Crafting normative messages to promote childhood vaccine advocacy

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Objective: Vaccines are one of the most significant accomplishments of biomedical science and public health. Yet despite their known safety and effectiveness, public confidence in vaccination—and childhood vaccination in particular—is decreasing. Here, we examine the effectiveness of two strategies for leveraging support for childhood vaccination: (1) persuasive normative messages, and (2) communicating the social benefits of vaccination. ***Method:*** Vaccination attitudes and behavioral intentions were examined in a sample of 403 American parents. After reading information about the measles, mumps, and rubella (MMR) vaccine, participants were exposed to either: (a) a descriptive normative message highlighting that most American parents vaccinate their children with the MMR vaccine, (b) an injunctive normative message highlighting that American parents think that vaccinating their children with the MMR vaccine is the right thing to do, (c) both (a) and (b), or (d) no normative message. Additionally, half the participants were given a verbal passage describing the mechanism of herd immunity and the social benefits of vaccination, whereas the other half received no such information. ***Results:*** Vaccination attitudes and MMR behavioral intentions were unaffected by the descriptive and injunctive normative messages when presented in isolation, whereas the combination of both normative messages significantly increased participant responses on the two measures. Communicating the social benefits of vaccination did not influence vaccination attitudes or MMR behavioral intentions. ***Conclusions:*** Persuasive messages that make both descriptive and injunctive vaccination social norms salient may be an effective strategy for increasing childhood vaccination uptake.

Keywords: vaccination, vaccine hesitancy, descriptive norms, injunctive norms, persuasive messages, herd immunity

A crucial feature of all societies is the existence of public goods—entities that depend upon the cooperation of group members to be provided. When provision succeeds, everyone benefits, whether they contributed to the public good or not. For this reason, public goods are often under-provided, or not provided at all. One vital public good is the herd immunity from disease conferred by vaccination. In many countries, the provision of this essential public good is under threat because vaccination—and childhood vaccination, in particular—is losing public confidence (Black & Rappuoli, 2010), in part, because of a rise in anti-vaccination misinformation (Khata, 2010). Accordingly, there is a pressing need to identify effective, evidence-based interventions to increase childhood vaccine advocacy. Here, we examine whether persuasive messages that make vaccine social norms salient can increase advocacy for the measles, mumps, and rubella (MMR) vaccine amongst American parents.

There are two types of social norms (Cialdini, Kallgren, & Reno, 1991): descriptive norms refer to people's perceptions of which behaviors are typically performed, whereas injunctive norms refer to people's

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perceptions of which behaviors are approved or disapproved. A wealth of evidence indicates that both types of norms shape behavior (Kallgren, Reno, & Cialdini, 2000; Rivis & Sheeran, 2003). For example, persuasive messages that make descriptive or injunctive norms salient have been shown to increase the uptake of various pro-environmental (Hurlstone, Lewandowsky, Sewell, & Newell, 2014; Schultz, Khazian, & Zaleski, 2008; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007) and health-protective behaviors (Mahler, Kulik, Butler, & Gerrard, 2008; Mollen, Rimal, Ruiter, Jang, & Kok, 2013; Smith-McLallen & Fishbein, 2008). There is also evidence that such persuasive messages are more effective when they activate descriptive and injunctive norms simultaneously, than when they activate either norm in isolation (Cialdini, Demaine, & Sagarin et al., 2006; Shultz et al., 2007, 2008).

In a recent review of the vaccine hesitancy literature, perceived social norms were identified as a key predictor of vaccine acceptance across 11 different studies (Larson, Jarrett, & Eckersberger et al., 2014). However, no studies have yet examined whether persuasive messages that make social norms salient can be used to leverage support for vaccination amongst parents. Our chief aim was to fill this gap in the literature. To this end, our sample of parents were exposed to either: (a) a descriptive normative message highlighting that most American parents vaccinate their children with the MMR vaccine, (b) an injunctive normative message highlighting that American parents think that vaccinating their children with the MMR vaccine is the right thing to do, (c) a conjunctive normative message combining both (a) and (b), or (d) no normative message.

A secondary aim was to examine whether the effectiveness of the normative messages could be modulated by communicating the social benefits of childhood vaccination in terms of the mechanism of herd immunity. Previous work has shown that communicating the concept of herd immunity can increase vaccine advocacy (Betsch & Böhm, 2018; Betsch, Böhm, Korn, & Holtmann, 2017). The rationale for including the herd immunity intervention was that it may enhance the effectiveness of the normative messages by providing message recipients with an explanation for why most people approve of vaccination and do vaccinate their children—namely, because high levels of vaccine compliance are required to reach the threshold for herd immunity to be conferred.

