THE EFFECTS OF NARRATIVE- VERSUS SCIENCE-ORIENTED MESSAGES ON PARENTS' ATTITUDES TOWARDS MMR VACCINE: THE MODERATION OF CONSPIRACY BELIEFS IN VACCINATION

By

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Title: The Effects of Narrative- Versus Science-oriented Messages on Parents' Attitude Towards MMR Vaccine: The Moderation of Conspiracy Beliefs in Vaccination

Research background: Vaccine hesitancy is ranked as a top ten global health threat by the WHO. One of the most skeptical childhood vaccines is MMR vaccine. Having a high level of conspiracy beliefs is one of the strongest psychological predictors contributing to vaccine hesitancy and anti-vaccination. The current study aims to: 1) compare the effectiveness of scientific- versus narrative-based messages in promoting positive outcomes related to MMR vaccination tendency, and 2) understand the effectiveness of the TPB versus Affect Heuristic theory in explaining vaccination behavior among VHPs.

Method: A total of 438 VHPs were randomly assigned into one of the four experimental messages: no exposure (n = 107), scientific (n = 111), narrative (n = 109), hybrid (i.e., narrative and scientific) (n = 111). Outcomes include vaccination intention, vaccine hesitancy, perceived risk toward measles and MMR vaccination, perceived benefit toward MMR vaccination, positive affect toward vaccination, attitudes toward vaccination and measles, subjective norms, and behavioral control toward MMR vaccination. ANOVA, multiple regression analysis, and the Johnson Neyman technique were implemented.

Results: ANOVA suggested significant differences among the four message conditions in predicting vaccination intention, positive affect, and perceived benefits. Pairwise comparisons

using Bonferroni adjustments suggested only exposure to hybrid messages significantly increased vaccination intention, positive affect, and perceived benefit toward vaccination compared to the control condition. However, the scientific message and narrative found no differences from each other, from the control group, and from the hybrid message. Considered general conspiracy belief (GCB) as the moderator, narrative message significantly increased MMR vaccination intention and positive affect only among those with a low to average GCB. No interaction effects were found for other interactions and outcomes. Unsurprisingly, when vaccination conspiracy beliefs was included as the moderator, none of the messages was effective in predicting the positive outcomes.

Discussion: Hybrid and narrative messages promoting MMR vaccination are effective among general VHPs and VHPs with GCB, respectively. Affect heuristic theory is more effective in explaining the behavioral change of VHPs than the TPB. Additionally, tailoring messages according to individuals' information processing styles could be an effective health communication strategy.

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CHAPTER I

INTRODUCTION

Vaccine hesitancy has been recognized as a global health threat since 2019 (WHO, 2019) and as one of the public health issues contributing to a prolonged pandemic period of COVID-19 (Chou & Budenz, 2020). Since vaccine hesitancy is a cross-cultural phenomenon, especially among high-income countries, several studies (e.g., Hornsey et al., 2018; Rozbroj et al., 2019; Sallam et al., 2021; Wong et al., 2020) have tried to investigate psychological mechanisms of vaccine-hesitant individuals. Interestingly, these studies reported conspiracy belief as the communal, strongest predictors of vaccine hesitancy.

Conspiracy belief is a set of thoughts stemming from a set of false beliefs that significant social events or circumstances are attributed to a small group of powerful, malevolent actors who manipulate information and resources to serve their interests (Douglas et al., 2016; Goertzel, 1994; Sutton & Douglas, 2020). In addition to conspiracy beliefs in general, some individuals may subscribe to the conspiracy beliefs within specific areas, such as vaccination (Tomljenovic et al., 2019), climate change (Uscinski et al., 2017), or the existence of lizard humans and aliens (Swami et al., 2014). Studies have found that individuals who subscribe to one set of conspiracy theories are likely to subscribe to others (Goertzel, 1994; Sutton & Douglas, 2020).

Studies have identified subscription to conspiracy theories as a psychological mechanism related to the search for closure when certainty, control, and power is lacking (Kossowska & Bukowski, 2015). As a way to gain back control and certainty, conspiracists often hold on to a set of beliefs and behave in certain ways that are against the information and guidelines distributed by governmental-related organizations, including health and scientific institutions

(Connolly et al., 2019). Conspiracy theories lead to several public crisis management difficulties related to health and environmental issues.

To lessen and debunk the misbeliefs among the conspiracists, which in turn could change their attitudes and behaviors, scholars have investigated their information processing styles based on the Dual Information Processing Model. The Dual Information Processing Model posits that humans process information via two independent routes: experiential and analytical. While the experiential route is experiential, intuitive, affect-based, and relatively effortless, the analytical route is deliberative, conscious, reason-based, and relatively slow (Epstein, 2012; Slovic et al., 2004). Studies found that providing rational arguments is an effective strategy for correcting information among conspiracists (Orosz et al., 2016; Swami, 2014). In other words, conspiracists can better process information via the analytical route compared to the experiential route. Interestingly, an experimental study (Stojanov, 2015) found that people with high medical-related conspiracy beliefs are likely to process information experientially rather than analytically.

To understand the logic of vaccine-hesitant individuals, an abundant amount of studies have applied traditional health behavior theories, including the Health Belief Model and the Theory of Planned Behavior, to identify health behavior constructs that could increase vaccination intention—the closet predictor of actual vaccination acceptance. However, these traditional health theories have been developed under the assumption that humans are rational actors (Brewer et al., 2007). In other words, the theories believe that individuals process information analytically. However, humans simultaneously process information via analytical and experiential routes (Epstein, 2012).

In fact, affect heuristic theory posits that the first, instantaneous response in human decision making is mostly based on affect, the core element of the experiential information

processing system (Slovic et al., 2004; Slovic, 2007). Affect refers to the negative or positive feelings associated with a target. Affect heuristic theory also proposes that humans use affect to make a judgment by weighing perceived risks and perceived benefits toward a certain object or behavior (Alkahami & Slovic, 1994). When a positive affect is attached to a certain target, individuals are likely to perceive less risk and perceive greater benefits (Alkahami & Slovic, 1994). In other words, vaccination promotion can be encouraged by increasing the positive affect associated with vaccination. Additionally, Epstein (2012) posited that, while the analytical system encodes reality in abstract symbols, words, and numbers, the experiential system of humans encodes reality in concrete images, metaphors, and narratives to which feelings are attached. In other words, positive affect toward vaccination could be enhanced by integrating images, metaphors, and narratives into health promotion messages.

