived injunctive norms, thus corroborating H2 and the idea of second-level norm setting. Regarding differences between regular and non-regular news media users (RQ1), we observe time-lagged effects of media reporting only among regular newspaper readers.

Discussion

The study combined data of a content analysis of news media and a rolling population survey during the COVID-19 vaccination campaign to gain insights into media's role in the process of norm setting during a crisis. Generally, the study supported the notion of norm setting, with public perceptions of injunctive norms being more influenced by news media reporting than perceptions of descriptive norms, and issue valence turning out to be a more relevant factor in norm setting than issue salience. More specifically, we did not find evidence for first-level norm setting—that is, the transfer of issue salience to perceived descriptive norms in the public—but we did find evidence for second-level norm-setting, the transfer of issue valence in media reporting to perceived injunctive norms. Furthermore, norm setting was only found among regular newspaper readers and turned out to occur rather on the month- than week-level. In the following section, we discuss the differences found between descriptive and injunctive norms, first- and second-level norm setting, and regular and non-regular newspaper readers.

Concerning the differentiation between descriptive and injunctive normative perceptions, the results indicate that injunctive approval perceptions seem to more strongly depend on descriptive prevalence perceptions than the other way around, indicating that people regard a behavior as a more reliable indicator of the behavior's approval than its approval as an indicator of its actual execution, which seems plausible given that behaviors are more directly observable than attitudes. Altogether, this finding suggests that people are more insecure about how others think compared to what others do and are thus more susceptible to cues about injunctive than descriptive norms. This could also be a reason why media reporting has more and stronger influences on perceived injunctive than on descriptive vaccination norms.

More specifically, our results did not support the notion that the salience of COVID-19 vaccination influences perceptions of descriptive vaccination

norm, which we referred to as first-level norm setting. However, we did find evidence for second-level norm setting: The valence of the COVID-19 vaccination issue set perceptions of the public injunctive vaccination norm. Thus, the results corroborate the idea that the evaluation of the vaccination issue in the media served as heuristic cue by which people inferred the public's approval of vaccination. The difference found between first-level and second-level norm setting is to some extent consistent with findings in agenda setting-research: studies on issue valence revealed higher correlations than studies on issue salience (e.g., Lopez-Escobar, 1998; Wu & Coleman, 2009). According to Wu and Coleman (2009), this could be explained by a hierarchy of effects: The valence of issues might gain more attention than the sheer salience of issues and, thus, perceptions including evaluations might be more strongly affected than perceptions about the importance of issues and behaviors. That we did not find any salience effect on perceived descriptive norm might be further explained by a ceiling effect in the specific context of the COVID-19 vaccination campaign: Already at the very beginning of the campaign and the study period, the perceived descriptive norm in the population was relatively high (59% of the Swiss population was willing to get vaccinated), and vaccination was already a majority norm in the perception of the Swiss population. In this context, an increasing frequency of media reporting about the vaccination campaign might not have been able to substantially increase this perception. The salience of media reporting might play a more important role in cases where a newly introduced and not yet established crisis measure is increasingly frequently present in media reporting, which future studies must investigate.

Last, we found time-lagged effects of media reporting only among regular newspaper readers. Temporal precedence is a precondition for causality, and given that we also considered other important principles of causality in the study and analysis design—such as autoregressive effects and control variables (Eichler, 2013)—we interpret these effects as indications of causal norm-setting influences. Most of these time-lagged effects were on a month level, suggesting rather slow norm-setting processes. The relatively long time lags are generally in line with findings in agenda-setting research indicating that "agenda setting is more a long-term effect" (Wanta & Ghanem, 2007, p. 45), which may take up to 4 weeks to occur or even longer (Wanta & Hu, 1994). This might indicate that the full effects of media influences do not unfold immediately but rather over some stages of change (Slater, 1999). One important stage in the process of norm setting might be interpersonal communication (Brosius, 1996), which studies have found to be influential in shaping normative perceptions (Geber et al., 2019; Hendriks et al., 2021). Interpersonal communication in which people more or less explicitly discussed social norms

might not only serve as mediators, transmitting media influences over time, but also moderators, increasing norm-setting influences of the media (Southwell & Yzer, 2007).

Theoretical implications

These findings include important theoretical implications. First, the observation that injunctive norm perceptions were more susceptible to external cues suggests that people are more uncertain about what others think compared to what others do. This implies that though descriptive and injunctive aspects are highly interlinked and develop over time in parallel, they are analytically different aspects of social norms. Thus, they not only differ in their downstream effects on behavior, as theorized in the focus theory of normative conduct (Cialdini et al., 1990) and theory of normative influence (Rimal & Real, 2005), but also in the process of how they form through communication, such as through norm-setting processes by the media.