It was hypothesized that: (1) there would be a main effect of the normative message manipulation, such that post-manipulation attitude and MMR behavioral intention would be higher in the descriptive norm and injunctive norm conditions than in the no-normative-message condition, but lower in turn than in the conjunctive norm condition; (2) there would be a main effect of the herd immunity manipulation, such that post-manipulation attitude and MMR behavioral intention would be higher when the social benefits of herd immunity are communicated, compared to when those benefits are not communicated; and (3) post-manipulation attitude and MMR behavioral intention would be subject to an interaction, such that communicating the social benefits of herd immunity would be more effective in the descriptive norm, injunctive norm, and conjunctive norm conditions, than in the no-normative-message condition.

Methods

Ethical approval to conduct the study was granted by the Human Ethics office at the University of Western Australia (RA/4/1/8187).

Participants

Participants (N = 403; 54% female; mean age = 37.36; s = 11.34; range 18 – 73 years) were recruited during August 2016 using Prolific—an online crowdsourcing platform (https://prolific.ac). The data came from parents (or expecting parents) aged 18 years or older, who were citizens and residents of the United States, with English as their primary language. Participants received an honorarium of US$4.

Design

The study adopted a 4 (normative message: no norm vs. descriptive norm vs. injunctive norm vs. conjunctive norm) $\times$ 2 (herd immunity: no message vs. with message) between-participants design. Participants were randomly allocated to one of the eight conditions, with the constraint of roughly equal cell sizes.

Materials & Procedure

For economy of exposition, all study materials are reported here only in brief—see the online supplemental materials for further information.

The study was administered as an online survey. Participants provided informed consent initially, before answering various demographic questions. Next, participants completed several baseline normative perception and vaccination attitudinal measures. To measure normative perceptions of the MMR vaccination rate, participants were asked to estimate how many US parents (out of 100) vaccinate

Table 1
Participant characteristics.

Demographic	%
Gender	
Male	45
Female	55
Age	
18 – 29	25.7
30 – 39	39.4
40 – 49	17.3
50 +	17.6
Number of children	
1 – 2	73.1
3 – 4	21.1
5 – 6	1.5
Expecting a child	4.3
Race / ethnicity	
White, Caucasian	79.6
Black, African American	6.9
Asian	5.3
Hispanic, Latino	4.8
American Indian, Alaskan Native	1.5
Native Hawaiian, Pacific Islander	0.5
Other	0.8
Prefer not to say	0.5
Annual gross income	
< $30,000	22.6
$30,000 – $59,999	31.0
$60,000 – $89,999	25.2
$90,000 – $119,999	9.7
> $120,000	10.4
Prefer not to say	1.0
Highest education level	
Some high school	1.5
Completed high school	20.5
Vocational education / diploma	12.5
Currently enrolled in a Bachelor's degree	7.7
Completed Bachelor degree	43.5
Currently enrolled in postgraduate studies	1.5
Completed Master's degree	9.5
Completed Doctorate	3.3
Prefer not to say	0.5

their children with the MMR vaccine (*perceived descriptive norm*). Pre-manipulation vaccination attitudes were then elicited using an 8-item measure (*pre-manipulation attitude*). The scale had high internal consistency reliability (McDonald's ω = .91). This was followed by a single item asking participants the degree to which their general vaccination attitudes are a reflection of their core moral beliefs and convictions (*moral conviction*).

Participants were subsequently given a verbal passage providing general information about the MMR vaccine containing information taken from The Center for Disease Control and Prevention. This included a brief description of the risks posed by the three diseases the MMR vaccine protects against, age of administration, cost, and effectiveness of the vaccine. Participants assigned to the with-message condition of the herd immunity manipulation were subsequently given a graph and accompanying text highlighting how vaccination protects the community via the mechanism of herd immunity, whereas participants allocated to the no-message condition received no information about herd immunity. Next, participants received normative information based on the normative message condition to which they had been allocated. Participants assigned to the descriptive norm condition were presented with a graph and accompanying text highlighting the true descriptive norm that 92 out of 100 American parents immunize their children with the MMR vaccine[1]; participants assigned to the injunctive norm condition were presented with a graph and accompanying text highlighting the true injunctive norm that American parents believe that vaccinations are important and that vaccinating children with the MMR vaccine is the responsible thing to do[2]; participants assigned to the conjunctive norm condition received both the descriptive norm and injunctive norm graphs and accompanying texts in that order; participants in the no-norm condition received no normative information.

Next, participants completed the Vaccination Confidence Inventory (Rossen, Hurlstone, Dunlop, & Lawrence, 2018), a 22-item measure of vaccination attitudes that taps five major themes that are featured on anti-vaccination websites (*post-manipulation attitude*). These themes include: (1) vaccines are unsafe; (2) vaccines are ineffective; (3) malevolence of government and pharmaceutical companies; (4) vaccines are unnatural; and (5) parents should retain the right to decide whether one's child is vaccinated. The inventory had high internal consistency reliability (McDonald's ω = .97). Next, participants completed a single-item measure evaluating the likelihood that they would vaccinate a future child with at least one dose of the MMR vaccine (*vaccination intention*).

