

## Original Research

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# The Common Way in Which the Ministry of Health Conveys Information to the Public: A Simulation Among Israeli Parents with Different Attitudes and Behaviors Regarding Vaccination During a Measles Outbreak in Israel

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## Abstract

**Background:** Despite several empirical studies that have emphasized the problematic and ineffective way in which health organizations ‘correct’ information which does not come from them, they have not yet found ways to properly address vaccine hesitancy.

**Objectives:** (1) Examining the responses of groups with different attitudes/ behaviors regarding vaccination; (2) Examining the effect of the common methods of correcting information regarding the response of subgroups, while examining issues of reliability, satisfaction, and information seeking, as well as how health organization tools aid the decision-making process regarding vaccines.

**Methods:** A simulation study that included 150 parents of kindergarten children was carried out.

**Results:** Significant difference was found among the various groups (with respect to vaccination behavior) regarding the extent of their trust in the Ministry of Health ( $\chi^2(3) = 46.33$ ;  $P < 0.0001$ ), the reliability of the Ministry of Health’s response ( $\chi^2(3) = 31.56$ ;  $P < 0.0001$ ), satisfaction with the Ministry of Health’s response ( $\chi^2(3) = 25.25$ ;  $P < 0.0001$ ), and the level of help they felt the Ministry of Health’s tools provided them regarding vaccine-related decision making ( $\chi^2(3) = 27.76$ ;  $P < 0.0001$ ).

**Conclusion:** It is important for health organizations to gain the public’s trust, especially that of pro-vaccination groups with hesitant attitudes, while addressing the public’s fears and concerns.

## Introduction

Identifying the public’s subgroups regarding vaccination is a controversial endeavor.<sup>1</sup> There were 3 main groups among the public with respect to vaccination: pro-vaccination individuals who accept all vaccines; those who are hesitant and have many concerns, but may entirely or partially vaccinate; and those who refuse all vaccines. However, the scientific literature in recent years has revealed a wide spectrum of subgroups regarding the issue of vaccination.<sup>2</sup> For example, some studies have identified the public solely according to their attitudes about vaccination.<sup>3,4</sup>

However, other studies focused not only on vaccination attitudes, but also on vaccination behavior. These studies suggest that it is not accurate enough to identify the public solely according to their vaccination-related behaviors or attitudes, but rather based on a combination of both. For example, Benin *et al.* categorized their study participants based on a combination of behavior and attitudes.<sup>5</sup> Consistent with these findings, a previous study showed that pro-vaccination parents may have hesitant attitudes. These parents reported that they vaccinate their children with all the vaccinations but still have fears and concerns regarding the vaccines’ safety and effectiveness. Therefore, it is recommended that health authorities address the public’s fears and concerns in order to gain their trust, thus including those individuals who are pro-vaccination, and taking into consideration the difference between hesitant attitudes and hesitancy in practice among pro-vaccination parents.<sup>6</sup>

Vaccination information is delivered via various sources such as health organizations, healthcare workers, and social media. The reliability and accuracy of vaccination information are essential in making informed decisions.<sup>7–10</sup> Over the years, health organizations have dealt with ambiguous information delivered via media and interpersonal sources.<sup>11,12</sup> Traditionally,

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the myth-busting correction approach was used extensively by identifying the myth and providing a rebuttal.<sup>13</sup> It was also done by distinguishing between myths and facts.<sup>14–16</sup> However, this information correction method was found ineffective because repeating the myth only serves to make the information more familiar and therefore, more likely to be true.<sup>17</sup> In addition, studies found that the public refused to accept a judgmental approach without scientific evidence to back it up.<sup>18–20</sup> As a result, this strategy of communicating information was found to be ineffective in several empiric studies and noted to have led to backfired effects.<sup>17,21,22</sup>

Health organizations still utilized the same communication strategy of distinguishing between myths and facts during the Coronavirus disease of 2019 (COVID-19) crisis. During this period, health organizations continued along the same lines, treating any information that did not originate from them as 'biased.' Some of these organizations even cooperated with media giants such as Facebook, Google, and Amazon who removed and blocked information that was not in line with the information provided by the authorities.<sup>20</sup>

In light of the fact that vaccine hesitancy is becoming a central issue, health organizations worldwide need to address it. Despite several empirical studies that have emphasized the problematic and ineffective way in which health organizations 'correct' information which does not come from them, they have not yet found ways to properly address vaccine hesitancy. This empirical study seeks to deal with these 2 issues. It is worth noting that this study was conducted before the COVID-19 outbreak and seeks to (1) examine the responses of groups with different attitudes/behaviors regarding vaccination, and (2) examine the effect of the common method of correcting information (which comes from unofficial sources) on the response of sub-populations; while examining issues of reliability, satisfaction, information seeking, and the ways in which health organization tools aid the decision-making process regarding vaccine.

