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Use of narratives to enhance childhood vaccine acceptance: Results of an online experiment among Canadian parents

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ABSTRACT

Identifying effective interventions to promote children's vaccination acceptance is crucial for the health and wellbeing of communities. Many interventions can be implemented to increase parental awareness of the benefits of vaccination and positively influence their confidence in vaccines and vaccination services. One potential approach is using narratives as an intervention. This study aims to evaluate the effects of a narrative-based intervention on parents' attitudes and vaccination intentions. In a pre-post experiment, 2,000 parents of young children recruited from an online pan-Canadian panel were randomly exposed to one of the three videos presenting narratives to promote childhood vaccination or a control condition video about the importance and benefits of physical activity in children. Pre-post measures reveal a relatively modest but positive impact of the narratives on parents' attitudes and intention to vaccinate their child(ren). The results also suggest that narratives with more emotional content may be more effective in positively influencing vaccine attitudes than the more factual narrative. Using narratives to promote vaccination can positively influence parents' views and intentions toward childhood vaccines, but research is still required to identify the best components of such interventions.

Introduction

In Canada, routinely recommended vaccines for children are publicly funded, and programs are under the responsibility of provinces and territories which results in slightly different schedules and policies. For example, Ontario and New Brunswick require immunization for diphtheria, tetanus, polio, measles, mumps, and rubella immunization at school entry, while Manitoba requires a measles vaccination.[1] In 2021, the childhood National Immunization Coverage Survey estimated that vaccine coverage among 2-year-old children ranged from 77% for receipt of at least four doses of a vaccine against diphtheria, pertussis, and tetanus (DTaP) to 92% for receipt of at least one dose of a vaccine against measles[2] while 2% of children had not received any vaccine in their lifetime. This survey also reported that 6% of the parents of 2-year-olds (whose child had received at least one vaccine) were initially hesitant about vaccinating their child.[2] Mis- and disinformation are considered by experts to be a leading cause of or contributor to parental vaccine hesitancy.[3–5] To date, most studies on online vaccine misinformation have aimed to measure or quantify false information, used questionnaires to measure people's belief in different false conspiracy theories, or tested the effect of misinformation on vaccine attitudes using experimental research designs.[6–12] While work in this area has begun, there is currently less evidence of effective strategies to counteract or build resilience against false information about vaccination.[13]

In that context, a promising strategy is using narratives to promote vaccination.[14] Some meta-analyses have concluded that narratives are more effective than traditional fact-based educational or informational messages to increase the intention to adopt specific health behaviors.[15,16] However, there is less evidence on how to use narratives as a public health strategy to promote vaccination.[17,18] Thus, the objective of the study was to evaluate the effects of a narrative-based intervention on Canadian parents' attitudes and vaccination intentions.

Materials and methods

Data collection/sample

Respondents were drawn from a Leger online panel, a national panel of 400,000 individuals across 10 Canadian provinces (excluding northern territories). Participants aged 18 years old or over who were also parents of at least one child aged 5 or younger and could answer in French or English were eligible to participate. The study was conducted in April and May 2022.

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Study design

The study was conducted as a pre-post online experiment presenting narratives to promote childhood vaccination through short videos. Details on the development and pilot-testing of the narratives are reported elsewhere.[19]

Respondents were introduced to the purpose of the study and were asked to consent to participate. Participants who consented then completed the pre-experiment survey questionnaire that included measures of vaccine attitudes and intention and a series of socio-demographic questions (i.e. province of residence, age, gender, etc.). For progressing through the questionnaire, parents were asked to provide the (real or fictitious) first name of their child under 5 years old (the youngest child if more than one was under 5), which was then used to personalize items on parental attitudes and behaviors regarding vaccination (e.g., *Not including COVID-19 vaccines, have you ever refused any routine vaccinations recommended by your health-care provider for "CHILD'S NAME?"*).