Based on Dual Information Processing theory, the current study employs experimental research design to test message effectiveness (i.e., fact and statistics, narrative, hybrid, and no exposure) in enhancing vaccination acceptance-related behaviors, such as positive affect toward vaccination, vaccination intention, vaccine hesitancy, perceived risks, perceived benefits, positive attitudes, subjective norms, and behavioral control. This study compares the theoretical applicability of the Theory of Planned Behavior (Ajzen, 2002)—a traditional health behavioral change theory—and Affect Heuristic theory (Slovic et al., 2005)—a classic decision-making theory—in explaining childhood vaccination among vaccine-hesitant parents (VHPs) specifically. The findings suggest that classic health behavioral change theories might not be the most effective theoretical framework for vaccination promotion among VHPs.

Additionally, while prior studies focused on either vaccine hesitancy or conspiracy beliefs, the current study investigates the moderating role of two types of conspiracy beliefs—

general conspiracy beliefs (GCB) and vaccine conspiracy beliefs (VCB)—in addition to vaccine hesitancy. The current study sheds light on different messaging strategies for VHPs and VHPs with conspiracy beliefs. Moreover, the differences in persuasion resistance between GCB and VCB in predicting vaccination tendency-related behaviors suggest dissimilarity in messaging effectiveness among individuals who subscribe to different sets of conspiracy beliefs.

Finally, the current study employs the mumps-measles-rubella (MMR) vaccine as the case study, which well represents two out of three elements contributing to vaccine hesitancy, according to the 3Cs model proposed by WHO's SAGE Working Group (2014). First, because measles has been declared eliminated since 2000, the public's perceived risk toward measles is low. In other words, the public has high complacency to prevent measles. Second, due to the impact of Wakefield's study accusing MMR vaccine of contributing to autism in children (Motta & Stecula, 2021; Tafuri et al., 2014), the public views MMR vaccine as low in vaccine safety. In other words, the public has low confidence. By using MMR vaccine as a case study, the current research could enlighten health communicators and public health practitioners regarding information processing patterns and effective messaging strategies for VHPs, especially among those with conspiracy beliefs.

CHAPTER II

LITERATURE REVIEW

Vaccine Hesitancy

Vaccine hesitancy was ranked as one of the top ten global health threats of 2019 by the World Health Organization. Behaviorally, vaccine hesitancy is defined by the Strategic Advisory Group of Experts (SAGE) on Immunization of the World Health Organization (2014) as "delay in acceptance or refusal of vaccines despite availability of vaccinations services. Vaccine hesitancy is complex and context specific, varying across time, place and vaccines. It is influenced by factors such as complacency, convenience and confidence" (p. 7). Vaccine hesitancy cannot be directly measured from vaccine uptake alone because it also involves attitudinal constructs (Dubé et al., 2013; SAGE Working Group, 2014; Salmon et al., 2015).

In 2012, the SAGE Working Group proposed a simple model addressing the complexity of vaccine hesitancy through the "3Cs" model (SAGE Working Group, 2014). The model highlights three categories of vaccine hesitancy determinants: complacency, convenience, and confidence. Complacency occurs when vaccination is not considered necessary due to low perceived risks of diseases. The success of vaccination programs may also contribute to complacency, and eventually, hesitancy because, once a disease is no longer common, individuals may estimate risks of vaccination higher than risks of developing a particular communicable disease (MacDonald, 2015). Convenience refers to physical availability, affordability, geographical accessibility, health literacy (ability to understand language and literacy), and appeal of immunization that impacts vaccine uptake. Confidence is defined as trust in vaccine effectiveness and safety, trust in the delivery system (e.g., reliability and competence

of the health professionals), and trust in policymakers who make a decision about the need of vaccination.

To help researchers in conceptualizing vaccination hesitancy as a broad problem beyond an issue of the 3Cs, which in turn will facilitate the development of vaccination interventions, the SAGE Working Group has developed a model called "Vaccine Hesitancy Determinants Matrix" by the SAGE Working Group suggesting three levels of influences: Contextual, individual and group, and vaccine-specific issues influences (SAGE Working Group, 2014). First, contextual influences refer to those arising from historic, socio-cultural, institutional, economic or political systems, as well as communication and media environments. Second, individual and group influences refer to those that happen from personal perceptions of the vaccine or influences of social/peer environment, such as one's personal experience with vaccination, beliefs and attitudes about health and prevention, knowledge, perceived and heuristic risk/benefit, and social norm. Finally, vaccine/vaccination-specific issues refer to one's concerns directly related to a specific vaccine, including the introduction of a new vaccine or a new formula, mode of vaccination program delivery, reliability of vaccination supply, and costs.

Extended from the 3Cs model, Betsch and colleagues (2018) proposed 5Cs model of psychological antecedents of vaccination. The five elements include confidence, complacency, constraints, calculation, and collective responsibility. While Betsch and colleagues (2018) agreed on the 3Cs constructs recommended by the Sage Working Group (2014), they offered the term constrains instead of the original convenience construct because convenience implies vaccination as individual responsibility and, thus, mixes up social determinants. Calculation refers to individuals' engagement in information searching to evaluate risks of infections against risks of

vaccination. Finally, collective responsibility refers to the willingness to protect others by vaccinating themselves, which in turn can raise herd immunity.

While these aforementioned models focus on determinants of vaccine hesitancy as a whole ranging from individual to social factors, Brewer and colleagues (2017) suggested that it is essential to focus on vaccine hesitancy determinants at the individual level for the following reasons. First, social determinants, such as vaccine availability or health literacy, are easier to pinpoint and be eliminated given enough resources, while individuals' attitudes that impact decision-making are more difficult to be changed, especially in high-income countries. Second, the benefits of public health can be established or shaken by the behavior of individuals, particularly in the context of vaccination. To further explain, a goal in getting a vaccination for individuals, in addition to protecting oneself, is to increase herd immunity, which in turn decreases the chances of communicable disease outbreaks. Finally, considering that vaccine hesitancy is a global phenomenon existing even among high-income countries where vaccine supply is abundant, it is worth questioning why such phenomenon remains persistent by investigating through the lens of psychology to understand responses at the individual level.

Focusing on the individual level, vaccine hesitancy, from a psychological point of view, refers to "a motivational state of being conflicted about or opposed to getting vaccinated" (Brewer et al., 2017, p. 163). Vaccine acceptance is predicted by motivation (or hesitancy) toward vaccination, which in turn is predicted by two constructs: disease risk appraisal (e.g., perceived likelihood of and perceived severity of infection) and vaccine confidence (e.g., perceived vaccine safety and perceived vaccine effectiveness) (Brewer et al., 2017). Vaccine confidence often overlaps with faith and trust in vaccines and the medical system (Brewer et al., 2017).