## Methods

### Research design and procedure

This study is part of a larger study that used a controlled experiment in which participants were randomly divided into 2 groups. The experiment was conducted during the measles outbreak in Israel in January 2020. At that time, the authorities tried to impose sanctions to prevent unvaccinated children from entering kindergarten. The study aimed to examine how the Ministry of Health's communication methods affected parents from different subgroups regarding vaccination. Both experimental conditions presented a simulation, starting with a dilemma regarding sending a child to kindergarten during the measles outbreak, knowing that some of the children in the kindergarten were un-vaccinated. The dilemma was followed by a mother's post on Facebook containing information about measles and the measles vaccine. In the next stage, a health organization's response was presented via 2 conditions: Condition 1 – common information communication approach formulated as a short response without addressing the emotional element (empathy and addressing the public's fears and concerns) and in terms that dismiss critics and oppositional voices<sup>20</sup>; and Condition 2 – recommended (theory-based) information correction, mainly communicating information transparently and addressing the public's concerns.

This study focuses only on Condition 1 (the common information communication approach) and is mainly based on a simulation that examines how groups with different attitudes and behaviors regarding vaccination respond to health organizations' traditional way of communicating information during an epidemic outbreak.

The study was approved by the Faculty of Social Welfare and Health Sciences Ethics Committee for Research with Human Subjects at the University of Haifa (approval no. 421/17).

### Sampling and data collection

The participants were sampled from iPanel, an Israeli Internet panel. An online survey was distributed to a representative panel of the adult population in Israel. The online survey was designed using Qualtrics XM online (Qualtrics Survey Software, Qualtrics Inc., Provo, Utah, USA). The study included parents whose children were in kindergarten (aged 3 - 5 years). The rationale behind including only parents whose children are in kindergarten stems from the relevance of vaccines to this specific population and the similarity between the simulation in the study - of sending a child to kindergarten - and the participants' real situation. The study included 150 parents who met the inclusion criteria. The participants were classified according to their vaccination behavior and attitude regarding vaccination.

### Questionnaire structure

The first part of the questionnaire included a filtering question that asked if the participant was a parent of a child in kindergarten (aged 3 - 5 years). If the participants met the inclusion criteria, they were asked to fill out their demographic information and were then asked if they give their children all the vaccines according to the nationally stipulated vaccination schedule. Next, the questionnaire included a validated vaccine hesitancy scale to identify their attitudes.<sup>23</sup> The second part of the questionnaire was divided into 3 stages with each stage being followed by questions (see [Table 1](#)). The first stage presented a dilemma for parents about whether or not to send their children to kindergarten during a measles outbreak, knowing that some kindergarten children were not vaccinated because of their parents' objection. In the next stage, they were shown a post written by the mother of one of the kindergarten children, containing information about measles and about the measles vaccine. In the third stage, the participants were shown a response by the official health authority (such as the Ministry of Health), trying to correct the information in the mother's post. The correction was formulated based on previous statements of the Ministry of Health, which disregarded the public's fears and concerns in relation to the mother who had written the post and the other parents.

### Classification of the participants according to their actual vaccination behavior

To determine the participants' actual vaccination behavior, they were asked if they give their children all of the vaccines according to the routine vaccination schedule. If they answered 'yes,' the participant was considered a pro-vaccination parent. If they answered 'no,' the participant was considered an anti-vaccination parent. However, in order to consider the participants vaccine-hesitant, they needed to answer: 'I'm selective in vaccinating my children' or 'I give my children all of the vaccines, but not according to the routine vaccination schedule.' A total of 115 pro-vaccination participants, 35 vaccine-hesitant participants, and 3