After completing the pre-experiment survey, participants were randomly assigned into four groups of 500 participants (i.e., one of the three intervention groups or one control condition group). The randomization was automated in the web survey using pure random assignment between control and one of the three intervention groups. Respondents were unable to skip or advance the 2–4 min videos. After viewing the video, participants responded to several questions, including the same vaccine attitudes and intention questions, in addition to other questions related to their level of interest in the video, changes in their opinion toward vaccines, the impact of the COVID-19 pandemic on their vaccination behavior, and frequency of use of the Internet and social media for information about child(ren)'s health. The post-experiment survey collected data on participants' level of interest in the video and perceived influence of the video on their opinions about childhood vaccination. At the end of the survey, an open-ended question allowed participants to write comments about the study.

The sample size necessary was estimated at 2,000 participants to detect a statistically significant difference of 5% in vaccine intention between the pre- and post-survey for all intervention and control groups ($n = 500$ for each group). The research firm was responsible for recruitment, survey administration, and ensuring quality (e.g., preventing multiple entries from the same individual and removing careless responses). A representative sample of participants in terms of province of residence was invited to participate. The research team had no access to personal identifying information on the participants.

Intervention and control conditions

Three narratives were tested: 1) *Parents' informed decision-making*: an existing online video showing parents of young children explaining why they finally decided to have them vaccinated with routinely recommended vaccines after having first refused due to online negative information about vaccines (available in English, with translation and subtitles added by the team for the French version), 2) *A mother's story*: an existing online video showing a mother and her disabled son where the mother of the consequences of a vaccine-preventable disease (VPD) (serogroup B meningococcal disease) for her son and call for action to vaccinate (available in French and in English with subtitles), and 3) *A pediatrician's story*: a newly created and developed video involving a publicly known pediatrician and infectious diseases specialist's account of cases of some VPD encountered in his work (both English and French versions recorded). During the pilot-testing phase of the study (see[19]), parents were critical of the healthcare professional's story and had different suggestions on how to make the video more compelling (e.g., fewer facts and more personal tone). We developed this specific video casting the story of a bilingual Canadian pediatric infectious disease specialist who shared his past clinical experiences treating two children who died from VPDs.

These videos lasted approximately the same length (i.e., 2–4 min). The control condition (*Control*) consisted of a video involving pediatricians and family doctors explaining the importance and benefits of physical activity in children with images of parents and children physically active. The duration of the control video was similar to those used for the intervention conditions (English and French versions were slightly different, because they were involving characters who spoke only English or French).

Outcomes measures

The two main outcome measures were as follows: 1) intention to accept future routine vaccines and 2) vaccine attitudes. The vaccination intention question (*Routine vaccines intention*) measured parents' willingness to accept future routine vaccines (other than COVID-19 vaccine) for their child, using a 6-point scale (very likely, somewhat likely, neither likely nor unlikely, somewhat unlikely, very unlikely and I do not know). Vaccine attitudes were measured using a 5-item validated scale (*5C short Scale*) developed by Betsch et al.[20] to assess vaccine hesitancy. Respondents had to indicate their level of agreement with five statements, using a 5-point scale (strongly disagree = 1, somewhat agree = 2, neither agree nor disagree = 3, somewhat disagree = 4, strongly agree = 5). A score of 3 was attributed to I do not know response.

Statistical analysis

Descriptive statistics were produced for all survey variables. Statistical analyses were conducted using SAS (version 9.4) at 5% significance level. The *Routine vaccine Intention* was dichotomized, i.e., those who express the intention to get vaccinated (likely-somewhat likely) vs. those who are uncertain or unlikely to get vaccinated (unlikely-somewhat unlikely-neither likely nor unlikely-Do not know).

For the first outcome (i.e., parents' intention to accept future routine vaccines), a McNemar 2×2 table test was conducted to compare the pre- and post-experiment survey results for each intervention and control group. To assess the intervention's effectiveness, a paired logistic regression analysis was performed.