Unfortunately, distrust in vaccines among U.S. parents has been increasing rapidly over the past decades. In 2000, a national telephone survey found that 19% of 1,600 parents had concerns about vaccines (Gellin et al., 2000). A national online survey conducted in 2009 indicated that, while 90% of 1,552 parents agreed that vaccines are a good way to protect children from diseases, more than 50% reported concerns about serious adverse effects of vaccines (Freed et al., 2010). According to a nationwide consumer survey in 2010, 77% of parents from 4,198 households reported a vaccine concern (Kennedy et al., 2011). The CDC found that, in 2017, while childhood immunization rates remained high during 2012-2017, the number of children with no vaccines at the age of 24 months has continuously increased (CDC, 2018). Additionally, a national survey in 2018 found that approximately 25% of parents reported serious concerns about vaccinating their children (Kemp et al., 2020).

Vaccine hesitant individuals are a heterogeneous group of people on a continuum between those who actively demand vaccines (i.e., pro-vaccine) and those who refuse all vaccines (i.e., anti-vaccine) (Dubé et al., 2013). The National Immunization Survey (NIS) by the Centers for Disease Control and Prevention (CDC) classified vaccine-hesitant parents into three categories: a) unsure (i.e., accept all recommended vaccines according to the schedule but remain unconfident in the acceptance); b) delay (i.e., not immunize their children in a timely manner); and c) refuse (i.e., refuse to get some vaccines but feel confident to accept other vaccines) to immunize their children (Gowda & Dempsey, 2013; Siddiqui et al., 2013). Another qualitative study found that parents respond to vaccination by one of the following patterns: a) fully accept vaccines without questions, b) accept all vaccines but have concerns, c) delay or reject some vaccines, or d) reject all vaccines (Benin et al., 2006).

A study by Gust and colleagues (2008) categorized vaccination behavioral patterns of U.S. parents into five groups: 1) immunization advocates—those who are strongly in favor of vaccines, highly trust in medical providers, and actively seek health information (33% of adults); 2) go along to get along—those who agree that vaccine is necessary, neutrally trust in medical providers and vaccine safety, and moderately active in seeking health information (26%); 3) health advocate—those who agree that vaccine is essential, slightly trust in medical providers and neutral in serious vaccine side effects, and moderately active seek health information (25%); 4) Fencesitter—those who slightly agree that vaccine is necessary, neutrally trust in medical providers and vaccine serious side effects, and slightly inactive in health information seeking (13%); and 5) worried—those who slightly disagree that vaccines are necessary, strongly concern about vaccine safety and serious side effects, and slightly distrust in medical providers (2.6%).

MMR Vaccine Hesitancy

One of the most skeptical vaccines for childhood preventable diseases among parents is the measles, mumps and rubella (MMR) vaccine (Siddiqui et al., 2013). The MMR vaccine skepticism has arisen from a medical journal article led by Andrew Wakefield, which got published in Lancet in early 1998. The study suggested a link between MMR vaccine and the development of autism in children (Motta & Stecula, 2021; Tafuri et al., 2014). Eventually, after twelve years of investigation into the study, the Wakefield article was retracted in 2010 with the conclusions as follows: 1) using fabricated data to claim the connection by collecting an extremely small sample size; 2) deliberately altering the medical history of the studied patients; 3) undiscovering conflict of interest of funding received from a law firm hoping to sue vaccine manufacturers; and 4) lacking replicability by other studies (Bicker, 2018)

Although the Wakefield study has been retracted for more than ten years, MMR vaccine hesitancy has lingered among parents. Using the data collected from 1990 through 2019 by the Vaccine Adverse Event Reporting System (VAERS) under the Department of Health and Human Services (DHHS), Motta and Stecula (2021) study found that the Wakefield study contributed to an immediate increase of approximately 70 cases of claims for MMR vaccine injury per month. In addition, the volume of negative news featuring the MMR vaccine across mainstream media outlets also increased in the weeks following the publication of Wakefield study (Motta & Stecula, 2021). Moreover, a national survey in 2019 reported that 1 in 3 Americans believes that childhood vaccination can lead to autism during childhood development (Stecula et al., 2020).

Among vaccine-hesitant parents (VHPs), compared to those with positive or unsure vaccination intention, VHPs with negative vaccination intention reported significantly greater MMR vaccine's perceived risk relative to its benefit and reported significantly lower perceived importance of MMR vaccine (Gowda et al., 2013). Consistent with a qualitative study (Evans et al., 2001) focusing on parental attitudes toward MMR vaccine. The study reported four key factors influencing parents' decisions: a) beliefs about MMR vaccine's risk and benefit in comparison with contracting the diseases, b) information regarding MMR vaccine safety from the media and other sources, c) trust and confidence in health professionals' advice and attitudes toward compliance with the received advice, and d) perceptions about the importance of individual choice within government policy on immunization. Although parents would welcome open discussions with health professionals, they reported experiencing unwelcome pressure from health professionals to comply (Evans et al., 2001).

Although the MMR vaccination rate has remained high (90% to 92%) in the U.S. since 2000 (CDC, 2018), the survey may overlook pockets of vaccine-hesitant and vaccine refusal

populations in particular communities. In 2018, approximately 14 major urban counties had large numbers of kindergarten children who were not vaccinated due to personal and philosophical belief reasons (Hotez et al., 2020). Among these 14 major counties, half of them, including Texas, Michigan, the American Southwest, and the Pacific Northwest, had measles outbreaks in 2019 (Hotez et al., 2020).

The consequences of lower MMR vaccination rates are evidenced by the recurrence of measles outbreaks in the United States throughout the last two decades (Olson, 2020; Smith, 2017). The first spike of measles started in 2011 with 220 cases, followed by 187 cases in 2013, 667 cases in 2014, 188 cases in 2015, 375 cases in 2018, and 1,282 cases in 2019 (CDC, 2022). Among those 1,282 cases, a total of 1,249 individual cases and 22 measles outbreaks across 31 states in the U.S. were reported during January 1-October 1, 2019 (CDC, 2022). This is the greatest number of cases reported in the U.S. since 1992 (approximately 2,200 cases) and since measles was declared eliminated in 2000 (CDC, 2022). Eighty-nine percent of measles patients in 2019 were unvaccinated or were unknown for their vaccination status, and 10 percent of them were hospitalized (Patel et al., 2019).