**Table 1.** The questionnaire structure

<p><b>Stage 1- Presenting the dilemma:</b> Please read the following story and answer the questions: <i>You are a mother or father who wants to send their son or daughter to kindergarten. The kindergarten is considered to be a very good one, is close to home, and on the way to your work. It has a great teacher and a waiting list. Some of the children in the kindergarten have not been vaccinated for measles because their parents refuse to vaccinate them. The identity of the unvaccinated children is unknown. The teacher informed the parents that there are 3 children who were not vaccinated for measles, and she is ethically precluded from telling the parents who they are.</i></p>	<p><b>Questions after Stage 1:</b></p> <ol style="list-style-type: none"> <li>(1) Following the story, would you send your son/daughter to the kindergarten? (Yes/No) Explain your answer.</li> <li>(2) Following the story, would you vaccinate your son/daughter? If you did not vaccinate at all (note: this question is for those who have not vaccinated their children at all), explain your answer. Will you continue to vaccinate your son/daughter with the second dose if you have vaccinated him/her with the first dose? Explain your answer.</li> <li>(3) After reading the story of the parents who do not vaccinate their children, to what extent do you fear that your son/daughter could be infected with measles? Please circle the answer that best describes your feelings on a scale of 1 (very little) to 7 (very much).</li> <li>(4) After reading the story, what do you feel about parents who do not vaccinate their children? (4.1) I identify with them, (4.2) I'm angry, (4.3) I'm indifferent.</li> <li>(5) After reading the story, what do you think about parents who do not vaccinate their children? (5.1) They are right, (5.2) They are wrong, (5.3) They are irresponsible, (5.4) It's their right to decide what is best for their son/daughter, (5.5) I'm ambivalent (on 1 hand, it's their right to decide; on the other hand, they are irresponsible, (5.6) Other ____.</li> <li>(6) Do you feel you have the tools to make a decision about sending your child to the kindergarten?</li> <li>(7) What information would you want to know about the vaccine in order to make the decision of whether or not to send your son/daughter to the kindergarten?</li> <li>(8) Who will you turn to for information about the measles vaccine considering the dilemma presented in the story? Please mark the main 2 sources you would turn to (list of sources).</li> <li>(9) Who do you consider the most reliable source for receiving this information? (Please mark only 1 answer.)</li> </ol>
<p><b>Stage 2-Facebook post:</b> Hi. I'm the mother of a 4-year-old girl, Gili. I don't usually post about these things, but I have to respond this time. I don't understand all this pressure from the Ministry of Health and parents about the measles vaccination. My mother, and her mother, who is about to turn 90, never got the measles vaccine because it used to be considered a mild childhood disease that the body could deal with by itself and overcome. Children who get the measles infection manufacture antibodies and their immune systems get stronger as a result. I read in a few places that children who are not vaccinated put vaccinated children at risk. What kind of nonsense is that? It's just the opposite - the vaccinated children who have the inactivated vaccine in their bodies can actually transmit the disease to the non-vaccinated children. I'm sick and tired of all these attempts to force parents to do things that aren't necessary. I am a caring and loving mother and that's why it's important for me to share this with you, dear mothers."</p>	<p><b>Questions after Stage 1:</b></p> <ol style="list-style-type: none"> <li>(1) After reading the story, what do you feel about parents who do not vaccinate their children? (1.1) I identify with them, (1.2) I'm angry, (1.3) I'm indifferent.</li> <li>(2) After reading the story, what do you think about parents who do not vaccinate their children? (2.1) They are right, (2.2) They are wrong, (2.3) They are irresponsible, (2.4) It's their right to decide what is the best for their son/daughter, (2.5) I'm ambivalent (on the one hand, it's their right to decide; on the other hand, they are irresponsible, (2.6) Other ____.</li> </ol>
<p><b>Stage 3-The Ministry of Health's response to the post:</b> "We would like to respond to the post that we received from one mother's social network. Unfortunately, there are many parents like this mother who are not professionals. This mother is not a physician and therefore she cannot be trusted. We reiterate that it is necessary to vaccinate with the MMR vaccination against measles. Anyone who does not vaccinate is thereby risking their lives and the lives of those around them. It is very important for all kindergarten children to be vaccinated. Millions of people around the world die every year as the result of contraction and complications related to measles. Therefore, we call on all parents to vaccinate your children - because vaccination saves lives!"</p>	<p><b>Questions after Stage 2:</b></p> <ol style="list-style-type: none"> <li>(1) After reading the Ministry of Health's response, would you send your son/ daughter to the kindergarten? (Yes/No) Explain your answer.</li> <li>(2) Following the above, to what extent do you fear that your son/daughter could be infected with measles? Please circle the answer that best describes your feelings on a scale of 1 (very little) to 7 (very much).</li> <li>(3) Are you satisfied with the response you received from the Ministry of Health? 1 (very little) to 7 (very much) Please explain your answer regarding your level of satisfaction.</li> <li>(4) What do you feel after reading the Ministry of Health's response? 1- I identify with the response, 2- I'm angry, 3- I'm ambivalent.</li> <li>(5) Did the Health Ministry's tools help you make a decision about sending your child to the kindergarten? 1 (very little) to 7 (very much)</li> <li>(6) After the Ministry of Health's response, will you continue to look for information? (Yes/No) In light of the Ministry of Health's response, what else do you want to know?</li> <li>(7) In light of the Ministry of Health's response, who will you turn to for information about the measles vaccine? Please mark the 2 main sources you would turn to (list of sources).</li> <li>(8) Who do you think is the most reliable source of information after reading the Ministry of Health's response? (Please mark only 1 answer).</li> <li>(9) Do you think the Ministry of Health's answer is credible? (Yes/No) Please circle the number that coincides with the degree of credibility you associate with the Ministry of Health's response on a scale of 1 (very little) to 7 (very much). Circle your answer and explain it.</li> </ol>

(Continued)

**Table 1.** (Continued)

(10) Have you been exposed to previous announcements by the Ministry of Health using similar language? Specify your answer. (Yes/No)
(11) Did the Ministry of Health influence your position? Please circle the answer that best describes your position: (10.1) Strengthened my position, (10.2) Weakened my position, (10.3) Did not affect my position. Explain your answer.