For the second outcome (i.e., vaccine attitudes), a mean score was calculated for the 5C short Scale for each participant using the approach of Betsch et al.[20] Responses to each item were coded as described above. A total mean score was computed for each participant (score ranged 5–25). Differences in scores between the pre- and post-survey for each intervention and control condition were assessed, and a Wilcoxon's signed-rank test and Kruskal–Wallis test were conducted by condition.

For both outcomes, data were adjusted by age, gender, income, and child's medical condition (i.e., with or without chronic medical conditions).

Differences in level of interest and perceived change in participants' opinions about childhood vaccination between each group were assessed. Sensitivity analyses were also conducted to explore the effect of the intervention when only participants with high reported level of vaccine hesitancy (i.e., those who responded "very hesitant or fearful" and "somewhat hesitant or fearful" to the item "How hesitant or fearful do you consider yourself to be about vaccinating your youngest child aged 0 to 5 with a routine recommended vaccine") were included in analysis.

The Centre de recherche du CHU de Québec-Université Laval Ethics Committee approved this study.

Results

Table 1 presents sample sociodemographics of participants by group. There were no differences in sociodemographic characteristics between groups, except that there were fewer participants born in Canada assigned to video 2, *A mother's story*.

Most participants were married or common law (87.6%) and identified as White (71.5%). The majority of participants were either working full-time (68.1%) or part-time (11.6%) (data not shown in the Table).

Table 2 presents respondent's child health status and vaccine attitudes and behaviors. At the pre-survey, a majority of the respondents (86.6%) indicated having a favorable intention to get their child any routine recommended vaccines other than the COVID-19 vaccine. Most participants held positive attitudes toward childhood vaccination and most children were vaccinated. Less than 20% reported being very or somewhat hesitant or fearful about vaccines (16.0%, $n = 320$).

With regard to the first outcome, i.e., the effectiveness of the narratives in parents' intention to accept future routine vaccines, no significant effect was observed post-survey in intervention groups (Table 3). Having been assigned to any intervention group condition did not increase participants' intention to vaccinate when compared to the control condition

Table 1. Sample demographics by intervention condition and total (%).

	Group Intervention				Total
	Parent's informed decision-making ($n = 500$) n (%)	A mother's story ($n = 500$) n (%)	A pediatrician's story ($n = 500$) n (%)	Control ($n = 500$) n (%)	($n = 2000$) n (%)
Province of residence					
Western provinces[1]	125 (25.0)	138 (27.6)	134 (26.8)	144 (28.8)	541 (27.1)
Ontario	149 (29.8)	145 (29.0)	155 (31.0)	139 (27.8)	588 (29.4)
Quebec	195 (39.0)	191 (38.2)	192 (38.4)	193 (38.6)	771 (38.6)
Eastern provinces[2]	31 (6.2)	26 (5.2)	19 (3.8)	24 (4.8)	100 (5.0)
Gender					
Man	157 (31.4)	169 (33.8)	152 (30.4)	145 (29.0)	623 (31.2)
Woman	343 (68.6)	327 (65.4)	346 (69.2)	351 (70.2)	1367 (68.4)
Other[3]	–	4 (0.8)	2 (0.4)	4 (0.8)	10 (0.5)
Highest level of education completed					
Elementary or high school (general or vocational training)	82 (16.4)	83 (16.6)	78 (15.6)	102 (20.4)	345 (17.3)
College (general pre-university or technical program)	165 (33.0)	163 (32.6)	169 (33.8)	162 (32.4)	659 (33.0)
University (undergraduate or graduate degree)	251 (50.2)	254 (50.8)	253 (50.6)	234 (46.8)	992 (49.6)
Prefer not to answer	2 (0.4)	–	–	2 (0.4)	4 (0.2)
Age					
18–29	62 (12.4)	180 (6.0)	84 (16.8)	83 (16.6)	309 (15.5)
30–39	315 (63.0)	296 (59.2)	300 (60.0)	296 (59.2)	1207 (60.4)
40–49	112 (22.4)	115 (23.0)	99 (19.8)	110 (22.0)	436 (21.8)
50–59	6 (1.2)	9 (1.8)	10 (2.0)	9 (1.8)	34 (1.7)
60 or older	5 (1.0)	–	7 (1.4)	2 (0.4)	14 (0.7)
Born in Canada*					
Yes	438 (87.6)	383 (76.6)	400 (80.0)	427 (85.4)	1648 (82.4)
No	62 (12.4)	117 (23.4)	100 (20.0)	73 (14.6)	352 (17.6)
Annual income					
Less than $50,000	58 (11.6)	75 (15.0)	82 (16.4)	88 (17.6)	303 (15.2)
Between $50,000 and $100,000	185 (37.0)	202 (40.4)	195 (39.0)	196 (39.2)	778 (38.9)
More than $100,000	236 (47.2)	210 (42.0)	196 (39.2)	193 (38.6)	835 (41.8)
Prefer not to answer	21 (4.2)	13 (2.6)	27 (5.4)	23 (4.6)	84 (4.2)