Moreover, the study's results corroborate the general idea that the media agenda influences perceptions of public norms. This speaks to the theoretical integration of agenda-setting theory and the model of presumed influence, which has been discussed as promising before (Huck et al., 2009; Jeffres et al., 2008) but not yet transferred to the understanding of social norms formation. In this regard, we highlight the value of the presumed influence model (Gunther & Storey, 2003) as bridging theory, especially in social norms research. Jeffres et al. (2008) have already noted the linking function of the model of presumed influence because it offers an "audience perception of effects" (p. 476). In the context of social norms, this audience perception is of particular value because the perceptions of the audience refer to others, third persons, and norms are perceptions of others' behaviors and approval of behaviors.

Finally, it is notable that though crises are rather dynamic times, the time lags of the media influences in this study indicate that the process of norm setting evolves rather slowly, on a monthly level. Given the ongoing discussion about appropriate time lags in agenda setting (Luo et al., 2019) and media effects research (Wells et al., 2019), this is an important finding that may inform future longitudinal media effect research. Furthermore, the rather long time lags might point to some underlying social processes and mechanisms, such as interpersonal communication as the mediator and moderator of norm-setting processes (Brosius, 1996; Southwell & Yzer, 2007). The present study, however, did not directly test these processes; they are thus rather speculative and require further theoretical and empirical investigation.

Practical implications

The continuous monitoring of the public discourse and normative perceptions regarding prevention measures is practically insightful as it provides important information for crisis communication. Specifically, the content analysis data help us understand how the news media responded to pandemic developments and political decisions, and the survey data reveal how normative perceptions of prevention measures developed over time. Beyond the pure descriptive information value, the analysis of the interdynamics between media reporting and normative perceptions help us "make sense of a chaotic, unpredictable, and increasingly complex communication and mass opinion system" (Wells et al., 2019, p. 4036).

Specifically, the present study's findings suggest that mass media influences on normative perceptions unfold their effects slowly—that is, more at a monthly and less at a weekly level. This implies some chances for strategic crisis communication because the development of the crisis and the media coverage can be monitored, allowing for identifying and addressing undesirable developments in public perceptions through communication at an early stage. In this regard, the findings indicate that public perceptions of descriptive norms in the population might be more difficult to address through communication, because they appeared relatively stable, whereas perceptions of injunctive norms appeared relatively susceptible to communicative influences, implying that positive messages can increase public approval perceptions.

Limitations and outlook

The study's linkage design integrating content and survey data over a period of about 1 year followed the latest calls in communication research (Vreese et al., 2017; Wells et al., 2019). At the same time, the study faced limitations that provide directions for future research. First, we performed the trend analysis at the aggregate level to examine norm-setting processes in the overall population, which was insightful for understanding general societal processes. However, this design did not allow for studying processes that might mediate media effects, such as interpersonal communication (Brosius, 1996; Huck et al., 2009). This also applies to cognitive processes involved in presumed influence (Gunther & Storey, 2003) on which we based our argumentation for the hypotheses but which we did not test directly. Future panel designs might combine data on media content and normative perceptions at the individual level to take account of mediators and moderators that cover susceptibility to media effects (Valkenburg & Peter, 2013),

Second, to examine differences in media influences between regular and non-regular news media users, we used the research institute's data on panelists' newspaper use that is only collected on a yearly basis and only covers a limited part of news media use. Thus, the division between regular and non-regular news media consumers in this study was rather rough, but it provided crucial insights on influences in the norm formation process.

Third, it is important to note that the findings emerged from a Western society and in the context of a democratic media system. It is unclear to what extent the present findings are transferrable to other cultural settings. Empirical evidence on communicative and normative influences on COVID-19 prevention behavior in varying settings suggests that the norm formation process depends on media system-related and cultural factors (Geber & Ho, 2022). Therefore, future research should consider cross-cultural differences in public norm-setting.

Finally, the scope of the present findings is restricted to the context of the COVID-19 pandemic, and we do not know whether the findings also apply to other crises, such as the climate crisis. Thus, we need further evidence on media-based norm-setting processes in other crisis contexts. Ultimately, the goal should be to classify crises along meaningful theoretical attributes, such as their dynamic or everyday salience, to understand the extent to which norm-setting processes occur.

Conclusion

The study provides initial answers to the question of how media reporting forms normative perceptions of the prevalence and approval of risk mitigation measures in the population. Overall, the results corroborated the notion with regard to norm setting. Specifically, while we found no evidence for first-level norm setting—that is, the transfer of issue salience in the media to perceived public descriptive norms—we did find evidence for second-level norm setting: Issue valence in media reporting influenced perceptions of public injunctive norms. Further research is necessary to understand possible underlying processes, such as indirect influences through interpersonal communication. Moreover, owing to the increasing severity, dynamic, and synchronization of current global crises, future research must generate insights on the process of norm formation across crises and cultures to prepare for future challenges.

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Data availability statement

Content analysis categories, survey questions, data analysis codes, and datasets are available as supplementary material: https://researchbox.org/1063.

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