**Table 2.** Vaccine hesitancy 5-point Likert scale questions

To what extent do you agree with each of the following statements? Please indicate your response with a check mark (✓) in the appropriate box, according to the scale.	1 (strongly disagree)	2 (disagree)	3 (neither agree nor disagree)	4 (agree)	5 (strongly agree)
Routine childhood vaccines are important for my child's health.					
Childhood routine vaccines are effective.					
Having my child vaccinated is important for the health of others in my community.					
All childhood routine vaccines offered by the Ministry of Health are beneficial.					
The information I receive about vaccines from vaccine programs is reliable and trustworthy.					
Getting vaccinated is a good way to protect my child/children from diseases.					
Generally, I do what my doctor or the Ministry of Health recommends regarding vaccines for my child/children.					

anti-vaccination participants answered the question. The anti-vaccination participants were excluded from the study because they were statistically a small group.

#### *Classification of the participants according to their vaccination attitude*

A vaccine hesitancy scale was designed to identify attitudes regarding vaccine effectiveness and importance. The scale was based on a previously validated vaccine hesitancy scale,<sup>23</sup> and included an index of 7 statements using a 5- point Likert scale in which participants were asked the extent to which they agree or disagree with each statement (Cronbach  $\alpha = 0.91$ ). The statements focused on the effectiveness and importance of routine vaccines (Table 2). The level of hesitation is indicated by the score of the 5- point Likert scale. An index score of 2 and below indicates low hesitation regarding vaccination. However, a high hesitation score should be above 2. The study included 114 participants with pro-vaccination attitudes (a score of 2 and below) and 36 participants with hesitant attitudes (a score above 2).

#### *Classification of the participants according to their vaccination attitude/ vaccination behavior*

In order to examine how groups with different vaccination attitudes and behavior respond to the information corrections provided by the Ministry of Health, the participants were classified, using a combination of their vaccination attitude and vaccination behavior, into 4 groups: 102 pro-attitude/ pro-behavior (PA/PB) participants, 12 pro-attitude/ hesitant-behavior (PA/HB) participants, 13 hesitant-attitude/ pro-behavior participants (HA/PB), and 23 hesitant-attitude/ hesitant-behavior (HA/HB) participants.

#### **Analysis**

In the first stage, distributions were tested for the demographic questions. In the second stage, the measured variables were divided

into 2 categories: category 1 measured variables before the participants' exposure to the simulation, which included their trust in the Ministry of Health, information seeking, and health literacy; category 2 also measured variables after the participants' exposure to the simulation. It included the reliability of the Ministry of Health's response, the level of satisfaction with the Ministry of Health's response, and the level of the help obtained from the Ministry of Health's tools in making a decision about vaccine. The Kruskal-Wallis test was conducted to evaluate the differences between the distribution of the measured variables among the four vaccination attitude/ behavior subgroups: PA/PB participants, PA/HB participants, HA/PB participants, and HA/HB. It was followed by the Dwass-Steel-Critchlow-Flinger method (DSCF) for multiple comparisons. In addition, the Chi-square test was used to test the variable of further information seeking following the Ministry of Health's response in relation to the four different attitude/ behavior groups.

#### *Reliability and validity*

The current study and the research tools are based on two previous studies that we carried out. One study examined different groups in Israeli society using the hesitation scale.<sup>6</sup> Another study which we conducted with students examined through simulation, the participants' reactions to the Ministry of Health's information transfer methods.<sup>24</sup>

#### **Results**

The study participants included 31 (20.7%) males and 119 (79.3%) females. Most of the study participants (57.3%) were between 30 - 39 years of age, 22.7% were between 18 - 29 years of age, and 19.3% were between 40 - 49 years of age. The majority (73.3%) of the study participants were Jewish, and 21.3% were Arab. The majority (93.3%) of the study participants are married and have a BA