[1]Include British Columbia, Alberta, Saskatchewan and Manitoba.
[2]Include New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland and Labrador.
[3]Include Non-binary, transgender, Two-spirit and other identities specified by respondents.
[4]Include Strongly agree and Somewhat agree answers.
[5]Include Strongly disagree and Somewhat disagree answers.

Table 2. Health and vaccination attitudes and behaviors at baseline (%).

	Group Intervention				Total	
	Parent's informed decision-making (n = 500) n (%)	A mother's story (n = 500) n (%)	A pediatrician's story (n = 500) n (%)	Control (n = 500) n (%)	(n = 2000) n (%)	p-value
To the best of your knowledge, is your youngest child aged 0–5 years currently experiencing or been diagnosed with important diseases or health problems (i.e. chronic diseases)?						
Yes	34 (6.8)	36 (7.2)	31 (6.2)	45 (9.0)	146 (7.3)	.45
No	453 (90.6)	454 (90.8)	458 (91.6)	438 (87.6)	1803 (90.2)	
Do not know/Prefer not to answer	13 (2.6)	10 (2.0)	11 (2.2)	17 (3.4)	51 (2.6)	
Not including COVID-19 vaccines, have you ever refused any routine vaccinations recommended by your health care provider for your youngest child aged 0–5?						
Yes	22 (4.4)	34 (6.8)	25 (5.0)	22 (4.4)	103 (5.2)	.25
No	461 (92.2)	440 (88.0)	453 (90.6)	462 (92.4)	1816 (90.8)	
Child is less than 2 months of age and has not yet received their first vaccines	7 (1.4)	17 (3.4)	13 (2.6)	12 (2.4)	49 (2.5)	
Do not know/Prefer not to answer	10 (2.0)	9 (1.8)	9 (1.8)	4 (0.8)	32 (1.6)	
How hesitant or fearful do you consider yourself to be about vaccinating your youngest child aged 0–5 with a routine recommended vaccine (e.g. routine vaccination such as measles, pneumococcal, meningococcal vaccines)?						
Very hesitant or fearful	14 (2.8)	25 (5.0)	21 (4.2)	23 (4.6)	83 (4.2)	.76
Somewhat hesitant or fearful	56 (11.2)	66 (13.8)	60 (12.0)	55 (11.0)	237 (11.9)	
Not very hesitant or fearful	120 (24.0)	112 (22.4)	101 (20.2)	103 (20.6)	436 (21.8)	
Not at all hesitant or fearful	301 (60.2)	291 (60.8)	311 (62.2)	311 (6.2.2)	1214 (60.7)	
Do not know	9 (1.8)	6 (1.0)	7 (1.4)	8 (1.6)	30 (1.5)	
My religious or spiritual practices (or ideas, or values, or beliefs) influence my health choices.						
Agree[1]	109 (21.8)	125 (25.0)	125 (25.0)	121 (24.2)	480 (24.0)	.53
Neither agree nor disagree/ Do not know	92 (18.4)	87 (17.4)	104 (20.8)	102 (20.4)	385 (19.3)	
Disagree[2]	299 (59.8)	288 (57.6)	271 (54.2)	277 (55.4)	1135 (56.8)	
How likely are you to get YOUR youngest child aged 0–5 any future routine recommended vaccines, other than COVID-19 vaccine?						
Very likely	345 (69.0)	344 (68.8)	338 (67.6)	333 (66.6)	1360 (68.5)	.074
Somewhat likely	94 (18.8)	85 (17.0)	88 (17.6)	105 (21.0)	372 (17.8)	
Neither likely nor unlikely	20 (4.0)	33 (6.6)	29 (5.8)	31 (6.2)	113 (5.5)	
Somewhat unlikely	15 (3.0)	8 (1.6)	17 (3.4)	8 (1.6)	48 (2.7)	
Very unlikely	22 (4.4)	23 (4.6)	13 (2.6)	15 (3.0)	73 (3.9)	