Finally, participants in the descriptive norm and injunctive norm conditions answered a comprehension question designed to assess their recollection of the information conveyed in the descriptive or injunctive norm graphics and text passages (participants in the

[1]CDC Report (2016), National, state and selected local vaccination among children aged 19–35 months.

[2]Pew Research Center (2015), Public and scientists' views on science and society.

Table 2
Means and standard deviations (in parentheses) for the five dependent measures as a function of the normative message and herd immunity manipulations.

Manipulation		Dependent Measures				
		Pre-Manipulation			Post-Manipulation	
Normative Message	Herd Immunity	Perceived Norm	Pre-Manipulation Attitude	Moral Conviction	Post-Manipulation Attitude	Behavioural Intention
No Norm	No Message	84.39 (12.47)	5.00 (1.34)	6.04 (3.03)	4.99 (1.34)	8.16 (3.04)
	With Message	84.16 (15.65)	5.31 (1.24)	6.55 (2.78)	5.25 (1.13)	9.12 (1.87)
Descriptive Norm	No Message	85.50 (15.92)	5.18 (1.28)	6.06 (3.06)	5.20 (1.30)	8.88 (2.52)
	With Message	84.65 (18.41)	5.15 (1.50)	6.14 (3.04)	5.04 (1.41)	8.59 (2.83)
Injunctive Norm	No Message	85.73 (14.03)	5.23 (1.18)	6.17 (2.93)	5.26 (1.17)	9.10 (2.12)
	With Message	81.53 (15.14)	5.06 (1.43)	6.86 (2.63)	4.94 (1.43)	8.61 (2.75)
Conjunctive Norm	No Message	86.52 (8.55)	5.38 (1.20)	6.64 (2.98)	5.56 (1.18)	9.66 (0.90)
	With Message	87.53 (10.53)	5.37 (1.33)	6.64 (3.24)	5.49 (1.37)	9.30 (1.72)
		Marginal Means – Normative Message				
No Norm		84.27 (14.11)	5.15 (1.29)	6.30 (2.90)	5.12 (1.24)	8.65 (2.55)
Descriptive Norm		85.08 (17.11)	5.17 (1.38)	6.10 (3.03)	5.12 (1.35)	8.74 (2.67)
Injunctive Norm		83.61 (14.68)	5.14 (1.31)	6.52 (2.79)	5.10 (1.31)	8.86 (2.45)
Conjunctive Norm		87.01 (9.52)	5.38 (1.26)	6.64 (3.09)	5.53 (1.27)	9.49 (1.36)
		Marginal Means – Herd Immunity				
	No Message	85.54 (12.94)	5.20 (1.25)	6.23 (2.99)	5.26 (1.26)	8.95 (2.33)
	With Message	84.43 (15.27)	5.22 (1.37)	6.55 (2.92)	5.18 (1.34)	8.90 (2.35)

Note: Response scales were: 0% – 100% for perceived descriptive norm; 1 (strongly disagree) – 7 (strongly agree) for pre-manipulation attitude; 1 (not at all) –10 (very much) for moral conviction; 1 (strongly disagree) – 7 (strongly agree) for post-manipulation attitude; and 0 (very unlikely) – 10 (very likely) for behavioral intention.

conjunctive norm condition answered both comprehension questions).

Results

Preliminary analyses identified two participants who did not complete all measures; four participants who were not current or expectant parents; and a further three participants who failed both attention checks. The data of these nine participants were therefore removed from consideration. Participant characteristics for the final sample (N = 393) are given in Table 1, whereas descriptive statistics are given in Table 2.

Analysis of participants' estimate of the MMR vaccination rate indicated that 64.9% of individuals underestimated the actual vaccination rate (i.e., that 92% of American parents vaccinate their children with the MMR vaccine). The mean estimate was 84.99 (s = 14.15; range = 3 – 100), which is reliably lower than the true vaccination rate, $t(392) = -9.828$, $p < .001$. Perceived descriptive norm estimates did not vary reliably between conditions, $\chi^2(7) = 5.50$, $p = .599$. Similarly, there were no reliable differences between conditions in pre-manipulation vaccination attitude, $\chi^2(7) = 3.93$, $p = .788$, or moral conviction, $\chi^2(7) = 3.96$, $p = .783$.