Conspiracy Theories

Conspiracy theories can be defined as "attempts to explain the ultimate causes of significant social and political events and circumstances with claims of secret plots by two or more powerful actors" (Douglas et al., 2019, p. 4). While mostly thought of governments as the powerful actor, conspiracy theories could attribute the accusation to any group perceived as powerful and malevolent (Douglas et al., 2019). For example, conspiracy theories about the 9/11 terror attacks accuse Bush administration, the Saudi Government, the financial industry, and the

Jews. Conspiracy theories about climate change accuse scientists, communists, the United Nations, Democrats, and the government.

Conspiracy belief refers to a set of specific conspiracy theories. Some popular conspiracy theories include climate change is a hoax from governmental organizations and researchers aiming to secure money claimed as research funding; the U.S. government staged the 9/11 attacks as a justification to start the war; Princess Diana was murdered, or she faked her own death and is still alive; or the NASA moon landing was faked. Conspiracy theories are widespread. Approximately 60% of Americans continue to believe that the CIA killed President John F. Kennedy (Enders et al., 2018). A survey showed that more than a third of Americans agree that global warming is a hoax (Public Policy Polling, 2013). Four nationally representative surveys distributed during 2006-2011 found that half of Americans hold at least one conspiracy theory (Oliver & Wood, 2014a).

Some people have a tendency to develop conspiracy thinking or a conspiracy mindset. Studies suggested that people who already believe in a certain conspiracy theory are likely to believe in others, despite the irrelevant ones (Goertzel, 1994; Wood et al., 2012). Scholars suggest that such conspiracy mindset may indicate an underlying tendency for some individuals to prefer conspiracy explanations because of a bias against powerful disliked groups (Wood et al., 2012). Goertzel (1994) proposed that conspiracy beliefs are a monological belief system where these beliefs comprise a self-sealing and expanding network of ideas that mutually support each other. Consistent with other studies showing that individuals who subscribe to a conspiracy theory often turn to other conspiracy theories to explain why their conspiracy beliefs have no positive proof of evidence (Boudry & Braeckman, 2012; Keeley, 2019). Interestingly, despite contradicts among their theories (e.g., that Princess Diana was murdered or that she faked to be

dead on her and is still alive), such contradictions are no longer significant when the level of agreement that there was a cover-up among conspiracy theories believers were taken into account (Wood et al., 2012). In other words, conspiracy beliefs are only related to each other to the extent that they cohere with a higher-order belief system (Douglas et al., 2019).

Douglas and colleagues (2017) suggested that people tend to subscribe to conspiracy theories when the following social-psychological motives are met: epistemic, existential, and social. Epistemic motive is the desire for understanding, accuracy, and subjective certainty. Conspiracy theories stem from epistemic motives because the theories provide broad, consistent explanations that allow people to preserve their beliefs when they encounter uncertainty and contradiction. Conspiracy beliefs tend to be stronger when individuals perceive a pattern in randomness (e.g., van Prooijen et al., 2018), when events are large-scale or significant but the explanations are small and mundane (Leman & Cinnirella, 2013), and when events lack a clear official explanation. Conspiracy beliefs are often found among those who seek patterns and meaning in their environment, such as believers in paranormal phenomena (Oliver & Wood, 2014a), and those who overestimate their ability to understand complex causal phenomena (Vitriol & Marsh, 2018).

The existential motive is the desire for control and security. Conspiracy beliefs are a coping mechanism when individuals' existential needs are threatened because the beliefs allow them to reclaim a sense of control by rejecting official narratives, which in turn enable them to feel that they possess a better account (Douglas et al., 2019). Studies have shown that conspiracy beliefs are associated with a sense of powerlessness (Abalakina-Paap et al., 1999), anxiety (Radnitz & Underwood, 2017), and low feelings of control in the sociopolitical domain (van Prooijen & Acker, 2015). For example, people who subscribe to the conspiracy belief of the

dangers of MMR vaccine are mostly parents of autistic children themselves. The medical fact that there is no known cause and cure for autism causes the feelings of powerlessness among them and feeds more into the theory that there is a conspiracy at play (Andrade, 2020).

Social motive is the desire to maintain a positive image of the self or group. Conspiracy theories allow people to feel that they possess rare, important information that is above and beyond others, which in turn makes them feel special and boosts their self-esteem (Douglas et al., 2019). Studies have shown the association between conspiracy beliefs and the psychological need to feel unique to others (Imhoff & Lamberty, 2018; Lantian et al., 2018). Additionally, conspiracy theories are more prevalent among members of low-status groups compared to those in high-status groups (Abalakina-Paap et al., 1999; Crocker et al., 1999). For example, black Americans are more likely to believe in conspiracy theories about the American government conspiring against blacks (Crocker et al., 1999).

Medical Conspiracy Beliefs and Vaccination

Medical conspiracy beliefs in the U.S. are alarmingly high. A national survey with 1,351 participants reported that more than 50% of the American population has heard of the conspiracy theories suggesting that the FDA is intentionally suppressing natural cures for cancer because of drug company pressure, that the corporations were preventing public health officials from releasing data linking cell phones to cancer, and that physicians still want to vaccinate children even though they acknowledge that such vaccines can cause autism and psychological disorders (Oliver & Woods, 2014b). Interestingly, only 32%, 40%, and 42% disagreed with the aforementioned medical conspiracy beliefs, respectively. Additionally, high conspiracy beliefs is associated with greater use of alternative medicine, greater avoidance of traditional medicine,

greater use of herbal supplements, and less likelihood of getting annual checkups (Oliver & Woods, 2014b).

High conspiracy beliefs has been confirmed as a major psychological predictor of anti-vaccination individuals across cultures, geographical areas, and socioeconomic status (Hornsey et al., 2018; Rozbroj et al., 2019; Wong et al., 2020). The conspiracy theories relating to vaccinations include the following: harmful side effects of vaccines are hidden from the public; the U.S. government cooperates with pharmaceutical industries to earn money from the vaccines; and the data about vaccines are fake (Kata, 2012; Offit, 2007).

Belief in conspiracy theories is associated with mistrust in and rejection of scientific evidence (Jolley & Douglas, 2014). An experimental study reported that merely brief exposure to vaccine-critical content on the internet reduced the perceived risks of vaccine-preventable diseases and increased the perceived risk of vaccination (Betsch et al., 2010). A few experimental studies have revealed that the potential mediators of the relationship between exposure to conspiracy theories and vaccination intentions include perceiving danger in vaccines, feelings of powerlessness, disillusionment (i.e., the feeling of disappointment that something is not what it was believed to be), trust in authorities (Jolley & Douglas, 2014), and belief in anti-vaccine conspiracy theories (Jolley & Douglas, 2017).