I do not know	4 (0.8)	7 (1.4)	15 (3.0)	8 (1.6)	34 (1.7)	
5C score (Mean (SD))						
Vaccines administered to children in Canada are safe (Confidence)*	1.87(1.00)	1.88(1.01)	1.90(0.98)	1.92(1.04)	1.89(1.01)	.84
When I think about vaccinating CHILD'S NAME, I weigh benefits and risks to make the best decision possible (Calculation)*	1.88(1.07)	1.79(0.98)	1.85(1.07)	1.81(1.05)	1.83(1.04)	.50
If all children get vaccinated I do not need to get CHILD'S NAME vaccinated (Collective responsibility)**	4.38(1.01)	4.32(1.06)	4.36(1.04)	4.37(1.04)	4.36(1.04)	.69
Vaccinating CHILD'S NAME is unnecessary because there are very few vaccine-preventable diseases in my community (Complacency)**	4.32(1.09)	4.24(1.13)	4.26(1.1)	4.29(1.09)	4.28(1.1)	.43
Everyday stress prevents me from getting CHILD'S NAME vaccinated. (Constraints)**	4.32(1.05)	4.31(1.07)	4.29(1.05)	4.31(1.1)	4.31(1.07)	.81

Due to rounding, some percentages may not add to 100%.
[1]Include Strongly agree and Somewhat agree answers.
[2]Include Strongly disagree and Somewhat disagree answers.
*A score near 1 means that the participant agrees with the statement.
**A score near 5 also means that the participant agrees with the statement.

(AOR = 1.2895, 95% CI [0.9459–1.7578], p = .1078). In sensitivity analysis, when excluding participants reporting a low level of vaccine hesitancy or fearfulness, an increase of 8.6% in intention to accept future vaccines was observed post-survey for the *Pediatrician's story* intervention (p = 0,03) (data not shown in the Table).

With regard to the second outcome, i.e., the effectiveness of the narratives to change parents' attitudes toward vaccination, a slight but significant difference was observed in all intervention groups, except in the control (Table 4). In sensitivity analysis, when excluding participants reporting a low level of vaccine hesitancy or fearfulness, no significant change was observed in any groups (data not shown in the Table).

After viewing the allocated video, participants were also asked questions regarding their level of interest in the video they watched and perceived change in opinions about childhood vaccination (Table 5). Excluding the control condition, we observed that participants assigned to the *Parent's informed decision-making* video were less likely to find the video interesting compared to other videos (p < .0001). When participants were asked if the video had changed their opinion about childhood vaccines, a higher proportion of participants assigned to *A mother's story* video agreed compared to the other intervention groups (p < .0001). For most participants, the confidence about their vaccine decisions for their child increased after watching the video, except for participants in

Table 3. Effect of the videos on participants' intention to vaccinate with routine recommended vaccines (%) and results of the multivariate analysis.