**Table 3.** Sociodemographic characteristics of the quantitative survey participants (n = 150)

Variables	Sub-variables	Frequency	Percentage (%)
<b>Gender</b>	Male	31	20.7
	Female	119	79.3
<b>Age (in years)</b>	18 - 29	34	22.7
	30 - 39	86	57.3
	40 - 49	29	19.3
	≥ 50	1	0.7
<b>Ethnicity</b>	Jewish	110	73.3
	Arab	32	21.3
	Druze	7	4.7
	Other	1	0.7
<b>Marital status</b>	Married	140	93.3
	Divorced	4	2.7
	Unmarried single parent	1	0.7
	Parent in a relationship	5	3.3
<b>Education</b>	Primary school	2	1.3
	Secondary	16	10.7
	Post-secondary	32	21.4
	BA	67	44.7
	MA	29	19.3
	PhD	2	1.3
	Other	2	1.3
<b>Religious affiliation</b>	Secular	76	50.7
	Traditional	30	20.0
	Religious	25	16.7
	ultra-Orthodox Jew	19	12.6
<b>Total</b>		150	100

(44.7%) or MA (19.3%) degree. As per religious affiliation, 76 (50.7%) are secular, 30 (20.0%) are traditional, 25 (16.7%) are religious, and 19 (12.7%) are ultra-Orthodox Jews (Table 3).

### Findings of the analysis of the measured variables before the participants' exposure to the simulation

Two main variables were tested before the participants' exposure to the simulation: (1) trust in the Ministry of Health and (2) information seeking and health literacy. According to the Kruskal-Wallis test results (Table 4), a significant difference was found in the level of trust in the Ministry of Health according to the vaccination attitude/behavior groups ( $\chi^2(3) = 46.33$ ;  $P < 0.0001$ ). A higher level of trust was found among the PA/PB group ( $M = 5.71$ ), followed by the PA/HB group ( $M = 5.08$ ), and the HA/PB group ( $M = 4.31$ ). The lowest level of trust was found among the HA/HB group ( $M = 3.74$ ). However, insignificant difference was found between the vaccination attitude/behavior groups according to information seeking ( $\chi^2(3) = 0.59$ ;  $P = 0.8987$ ).

In order to make all possible pairwise comparisons between attitudes/behavior vaccination groups regarding trust level in the Ministry of Health, the Dwass-Steel-Critchlow-Flinger method (DSCF) was used (Table 5). A significant difference was found in trust in the Ministry of Health between the PA/PB and HA/PB groups ( $P = 0.0004$ ), between the PA/PB and HA/HB groups

( $P < 0.0001$ ), and between the HA/HB and PA/HB groups ( $P = 0.0289$ ).

### Findings of the analysis of the measured variables after participants' exposure to the simulation and the misinformation correction

According to the Kruskal-Wallis test results (Table 6), a significant difference was found between the different vaccination attitude/behavior groups according to the reliability of the Ministry of Health's response ( $\chi^2(3) = 31.56$ ;  $P < 0.0001$ ), satisfaction with the Ministry of Health's response ( $\chi^2(3) = 25.25$ ;  $P < 0.0001$ ), and the level of help associated with the Ministry of Health's tools in making a decision about vaccine ( $\chi^2(3) = 27.76$ ;  $P < 0.0001$ ).

A considerably higher average of reliability regarding the Ministry of Health's response was found among the PA/PB group ( $M = 5.43$ ), followed by the PA/HB group ( $M = 5.08$ ), and was significantly higher than the HA/PB ( $M = 4.46$ ) and HA/HB groups ( $M = 3.17$ ).

Higher satisfaction with the Ministry of Health's response means was found in the PA/PB group ( $M = 5.42$ ); the lowest level was found in the HA/HB group ( $M = 3.26$ ).

The DSCF method shows a significant difference in the reliability of the Ministry of Health's response between the HA/PB and PA/PB ( $P = 0.0345$ ) groups; the HA/PB and HA/HB groups ( $P = 0.0394$ ); the PA/PB and HA/HB groups ( $P < 0.0001$ ), and the HA/HB and PA/HB groups ( $P = 0.0205$ ) (Table 6).

Regarding satisfaction with the Ministry of Health's response, a significant difference was found between the PA/PB and HA/HB groups ( $P < 0.0001$ ), and between the HA/HB and PA/HB groups ( $P = 0.0277$ ) (Table 6).

In testing the difference between the groups according to the level of the help attributed to the Ministry of Health's tools in deciding about vaccine, a significant difference was found only between the PA/PB and HA/HB groups ( $P < 0.0001$ ), with a significantly higher mean among the PA/PB group ( $M = 5.10$ ), compared to the HA/HB group ( $M = 3.04$ ).

In testing the further information-seeking variable following the Ministry of Health's response by a Chi-square test, no significant difference was found between the groups. Most participants in each group continued to seek further information following the Ministry of Health's response (Table 7).