Theory of Planned Behavior for Vaccination Intention

One of the classic health behavioral change theories that have been applied to explain cognitive factors influencing vaccination intention among parents is the Theory of Planned Behavior (TPB) (Byrne et al., 2011). TPB has shown high predictability across a variety of health behavioral changes such as condom use (Montanaro & Bryan, 2014), breast cancer screening (Wang et al., 2019), and HPV vaccine uptake (Gerend & Shepherd, 2012).

TPB suggests that the most proximal determinant of behavioral change is intention, which is predicted by three distal determinants consisting of attitude, subjective norms, and perceived control (Ajzen, 2002). In addition, each distal predictor includes two subconstructs—attitude consists of beliefs about possible outcomes of the behavior and evaluations of these outcomes; subjective norms consist of beliefs about normative expectations of others and motivation to comply with the expectations; and perceived control consists of self-efficacy and controllability.

A recent meta-analysis regarding the effects of TPB constructs on vaccination intentions (Xiao & Wong, 2020) suggested that, while all proximal determinants (i.e., attitude, norms, and perceived behavioral control) were significant predictors, attitude toward vaccination was the strongest. The result was consistent with another meta-analysis relating to European parents' decision on MMR vaccine acceptance, suggesting that negative attitudes and behaviors toward vaccination were one of the significant factors associated with lower MMR vaccine uptake (Tabacchi et al., 2016).

Dual-Processing Theory in Decision Making

Several health behavioral theories, including the TPB, assume that humans make decisions and change health behaviors based on reasons rather than emotions. However, dual-processing theories suggest that individuals make a decision based on two qualitatively independent modes of information processing, according to the functioning of human brain designed to maximize survival and reproductive success (Okuhara et al., 2020). These two modes have different functions, strengths, and weaknesses (Evans & Stanovich, 2013).

The first or experiential mode (i.e., peripheral/heuristic mode, System 1) is evolutionarily old and shared with other animals. It is fast, automatic, intuitive, experiential, affect-based,

relatively effortless, and undemanding of computational capacity (Epstein, 2012; Slovic et al., 2004). The experiential processing mode responds instinctively and rapidly to stimuli in order to maximize survival and reproductive success (Evans & Stanovich, 2013). The differences in these responses across individuals are small (Okuhara et al., 2020).

The second or analytic mode (i.e., central/systematic mode, or System 2), on the other hand, is evolutionarily recent and distinctively human. It is slow, deliberative, conscious, analytical, reason-based, language-based, and computationally expensive (Okuhara et al., 2020). From psychology perspective, the analytic mode is viewed as a controlled processing mode that can examine and override the inappropriate, overgeneralized, biased responses generated by experiential modes (Okuhara et al., 2020). Responses from analytical modes differ across individual differences in working memory capacity and general intelligence (Evans & Stanovich, 2013).

While traditional studies in Dual Information Processing and health behavior theories suggested that processing new information via analytical mode yields normatively correct results, more recent research has supported that the analytical mode may fail to do so (Evans, 2011; Frankish, 2010). Many researchers have recently accepted that it is incorrect to describe the analytical mode as purely rule-based and logical because this explicit reasoning may involve a variety of other processes such as the application of heuristics, explicit associative thinking, and selective direction of attention (Frankish, 2010).

Although processing information via different modes may yield conflicting results (Epstein & Pacini, 1999; Stanovic & West, 2000), researchers point out that relying on both modes of thinking would yield the best decision for judgment makers (Epstein, 2012; Frankish, 2010; Slovic et al., 2004). This suggestion resonates with the emerging trend over the past

decades among health behavior scholars attempting to integrate the influence of affect on health behavioral change theories (Williams et al., 2019).

Affect and Risk Perceptions in Health Behavioral Theories

Although assuming individuals as rational actors, classic health behavior theories, including the TPB, in fact, are centered around risk perception (Brewer, et al., 2007), which is more experiential-oriented. Meta-analyses suggest that, despite small effect sizes, risk perceptions tend to be a significant predictor of vaccine acceptance (Brewer, et al., 2007; Floyd et al., 2000; Milne et al., 2000).

Ball et al. (1998) suggested that individuals use several heuristics to evaluate risk perception in vaccination decision-making. Compression bias influences individuals to overestimate the frequency of rare risks and underestimate the frequency of common risks, especially when the rare risks are portrayed by a witness via media reporting of vaccine injury. In addition, omission bias results in parents' preference of not vaccinating their child because of the perception that actions are more harmful than inactions, especially when the situation is ambiguous. This ambiguity avoidance could lead to vaccine-hesitant parents' preference for well-known natural risks from preventable diseases over unknown manmade risks from vaccination. With these heuristics, it is challenging to maintain public confidence in vaccines.

Most risk analysis is estimated quickly and effortlessly through the experiential mode of thinking (Slovic et al., 2004). People learn new information by mapping stimuli to positive or negative feelings and storing them in an "affect pool" (Slovic et al., 2004, p. 314). The feelings associated with each stimulus are retrieved from the affect pool to process overwhelming information in daily life. Such reliance on feelings in making a judgment is characterized as the affect heuristic (Slovic et al., 2004). Affect, as a core element of experiential mode, is

conceptualized as “the specific quality of ‘goodness’ or ‘badness’ of feelings” experienced while considering a particular target (i.e., an object or an event) (Slovic et al., 2004, p. 314).

Zajonc (1980) suggested that the very first reactions to stimuli are often affect-related, which occurs automatically and subsequently guides information processing and judgment. Zajonc's statement is supported by several empirical studies in decision research. For example, Alhakami and Slovic (1994) suggested that one’s perceived risks and perceived benefits toward a target could be predicted by the negative or positive affect occurring during the process of consideration. In other words, risk and benefit judgments are derived from referring to an overall affective evaluation of a target.

In addition, Alhakami and Slovic (1994) found that perceived risk and perceived benefit of a target were negatively correlated. In other words, when an individual thinks of a target favorably, the person is more likely to judge the risk as low and the benefit as high, and vice versa for an unfavorable target. This psychological mechanism could help to explain the phenomenon of vaccine hesitancy. To further explain, parents with high negative feelings toward vaccination are more likely to judge vaccines as risky, despite their high benefits, and therefore not immunize their child.

Experiential Information Processing and Narratives in Health Promotion

Epstein (2012) proposed that, while the analytical system encodes reality in abstract symbols, words, and numbers, the experiential system encodes reality in concrete images, metaphors, and narratives to which feelings are attached. The current standard practices in health promotion rely on providing facts through statistical evidence for reasoning to facilitate analytical judgment making. Unfortunately, numbers often fail to induce emotions and therefore fail to motivate actions (Slovic, 2007).