	Parent's informed decision-making (n = 500)		A mother's story (n = 500)		A pediatrician's story (n = 500)		Control (n = 500)		TOTAL (intervention, n = 1500)	
	PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)	PRE (%)	POST (%)
Very likely	69.0	64.4	68.8	71.0	67.6	66.0	66.6	62.0	68.5	67.1
Somewhat likely	18.8	21.4	17.0	16.8	17.6	19.0	21.0	22.6	17.8	19.1
Neither likely nor unlikely	4.0	4.4	6.6	5.0	5.8	7.2	6.2	6.6	5.5	5.5
Somewhat unlikely	3.0	2.8	1.6	2.4	3.4	3.6	1.6	1.6	2.7	2.9
Very unlikely	4.4	5.2	4.6	3.2	2.6	2.6	3.0	5.6	3.9	3.7
I do not know	0.8	1.8	1.4	1.6	3.0	1.6	1.6	1.6	1.7	1.7
AOR	0.8327		1.1793		0.9833		0.7664		0.9882	
[95% CI]	[0.6497–1.0673]		[0.9374–1.4836]		[0.7921–1.2207]		[0.5795–1.0136]		[0.8649–1.1292]	
p-value	0.1484		0.1592		0.8789		0.0623		0.8618	

AOR: adjusted odd ratio; CI: confidence intervals.
The model was adjusted by age, gender, income, and the child's medical condition (i.e., with or without chronic medical conditions).

Table 4. Effect of the videos on participants' attitudes toward childhood vaccines (5C score).

	Pre survey 5C score[§] M (SD)*	Post survey 5C score[§] M (SD)	Pre-post difference	p-value
Parent's informed decision-making (n = 500)	21.3 (3.5)	21.4 (3.6)	0.154	.0166
A mother's story (n = 500)	21.2 (3.5)	21.7 (3.4)	0.538	<.0001
A pediatrician's story (n = 500)	21.2 (3.6)	21.5 (3.5)	0.336	.0006
Control condition (n = 500)	21.2 (3.7)	21.3 (3.6)	0.046	.6417
Total intervention (n = 1500)	21.2 (3.5)	21.6 (3.5)	0.343	<.0001

*M = mean; SD = standard deviation.
[§]The score range is 5–25 with 5 representing the highest score of negatives attitudes toward vaccines and 25 indicating the most positive attitudes toward vaccination.

Table 5. Participants' level of interest in the video and perceived change in opinion about childhood vaccination (n, %).

	Group intervention			Total	p-value
	Parent's informed decision-making (n = 500) n (%)	A mother's story (n = 500) n (%)	A pediatrician's story (n = 500) n (%)	(n = 1500) n (%)	
How much have you enjoyed watching this video?					
Strongly liked	78 (15.6)	157 (31.4)	125 (25.0)	360 (24.0)	<.0001
Somewhat liked	167 (33.4)	163 (32.6)	134 (26.8)	464 (30.9)	
Neither enjoyed nor disliked	178 (35.6)	115 (23.0)	186 (37.2)	479 (31.9)	
Somewhat disliked	49 (9.8)	42 (8.4)	37 (7.4)	128 (8.5)	
Strongly disliked	28 (5.6)	23 (4.6)	18 (3.6)	69 (4.6)	
To what extent do you agree with the following statement: The video has changed my opinion regarding childhood vaccination.					
Strongly agree	18 (3.6)	59 (11.8)	37 (7.4)	114 (7.6)	<.0001
Somewhat agree	52 (10.4)	58 (11.6)	67 (13.4)	177 (11.8)	
Neither agree nor disagree	181 (36.2)	207 (41.4)	209 (41.8)	597 (39.8)	
Somewhat disagree	59 (11.8)	64 (12.8)	63 (12.6)	186 (12.4)	
Strongly disagree	178 (35.6)	108 (21.6)	111 (22.2)	397 (26.47)	
I do not know	12 (2.4)	4 (0.8)	13 (2.6)	29 (1.9)	
**The video made me feel … ** **					
More confident with my decision regarding routine vaccination of *my child**	59 (84.3)	109 (93.2)	94 (90.4)	262 (90.0)	.03
Less confident with my decision regarding routine vaccination of *my child**	9 (12.9)	2 (1.7)	7 (6.7)	18 (6.2)	
I do not know	2 (2.9)	6 (5.1)	3 (2.9)	11 (3.8)	