### Discussion

This study seeks to examine the responses of groups with different attitudes/behavior regarding vaccination to the common and typical communication methods used by the Ministry of Health by simulating such a response on social media. In addition, this study aims to provide a better understanding of where the pro-vaccination with hesitant attitudes group is situated on the spectrum between the pro-attitude/pro-behavior group and the hesitant-attitude/hesitant-behavior group.

In the first stage, this study examined the component of trust in the Ministry of Health among groups with different attitudes/behavior regarding vaccination. Previous studies indicate that trust in the vaccine delivery system is an essential factor in several explanatory models of vaccine hesitancy decision-making. According to these models, vaccine acceptance was found to be affected by distrust and lack of confidence in the safety and efficacy of vaccines,<sup>25,26</sup> as well as in the healthcare system that delivers the vaccines. In addition, the individual's knowledge and the

**Table 4.** The measured variables before participants' exposure to the simulation according to vaccination attitude/behavior group using the Kruskal-Wallis test

Variable	Group	N	Mean	Std	df	$\chi^2$	P
<b>Trust in the Ministry of Health</b>	Pro-attitudes/Pro-behavior (PA/PB)	102	5.71	1.12	3	46.33	< 0.0001
	Pro-attitudes/Hesitant-behavior (PA/HB)	12	5.08	1.51			
	Hesitant-attitudes/Pro-behavior (HA/PB)	13	4.31	0.85			
	Hesitant-attitudes/Hesitant-behavior (HA/HB)	23	3.74	1.05			
<b>Information seeking and health literacy</b>	Pro-attitudes/Pro-behavior (PA/PB)	102	3.80	1.52	3	0.59	0.8987
	Pro-attitudes/Hesitant-behavior (PA/HB)	12	3.69	1.80			
	Hesitant-attitudes/Pro-behavior (HA/PB)	13	3.56	1.17			
	Hesitant-attitudes/Hesitant-behavior (HA/HB)	23	3.87	1.19			

**Table 5.** Comparisons of level of trust in the Ministry of Health between groups using pairwise, 2-sided multiple comparison analysis (DSCF method)

Groups compared	P-value
HA/PB vs. PA/PB	0.0004
HA/PB vs. HA/HB	0.4960
HA/PB vs. PA/HB	0.2894
PA/PB vs. HA/HB	< 0.0001
PA/PB vs. PA/HB	0.5129
HA/HB vs. PA/HB	0.0289

information they receive about vaccines may also influence their vaccination decisions.<sup>1,27,28</sup> The study findings show a difference in the level of trust in the Ministry of Health among the different groups. The highest level of trust in the Ministry of Health was found among the PA/PB (pro-attitudes/ pro-behavior) group, followed by the PA/HB (pro-attitudes/ hesitant-behavior), and the HA/PB (hesitant-attitudes/ pro-behavior) groups. The lowest level of trust was found among the HA/HB group (hesitant-attitudes/ hesitant-behavior). These findings indicate that groups with pro-vaccination attitudes have a higher level of trust in the Ministry of Health than groups with hesitant attitudes. This finding can be explained by the cognitive dissonance theory, which proposes that people seek psychological consistency about their attitudes, beliefs, and behaviors. Inconsistency between attitudes and behavior is a primary type of cognitive dissonance, which may create psychological tension. This theory argues that some individuals resolve the dissonance by blindly trusting in whatever they want to believe, or by avoiding contradictory information that is likely to increase the magnitude of the cognitive dissonance.<sup>29,30</sup> Consistently, this study indicates that individuals with a higher level of trust in the Ministry of Health tend to express pro-vaccination attitudes and to be pro-vaccination – also as regards their behavior - in order to attain psychological consistency between their attitudes and behavior, and to avoid cognitive dissonance. Similarly, individuals with a lower level of trust in the Ministry of Health and have hesitant attitudes tend to also be hesitant in behavior to achieve a state of comfort. Another theory that reinforces the cognitive dissonance theory is Heider's balance theory, which conceptualizes the cognitive consistency motive as a means of achieving psychological balance. Heider's balance theory demonstrates a triadic relationship model, where 3 subjects are involved, and individuals seek to maintain a cognitive and emotional balance between 2 or more subjects, so that the ideas are in harmony and free from tension.<sup>30–32</sup> With respect to the findings of this study, the individual seeks to maintain a balance between his

trust in the Ministry of Health, his trust in the effectiveness and safety of vaccines (which are promoted by the Ministry of Health), and his behavior regarding vaccination. Therefore, a higher level of trust among the groups with pro-vaccination attitudes leads to a higher level of trust in the safety and effectiveness of vaccines (which are promoted by the Ministry of Health), eventually resulting in behavior that reflects vaccination acceptance, and vice versa.