In fact, judgment making, especially those related to risk-oriented issues, inevitably involves affect, despite the presentation of statistical evidence. A study by Slovic, Monahan, and MacGregor (2000) found that psychologists and psychiatrists perceived a fictional mental health patient as more dangerous and, subsequently, were more likely to refuse to discharge the patient when the patient was presented with frequentistic information (i.e., 20 out of every 100 patients), compared to probabilistic information (i.e., 20% of patients). The authors explained that this ratio-bias judgment happened because presenting risk information in frequentistic format, relative to probabilistic format, leads to a greater perceived risk in individuals by producing affect-laden imagery (e.g., "Some guy going crazy and killing someone") (Slovic, 2005, p. S37).

Instead of simply presenting facts with dry statistical evidence that lacks feeling elements to motivate actions, Slovic and colleagues (2005) suggested that affect-laden imagery can be produced even more by presenting information through narratives containing vivid, affect-laden scenarios and anecdotes. The images processed via the experiential system, in addition to visual images, may include any products of people's imagination, such as words, sounds, smells, and memories (Slovic, 2007).

Narrative forms of communication, such as entertainment education and testimonials, have become a more popular strategy for promoting health behavioral changes. Based on the key concepts from studies over the past decades, Hinyard and Kreuter (2007) characterized a narrative as "any cohesive and coherent story with an identifiable beginning, middle, and end that provides information about scene, characters, and conflict; raises unanswered questions or unresolved conflict; and provides resolution" (p. 778).

Meta-analyses have suggested that narrative health messages have positive persuasive effects on beliefs, attitudes, intentions, and behaviors (Braddock & Dillard, 2016; Shen et al.,

2015). Narratives can be influential in motivating individuals and getting them to adopt a target health behavior (Hinyard & Kreuter, 2007). By conveying personal experiences and perspectives toward risks of a particular disease and toward benefits of adopting a new health behavior, narratives can effectively capture an audience's attention, enhance their understanding, and add recall of information (Kreuter, et al., 2010).

The effectiveness of narratives or anecdotal messages in health communication could explain why anti-vaccination messages are influential and persuasive. Approximately 26% and 73% of U.S. parents reported having some trust in celebrities and other parents, respectively, believing their child was harmed by vaccination (Siddiqui et al., 2013). Consistent with the messaging strategies employed by anti-vaccination movements, a content analysis of anti-vaccination messages on social media found that these messages focus on the danger of vaccine toxicity and side effects by utilizing first-person narratives of a parent and photos of their child after vaccination to elicit emotions such as anger, fear, regret, and medical mistrust (Brewer et al., 2017; Kata, 2010; Shelby & Ernst, 2013). Photos, narratives, and anecdotal consisting of affect-laden, vivid imagery directly stimulate affects (i.e., emotions) and perceived risk of vaccination, which in turn prompts individuals to process information via experiential mode to prevent the threat of human's survival and reproductive instincts. Therefore, anti-vaccination messages are interesting and memorable.

The Interplay between Narratives and Statistical Information in Decision Making

Several meta-analyses and systematic reviews have investigated the effectiveness of statistical versus narrative content forms on persuasion. The findings yielded mixed results, possibly due to the varying of methods and measures used in each study. Taylor and Thompson (1982) found 6 out of 7 studies showed higher persuasive effects in case-history presentation

compared to statistical content. Baesler and Burgoo (1994) examined 19 studies and found that 13 studies supported higher effectiveness in narratives, two studies supported statistical evidence, and four studies showed no difference. Allen and Preiss (1997), on the other hand, found that statistical information was more persuasive than narratives.

Interestingly, a meta-analysis by Zebregs and colleagues (2015) investigated the effectiveness of statistical versus narrative messages in health campaigns on beliefs, attitudes, and intention and found that, while statistical-based messages have a stronger impact on beliefs and attitudes, narratives have a stronger influence on intention. They explained the findings in terms of the match between characteristics of variables. In other words, statistical evidence, beliefs, and attitude are primarily related to cognitive responses; narrative evidence and intention are primarily related to emotional responses (Zebregs et al., 2015). This suggests that narratives and statistical messages might influence different psychological constructs of health behavioral change.

Instead of polarizing the effectiveness of narratives versus statistical, several experimental studies comparing three types of messages (i.e., statistical, narrative, and hybrid) have supported that hybrid message (i.e., integrating both statistic and narrative messages) is the most effective strategy for health promotional messages (e.g., Delehanty et al., 2020; Maki, 2018; Nan et al., 2015; Okuhara et al., 2018). For example, the results from an experimental study by Nan et al. (2015) indicated that hybrid message focusing on the prevalence and consequences of HPV significantly increased the perceived risk of HPV infection relative to statistical and narrative types. However, statistical and narrative messages were not significantly different from each other in terms of influencing perceived risk, yet indirectly predicted vaccination intention through perceived risk construct (Nan et al., 2015). Another HPV

vaccination promotion study conducted an experiment among mothers also found a significant difference of hybrid messages in predicting mothers' intention to have their daughter accept HPV vaccine (Okuhara et al., 2018).

Conversely, some scholars suggested that presenting medical information in narratives may reduce the effectiveness of informed decision-making by a) biasing the presentation of information and b) discouraging individuals from analytically evaluating the information (Beyerstein, 2001; Chaiken, 1980). Several experimental studies support such an argument. Simulating an online health bulletin board, an experimental study by Betsch and colleagues (2011) found that narratives reporting vaccine adverse events can impact vaccination decisions, even when statistical information is presented along. The study found that a higher number of narratives resulted in lower vaccination intention; the relationship was mediated by the perceived risk of vaccination. Instead of showing an interaction effect, the presence of statistical and narrative information independently influenced the perceived risk of vaccination. Another experimental study by Rodriguez and colleagues (2016) also found that adding anecdotal stories into scientific news articles, despite increasing in agreeableness and persuasiveness, resulted in decreased ability to reason scientifically, even after controlling for educational level and thinking dispositions.

To date, there is no conclusive agreement whether narrative information presentation biases people’s ability in analytical thinking or not. Additionally, to the author’s knowledge, the current study is the first research investigating message effectiveness between factual/scientific, narrative, and hybrid messages and focusing on vaccine-hesitant parents in particular. Therefore, the current study aims to explore:

Research Question 1 (RQ1): Among vaccine-hesitant parents, which type of message is effective in promoting outcomes related to MMR vaccination tendency, including a) greater vaccination intention, b) greater positive affect toward MMR, c) greater perceived risks toward measles, d) lower perceived risks toward MMR vaccine, e) greater perceived benefits toward MMR vaccine, f) lower vaccine hesitancy toward MMR vaccine, g) greater positive attitudes toward MMR vaccine, h) greater negative attitudes toward measles, i) greater subjective norms toward MMR vaccination, and j) greater behavioral control toward MMR vaccination?