*The survey questions referred to *of CHILD's NAME* instead *of my child*.
**Only respondents who answered strongly agree or somewhat agree to the question: "To what extent do you agree with the following statement: The video has changed my opinion regarding childhood vaccination" answered this question.

the *Parent's informed decision-making* video; however, the decrease in confidence observed was not statistically significant.

A qualitative analysis of the comments left by the participants (n = 361) at the end of the questionnaire also yielded valuable insights regarding participants' appreciation of the study. While most of the comments stated that respondents did not have additional thoughts to add about the study or the vaccination, we recorded some positive and negative comments related to the video the participant watched or vaccination in general. Some parents indicated having positive views toward vaccines in general but being distrustful of COVID-19 vaccines. Many parents also indicated the importance of educating and increasing parents' awareness toward vaccines, including using the narratives used and developed for the research.

Discussion

Since the popularization of the Internet in the 2000s, the ubiquity of "anti-vaccine" discourse online has been considered by many experts as a key driver of vaccine refusal.[5] The COVID-19 pandemic only reinforced the need for public health authorities to tackle online mis- and disinformation to build resilience and maintain vaccine confidence.[21] Given the noisy communication environment available on the Internet, with an increasing presence of false or misleading information about vaccines, it is imperative that public health use effective interventions to counterbalance these false discourses. Vaccine acceptance requires public trust in public health officials who are responsible for communicating accurate information and dispelling mis/disinformation.[22,23]

Responding to the call to use narratives in public health messaging,[24] we tested the impact of three short videos (2–4 minutes) on parents' vaccination intentions and attitudes. Our findings indicate a relatively modest but positive impact on parents' intention to vaccinate and the level of vaccine hesitancy. While this study did not measure the different features of the narratives that are likely to influence vaccine attitudes (e.g., loss vs gain frame, content/tone, views about the messengers, etc.), the persuasiveness of emotional over factual information is already recognized in the literature.[25,26]

However, many questions remain unanswered on how to convey emotional narratives in public health communication interventions effectively. For example, two meta-analyses[27,28] reported that fear appeals in public health messaging are more persuasive and more effective in modifying attitudes and intention to adopt a recommended behavior. However, these meta-analyses were not specific to vaccination and the potential of a back-fire effect is often mentioned when emotional messages that highlight the potential severe outcomes of non-vaccination are developed.

Moreover, the backfire effect (i.e., a cognitive bias occurring when people's existing beliefs become more entrenched when faced with contradictory evidence)[29] can especially occur in echo chambers where people are mostly sharing vaccine critical views.[30] Indeed, some studies highlight that preexisting attitudes toward vaccination can influence the perception of messages.[31–34] In our study, most participants held positive attitudes toward childhood vaccination and most children were vaccinated, which limited our analysis of the impact of the narratives based on preexisting attitudes. However, even amongst this relatively highly accepting population, more acceptance was seen post video likely showing evidence of reinforcement in those beliefs. In our qualitative work to develop and pilot-test the narratives, most parents considered "fear-based" messaging to be a legitimate public health strategy to counter the very emotional stories on vaccine risks used by most vaccine-critical content.[19]