In addition, these findings show that the pro-vaccination (in behavior) group members with hesitant attitudes do not trust the information they receive from the Ministry of Health. However, their trust issues have not yet had an impact on their behavior. This situation may change at some point, making these individuals hesitant in their behavior in the future.<sup>24–26</sup> Therefore, health organizations should focus on building trust among the public as well as communicating clear and transparent information about vaccines.

Different interpretations may be offered to explain why a group expressing hesitant attitudes still chooses to vaccinate, despite their low level of trust in the health organization. For example, social norms were found to play a powerful role in vaccination-related decisions in several studies. According to these studies, individuals vaccinate their children or get vaccinated themselves because vaccination is considered a social norm; everybody is doing it thus it seems like the normal thing to do.<sup>33–35</sup> For instance, a systematic review of vaccine uptake during the 2009 H1N1 influenza pandemic indicates that the belief that family and friends have been vaccinated, or that others would want to be vaccinated, were associated with vaccination intention as well as actual uptake.<sup>36</sup>

Another interpretation of the gap between hesitant attitudes and pro-vaccination behavior may be attributed to risk perception. Parents may choose to vaccinate their children despite their concerns and fears because of a low-risk perception of adverse effects due to positive experience with vaccines, low reported incidence of serious adverse effects after vaccination, or the high risk of disease infection. Some studies support this finding and suggest that an individual's decision-making process regarding vaccines may be shaped by determinants such as the perceived risk of disease infection,<sup>37–39</sup> the perceived safety and efficacy of the vaccine,<sup>40,41</sup> as well as the social and financial costs associated with vaccination and disease infection.<sup>42</sup>

The second stage of the study presented a simulation of the Ministry of Health's common information communication transfer methods via social media. This simulation aimed to examine the response of vaccination attitudes/ behavior subgroups to this method of communication by measuring several variables, following participants' exposure to the Ministry of Health's

**Table 6.** The difference in the measured variables after the misinformation correction according to the vaccination attitude/ behavior group using the Kruskal-Wallis test, followed by the Pairwise, 2-sided Multiple Comparison Analysis (DSCF method)

Variable	Group	Kruskal-Wallis Test						DSCF method	
		N	Mean	Std	df	$\chi^2$	P	Significant Difference	P
<b>Reliability of the Ministry of Health's response</b>	Pro-attitudes/Pro-behavior (PA/PB)	102	5.43	1.35	3	31.56	< 0.0001	HA/PB vs. PA/PB	0.0345
	Pro-attitudes/Hesitant-behavior (PA/HB)	12	5.08	1.38				HA/PB vs. HA/HB	0.0394
	Hesitant-attitudes/Pro-behavior (HA/PB)	13	4.46	0.78				PA/P) vs. HA/HB	< 0.0001
	Hesitant-attitudes/Hesitant-behavior (HA/HB)	23	3.17	1.83				HA/HB vs. PA/HB	0.0205
<b>Satisfaction with the Ministry of Health's response</b>	Pro-attitudes/Pro-behavior (PA/PB)	102	5.42	1.52	3	25.25	< 0.0001	PA/PB vs. HA/HB	< 0.0001
	Pro-attitudes/Hesitant-behavior (PA/HB)	12	5.25	1.42				HA/HB vs. PA/HB	0.0277
	Hesitant-attitudes/Pro-behavior (HA/PB)	13	4.54	1.05					
	Hesitant-attitudes/Hesitant-behavior (HA/HB)	23	3.26	1.19					
<b>The level of help attributed to the Ministry of Health's tools in making a decision about vaccine</b>	Pro-attitudes/Pro-behavior (PA/PB)	102	5.10	1.40	3	27.76	< 0.0001	PA/PB vs. HA/HB	< 0.0001
	Pro-attitudes/Hesitant-behavior (PA/HB)	12	4.00	1.76					
	Hesitant-attitudes/Pro-behavior (HA/PB)	13	4.00	1.08					
	Hesitant-attitudes/Hesitant-behavior (HA/HB)	23	3.04	1.69					

**Table 7.** Comparison of further information seeking following the Ministry of Health's response using the Chi-Square test