Post-manipulation attitude and MMR behavioral intention were analyzed via separate linear and ordinal regression analyses, respectively, with the dummy-coded main effect of normative message, the main effect of herd immunity, and the normative message × herd immunity interaction as predictors. For the analysis of post-manipulation attitude, there was a reliable effect of normative message. Specifically, compared to the no-norm baseline condition, the conjunctive norm message produced a reliable increase in post-manipulation attitude ($\beta = 0.57$, $SE = .26$, $t = 2.19$, $p = .029$), whereas the descriptive norm ($\beta = 0.21$, $SE = .26$, $t = 0.82$, $p = .413$) and injunctive norm messages ($\beta = 0.27$, $SE = .26$, $t = 1.03$, $p = .303$) presented in isolation were both ineffective (see Figure S1A of the online supplemental materials). There was no reliable effect of herd immunity ($\beta = 0.26$, $SE = .26$, $t = 1.00$, $p = .319$). The interaction terms examining the effect of herd immunity at the level of descriptive norm ($\beta = -0.42$, $SE = .37$, $t = -1.15$, $p = .252$), injunctive norm ($\beta = -0.58$, $SE = .37$, $t = -1.56$, $p = .119$), and conjunctive norm ($\beta = -0.33$, $SE = .37$, $t = -0.89$, $p = .375$) were all non-reliable.

Turning to the analysis of MMR behavioral intention, the results mirrored the analysis of post-manipulation attitude. There was a reliable effect of normative message—compared to the no-norm baseline condition, the conjunctive norm message produced a reliable increase in MMR behavioral intention ($\beta = 1.30$, $SE = .45$, $t = 2.90$, $p = .004$), whereas the descriptive norm ($\beta = 0.83$, $SE = .42$, $t = 1.95$, $p = .100$) and injunctive norm messages ($\beta = 0.83$, $SE = .42$, $t = 1.95$, $p = .052$) presented in isolation were both ineffective

(see Figure S1B of the online supplemental materials). There was no reliable effect of herd immunity ($\beta = 0.59$, $SE = .40$, $t = 1.48$, $p = .140$). The interaction terms examining the effect of herd immunity at the level of descriptive norm ($\beta = -0.86$, $SE = .58$, $t = -1.47$, $p = .142$), injunctive norm ($\beta = -1.04$, $SE = .59$, $t = -1.77$, $p = .076$), and conjunctive norm ($\beta = -0.98$, $SE = .63$, $t = -1.57$, $p = .117$) were all non-reliable.

Discussion

We report the first study to examine whether persuasive messages that make vaccination social norms salient can be used to increase childhood vaccine advocacy. We obtained partial support for our first hypothesis. Specifically, the persuasive message aligning both descriptive and injunctive MMR vaccination social norms increased vaccination attitudes and MMR behavioral intentions, compared to a no-normative-message baseline. However, when presented in isolation, neither the descriptive nor the injunctive normative messages were effective. It would therefore seem that knowing what most people do, and what most people approve of, is a necessary pre-condition for the constructive influence of social norms on vaccination attitudes and intentions to materialize. At variance with our second hypothesis—and recent previous research (Betsch & Böhm, 2018; Betsch et al., 2017)—vaccination attitudes and MMR behavioral intentions were unaffected by communicating the social benefits of vaccination in terms of herd immunity. One speculation for this discrepancy is that it reflects differences in the way herd immunity information was communicated—in the studies of Betsch and colleagues, it was communicated by an interactive graphical simulation, whereas here it was communicated, more primitively, by a graph and text passage. Finally, communicating the social benefits of vaccination also failed to interact with the normative messages, at odds with our third hypothesis.

There are some potential limitations of the current study that merit comment. First, our data are based on a self-selected sample of members of an online crowdsourcing website. Accordingly, the results may not generalize to the American population at large. Second, the majority of our participants had a pro-vaccination outlook, as reflected by the fact that 245 out of 393 participants (62%) registered a composite scale score between 5–7 on the pre-manipulation vaccination attitude scale, reflecting moderate to strong agreement with pro-vaccination statements. Therefore, we cannot be certain that the beneficial action of making salient both descriptive and injunctive MMR vaccination social norms would generalize to a more vaccine-hesitant sample of parents. However, by the same token, the pro-vaccination outlook of our sample may also have mitigated against observing a beneficial effect of the descriptive norm, injunctive norm, and herd immunity interventions. This is because responses on the post-manipulation attitude and MMR behavioral intention measures were already close to their upper limits in the control condition, leaving little room to observe an increase in responses on these measures.

Notwithstanding the above-mentioned potential limitations, the current study provides a "proof of concept" that persuasive messages that align descriptive and injunctive vaccination social norms—what we call conjunctive norms—can be used to increase childhood vaccine advocacy. Future research could examine whether the results reported here generalize to a representative sample of American parents, which would include a higher proportion of parents holding vaccine-hesitant views.

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