Another area for future research on narratives for vaccine promotion is the relationship between different types of characters showing different emotions. A literature review on narratives concluded that the description of the emotions experienced by the characters is a promising feature for changing health attitudes and intentions.[35] Findings of another review have highlighted that identification with the character is an important driver of the impact of that narrative on attitudes and behavior.[36–40] Findings from a recent meta-analysis indicated that narratives told in the first-person point of view increase identification with the main characters and led to higher levels of perceived susceptibility.[15] In our study, parents were exposed to only one of such narratives which limits exploring this question. However, findings of our qualitative study where parents saw all the narratives highlighted that parents are more likely to identify with other parents' stories. However, advice from health-care providers about vaccines was reported to be more trustworthy. What remains to be explored is the potential differential impact of very emotional vaccine narratives from different characters (another parent, a health-care provider, a child).

Finally, the literature on effective interventions to address vaccine hesitancy and enhance vaccine acceptance is clear that there is no 'one-size-fits-all' strategy.[41] When used alone, interventions to inform and educate about vaccination are not sufficient to enhance vaccine acceptance and uptake.[41,42] A recent review highlighted that factual information may increase be effective to increase uptake among parents with already positive attitudes but are unlikely to address hesitancy.[43] As the factors leading to vaccine acceptance or refusal are complex, context-specific, and likely to vary for different vaccines and over time, tailoring messages to preexisting attitudes and beliefs is of key importance. The most effective intervention to address vaccine hesitancy is one-on-one communication based on motivational interviewing techniques.[44] However, these interventions are time- and resources-intensive. In digital environment, storytelling and use of narratives are promising approach to share vaccination information in a meaningful approach that may resonate more than factual information that are typically used in public health messaging.[25,45] The use of narratives was shown effective to enhance smoking cessation behaviors,[46] and two recent meta-analyses have concluded that narratives are more effective than traditional educational or informational messages to increase the intention to adopt specific health behaviors.[16,47] Future experimental research should evaluate the effectiveness of narratives that are tailored to parents' preexisting beliefs or that feature characters with which different parents relate compared with non-tailored 'generic' narratives. A user-centered design approach to develop future narrative-based interventions could allow such tailoring.[40,48]

Our findings should be interpreted in light of study limitations. First, our study was conducted in among a sample of Canadian parents and, although we achieved provincial and territorial representativeness, more mothers than fathers participated, and participants have higher level of education than the overall Canadian population. Our findings may thus not be generalizable to other Canadian parents or other health context. As mentioned, most of the participants began the study with preexisting positive attitudes toward vaccines, so we were not able to explore the association between preexisting attitudes and narrative effectiveness. Future research may include using sampling strategies to maximize variation in vaccine attitudes at baseline. Our outcome measures are self-reported. Our study collected data on immediate reactions to messages only; long-term effects of these messages on attitudes

and behaviors were not explored. Exposing parents only once to such communications may not generate a lasting impact on vaccination decisions. We used a web-based panel, and although there were no differences in participants' sociodemographic characteristics between groups, it is possible that our sample of parents is not representative of the diversity of parents in Canada. Finally, this study was conducted in the context of the COVID-19 pandemic and mass vaccination efforts. Studies conducted in Canada during the pandemic showed low parental intention to vaccinate their children against COVID-19.[49–51] However, findings on the impact of the pandemic on Canadian parents' attitudes toward routine childhood vaccines are mixed, with some studies reporting minimal or no impact[2,52] and others indicating a decrease in parents' level of confidence.[53,54] It is thus possible that this particular context has influenced the outcome of our project to some extent.

In conclusion, our findings suggest a small but positive impact of narratives on parents' attitudes and intentions toward childhood vaccines. The interest in narrative persuasion research is growing, but further guidance is still required to empower public health organizations to harness this communication strategy.[55] In the aftermath of the COVID-19 pandemic, the need for effective strategies to build resilience against vaccine disinformation and foster vaccine confidence is clear.[21] Using narratives is a promising approach to communicating the importance of vaccination to parents that could be part of the public health communication toolkit for vaccination.

Disclosure statement

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