Conspiracy Beliefs, Information Processing Styles, and Vaccination

Conspiracy theories are extremely resistant to correction, especially through direct denials or counterarguments from official and governmental organizations (Vermeule & Suntein, 2009). The evidence provided by the organizations will be claimed as a product of the conspiracy itself (Vermeule & Suntein, 2009).

To lessen and debunk the misbeliefs, which in turn could change attitudes and behaviors, researchers (e.g., Douglas et al., 2019) have called for more clarity in information processing styles among individuals with conspiracy beliefs. Studies suggested that conspiracy beliefs are associated with the need of cognitive closure (Garrett & Weeks, 2017; Marchlewska et al., 2018). However, they are likely to manifest the "connecting the dots" thinking style (Andrade, 2020). Mikušková (2017) found that student teachers with high conspiracy beliefs were more likely to score lower in rational thinking style. Douglas and colleagues (2019) suggested that individuals with conspiracy beliefs appear to be those who seek accuracy but perhaps lack the cognitive tools or experience some barriers preventing them from being able to find a more rational explanation to explain an event.

Aligned with the assumptions of Douglas and colleagues (2019), studies found that encouraging an analytical thinking style contributes to a lower tendency to believe in conspiracy theories (Swami et al., 2014). Most studies have supported that one of the most effective ways to lessen conspiracy beliefs is to provide rational arguments (Orosz et al., 2016; Swami et al., 2014). On the contrary, empirical studies (e.g., Latimer et al., 2007; Williams-Piehota et al., 2003) found that matching messages to individuals' information processing style yields better results in health behavioral change. For example, a field experiment (Williams-Piehota et al., 2003) tested the effectiveness of mammography promotion messages (statistical versus third-person narrative) among women who called the National Cancer Institute by tailoring to individual's need of cognition (NFC) (high versus low). The study found that, while the mismatched message was markedly less effective, messages matched to individuals' need of cognition were better at motivating mammography 6 months later.

The mismatched information processing styles and message format could explain why statistical, factual message of vaccination promotion is barely effective among vaccine-hesitant parents (VHPs), especially those with high conspiracy beliefs. Scant studies (Jolley & Douglas, 2014; Stojanov, 2015) have tried to inoculate vaccine conspiracy beliefs by counter-arguing and debunking such beliefs. However, even though both techniques helped reduce belief in conspiracy theory, neither increased intention to have a fictitious child vaccinated. Interestingly, Stojanov (2015) found that people who are high in medical conspiracy beliefs were likely to process information via the experiential rather than the analytical route. Therefore, exposing VHPs with vaccine conspiracy beliefs (VCB) to a vaccination promotion message in narrative format, which facilitates experiential information processing style, could be an effective strategy in promoting vaccination decision making.

Given the contradictions between encouraging analytical thinking for reducing conspiracy thinking and tailoring message format to information processing styles for promoting behavioral change, the current study aims to explore:

Research Question 2 (RQ2): Considering vaccine conspiracy beliefs (VCB) as the moderator, which message and to what extent is effective in promoting the outcomes related to MMR vaccination tendency, including a) greater vaccination intention, b) greater positive affect toward MMR, c) greater perceived risks toward measles, d) lower perceived risks toward MMR vaccine, e) greater perceived benefits toward MMR vaccine, f) lower vaccine hesitancy toward MMR vaccine, g) greater positive attitudes toward MMR vaccine, h) greater negative attitudes toward measles, i) greater subjective norms toward MMR vaccination, and j) greater behavioral control toward MMR vaccination?

Research Question 3 (RQ3): Considering general conspiracy beliefs (GCB) as the moderator, which messages and to what extent are effective in predicting the aforementioned outcomes associated with MMR vaccination tendency?

CHAPTER III

METHOD

Study Design

A one-way between-subjects experiment with four conditions was conducted. The conditions include 1) being exposed to a factual message, 2) being exposed to a hybrid message, 3) being exposed to a narrative message, and 4) no exposure to any message (i.e., the control group). To qualify as a target participant, participants must report themselves: 1) being a parent of a child aged 0-6 years; 2) residing in the United States; and 3) self-reporting as having hesitancy toward vaccines in general or specifically with the MMR vaccine.

The experiment was conducted online via Qualtrics as a questionnaire. Amazon Mechanical Turk was used to recruit participants and distribute the experiment. The public landing page of MTurk for the pre-screener stated the following messages:

> "We would like to invite you to join our study. This is a pre-screener with 7 short questions and would not take longer than 2 minutes. You will receive 2¢ for completing this pre-screener. If you are an eligible participant, we will send you an invitation to complete the next task."

Once MTurk members clicked the study link, they proceeded to the screening questions, which included: 1) are you a parent? (Yes/No); 2) How old is your child? (if you have more than one child, please indicate the youngest child's age) (0-6-year-old/7-14-year-old/15-18-year-old); 3) Do you live in the U.S.? (Yes/No); 4) Regarding COVID-19 situation, how important it is for you to wear a mask in public places (1 = extremely not important, 5 = extremely important); 5) Do you think vaccines in general are safe? (Yes/Maybe/No); 6) Do you think the measles-mumps-rubella (MMR) vaccine is safe? (Yes/Maybe/No); and 7) how often do you exercise

(everyday/a few times a week/once a week/less than once a week/I usually don't exercise). Participants who passed through the screeners were those who responded as follows: "Yes" to question 1 and 3, "0-6-year-old" to question 2, and either "Maybe" or "No" to either question 5 or 6. Question 4 and 7 are general screeners created to hide the purpose of the study. Participants who did not pass the screeners were thanked for participation and instructed to put the given survey code randomly generated by Qualtrics onto MTurk page. For those who met participating criteria, Qualtrics stated the following messages

> "You are invited to participate in our study. The study will ask you to read an article associated with vaccination in children and answer some relevant questions. The study is expected to last approximately 15 minutes. You will receive additional compensation of $2. Your participation is voluntary, and you may choose to quit the study anytime that you feel uncomfortable."