Group	Seeking information following the Ministry of Health's response			
	Yes		No	
	N	%	N	%
Pro-attitudes/Pro-behavior (PA/PB)	68	66.67%	34	33.33%
Pro-attitudes/Hesitant-behavior (PA/HB)	10	83.33%	2	16.67%
Hesitant-attitudes/Pro-behavior (HA/PB)	11	84.62%	2	15.38%
Hesitant-attitudes/Hesitant-behavior (HA/HB)	18	78.26%	5	21.74%
Chi-Square test	$\chi^2(3) = 3.59, P = 0.3089$			

response to a Facebook post posted by a mother. Examining the reliability of the Ministry of Health's response variable indicates that subgroups with pro-vaccination attitudes, regardless of their behavior (pro/ hesitant), tend to perceive the Ministry of Health's response as more reliable than subgroups with hesitant attitudes. This finding can be explained by a higher basic level of trust in the

Ministry of Health among groups with pro-vaccination attitudes, as mentioned previously in this study. However, the hesitant behavior among the group with pro-vaccination attitudes may have arisen from reasons unrelated to attitudes such as physical availability, affordability and willingness to pay, geographical accessibility, ability to understand (language and health literacy), and appeal of immunization services' affect uptake.<sup>43</sup> Therefore, the group with pro-vaccination attitudes and hesitant behavior may still have the intention to vaccinate their children or to get vaccinated themselves.

Another measured variable in the simulation is satisfaction with the Ministry of Health's response. The findings point to a significant difference only between the group of pro-vaccination attitudes and behavior and the group of hesitant attitudes and behavior. This finding also indicates that all groups had a similar satisfaction level, and respectively strengthens the claim that the hesitant-attitudes/pro-behavior group is situated in the middle of the spectrum - between the pro-attitudes/pro-behavior group and the hesitant-attitudes/hesitant-behavior group. By following the aforementioned findings, this group may turn into one of the subgroups situated at the ends of the spectrum. Therefore, these findings predict that all groups will seek further information.

Consistent with the above findings, this study indicates that most participants in all 4 vaccination groups reported that they

would continue seeking further information, even after reading the Ministry of Health's response to the post on social media. In other words, even the pro-vaccination attitudes and behavior group (PA/PB) finds the information they receive from the Ministry of Health insufficient. Similarly, previous studies found that information insufficiency and untrustworthiness are positively associated with further information seeking,<sup>44–48</sup> and encourage the public to search for further information from other information sources,<sup>49</sup> apart from that of the health organization itself. Moreover, previous studies also found that information seeking may represent an initial step in changing actual behavior,<sup>50</sup> as well as improving the degree of trust in information sources about vaccination.<sup>51</sup> Therefore, it is crucial for health organizations to present sufficient information addressing the fears, concerns, and questions of all the vaccination subgroups in order to gain the public's trust.<sup>20</sup>

In summary, the study findings emphasize the importance of trust as a central component in shaping the public's attitudes and behaviors. In this study, trust was found to be associated with the public's perception of the reliability of the health organization as an information source, and satisfaction regarding the health organization's communication methods and responses. Therefore, it is important for health organizations to gain the public's trust, especially that of pro-vaccination groups with hesitant attitudes, while addressing the public's fears and concerns.

### Limitations

Although the study's sample is representative, only those participants who participated by choice were included. Therefore, the participants' recruitment may be a study limitation and an indicator of selection bias.

It is also important to note that this study was conducted before the COVID-19 outbreak in Israel. Following the COVID-19 pandemic, the vaccine hesitancy phenomenon became more widespread. Many studies have reported a pattern of increasing doubts about the COVID-19 vaccine's safety and effectiveness.<sup>52–54</sup> This study points to a further potential expansion of vaccine hesitancy due to the gap between attitudes and behavior among individuals with hesitant attitudes and pro-vaccination behavior. Therefore, future studies should continue to investigate the phenomenon of vaccine hesitancy and explore how the COVID-19 outbreak has increased vaccine hesitancy. In addition, health organizations have to deal with, correct, or respond to a vast amount of information on social media, especially during the COVID-19 pandemic. As a result, further studies should be conducted to develop effective ways for health organizations to communicate and correct information which, as this study found, obviously affect the public's trust.

### Conclusions

Trust plays a central role in shaping the public's behaviors and attitudes, and mediates between several determinants such as seeking further information, and satisfaction with and reliability of the health organization. Therefore, health organizations need to foster trustworthiness among all the groups regarding vaccination, especially pro-vaccination individuals with hesitant attitudes who may eventually become hesitant also in behavior. In order to gain the public's trust, health organizations are required to change their traditional communication methods and adopt a new communication strategy based on communicating transparent

and complete information, while addressing the public's fears and concerns.

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**Abbreviations.** COVID-19, Coronavirus Disease of 2019; Dwass-Steel-Critchlow-Flinger method, DSCF; hesitant-attitude/ hesitant-behavior, HA/HB; hesitant-attitude/ pro-behavior, HA/PB; pro-attitude/ hesitant-behavior, PA/HB; pro-attitude/ pro-behavior: PA/PB.

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