The invited participants firstly encountered an informed consent page, which indicated the details of the study, the researcher's contact information, and a statement of voluntary participation. People who consented to participate were asked to respond to the moderator variables (i.e., conspiracy beliefs in general and conspiracy beliefs in vaccination). Participants were then randomly assigned to one of the four experimental conditions. After participants finished reading the content in their condition, they were presented with manipulation check items (i.e., the level of analytical thinking and experiential thinking), followed by dependent variables relating to MMR vaccine (i.e., vaccination intention, vaccine hesitancy, perceived risks in the disease, perceived risks in vaccination, perceived benefits in vaccination, affect toward vaccines, and attitudes toward vaccination), and demographic information questions.

Stimuli

The experimental stimuli consisted of four conditions: 1) factual message, 2) hybrid message, 3) narrative message, and 4) no exposure to any messages (i.e., the control group). Information in the stimuli was developed from the CDC website across different vaccination pages. Each stimulus consisted of eight elements: introduction, measles prevalence, measles contagiousness, measles complications, MMR vaccine effectiveness, MMR vaccine side effects, MMR vaccine safety, and conclusion.

For the factual stimulus, the messages were directly retrieved from the CDC webpages, which are publicly available; minor changes were made for content flow. Regarding the hybrid stimulus, the content written from the first-person point of view was developed further from the factual stimulus. Although some storylines and characters in the hybrid stimulus were added, it was controlled by directly retrieving most of the messages from the factual stimulus. For the narrative stimulus, the content was adjusted from the hybrid stimulus by deleting some scientific explanations and eliminating statistical information. The total word count of the factual, hybrid, and narrative stimulus is 434, 702, and 591 words, respectively. Please see Appendix A for detailed stimuli. Bolded messages in the hybrid condition represent the differences in storylines that were added from the factual condition. Underlined, italicized messages in the narrative condition represent the changes from the hybrid condition.

As the experiment was conducted online, the stimuli were presented to participants in the form of text on a Qualtrics survey. To help them stay focused on the text, factual stimulus and narrative stimulus were separated into chunks with approximately 150 words per chunk. No images were added. To ensure that participants pay attention, each chunk was timed for 30 seconds before they could click to the next screen.

Power Analysis

G* power analysis for ANCOVA was used to estimate the sample size with a small to medium f effect size (.15), error = .05, power = .80, numerator df = 3, number of groups = 4, number of covariates = 1. At least 489 participants are required for ample statistical power.

Measures

Moderator:

1) *General conspiracy beliefs.* The Generic Conspiracist Beliefs (GCB) scale of Brotherton, French, and Pickering (2013) was applied to measure individual differences in generic conspiracist ideation as a monological belief system unpinned by a relatively small number of generic assumptions about the typicality of conspiratorial activity in the world. The scale consists of 15 items with a 5-point Likert scale and can be considered a unidimensional measure, although consisting of five subconstructs. The response options ranged from *definitely untrue* (coded as 1) to *definitely true* (coded as 5). A higher score indicates a higher level of general conspiracy beliefs. GCB in our study showed good to excellent reliability (α = .89), which is consistent with the studies by Brotherton et al. (2013) (α = .94) and Swami et al. (2014) (α = .91).

2) *Conspiracy beliefs in vaccination*. The vaccine conspiracy beliefs (VCB) scale of Shapiro and colleagues (2016) was implemented. The scale is unidimensional and consists of 7 items with a 5-point Likert scale with response options ranging from strongly disagree (coded as 1) to strongly agree (coded as 5). A higher score suggests a higher level of conspiracy beliefs in vaccination. VCB of this study shows good to excellent internal reliability (α = .89), which is close to the prior studies of Shapiro et al., (2016) with α = .93 and Ruiz and Bell (2021) with α = .95.

Manipulation Checks:

1) *Information processing method:* Information-Processing Questionnaire (IPQ) (Smerecnik et al., 2012) was used to assess information processing after the exposure to experimental condition. The scale is a self-report inventory and consists of 10 items representing two dimensions: systematic (i.e., analytical) processing and heuristic (i.e., experiential) processing styles. Response pattern is a 7-point Likert scale (1 = *completely disagree*; 7 = *completely agree*). Two composite variables of each subscale were created by averaging the items with a higher score suggesting a higher tendency of the particular information processing style. The scale reliability of the analytical and heuristic processing style in the current study is adequate (α = .82 and .79, respectively). This reliability is consistent with prior studies showing α = .81 to .79 and α = .70 to .71 for analytical and heuristic subscales, respectively (Gaspar et al., 2016; Lu, 2014).

Dependent Variables:

1) *MMR vaccination intention*. This measurement was adopted from a single item of studies by Jolley and Douglas (2014) and Stojanov (2015) into a two-item scale. Parents' willingness to vaccinate a fictional child was assessed by asking two questions after reading a given scenario: "Imagine that you are a parent of one-year-old Jordan. Your doctor scheduled Jordan to receive an MMR vaccine in the next week. 1) Would you take Jordan to receive the vaccine in the next week?; and 2) Would you take Jordan to receive the vaccine in the next couple months?" The response option is a 5-point Likert scale (1 = *definitely not*, 5 = *definitely yes*). The two items were averaged to create a composite variable with a higher score suggesting a higher vaccination intention level. Cronbach's Alpha of these two items suggests good reliability (α = .85).

2) *Vaccine hesitancy in MMR vaccine*. Vaccine Hesitancy Scale (VHS), an instrument developed by WHO's Strategic Advisory Group of Experts on Immunization in 2015 (Shapiro et al., 2018), was slightly modified to assess the level of hesitancy toward the MMR vaccination. Despite being relatively new, VHS scale has been adapted and used, either fully or partially, to assess vaccine hesitancy among parents across cultures and socioeconomic statuses (e.g., Akel, et al., 2021; Wagner et al., 2019).

For the current study, the MMR-VHS scale consists of ten-item statements with a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). A composite score was created by averaging items. A greater score represents a greater level of MMR vaccine hesitancy. Although consisting of two sub-constructs, including 'lack of confidence' and 'risks' factors, prior studies (Akel et al, 2021; Shapiro et al., 2018; Wagner et al., 2019) have used VHS as a single construct and yielded good reliability (α = .81 to .95). Reflected in the current study, VHS as a single factor measurement yielded good reliability (α = .88).

3) *Perceived risk toward measles*. Modified from affect heuristic studies (e.g., Alhakami & Slovic, 1994), respondents were asked, "based on what you know, how RISKY do you think measles is?" (1 = not at all risky, 5 = extremely risky). A higher score indicates a higher level of perceived risk.

4) *Perceived risk toward MMR vaccine*. A single-item prevalently used in affect heuristic studies (e.g., Alhakami & Slovic, 1994) was modified. Respondents were asked, "based on what you know, how RISKY do you think the MMR vaccine is?" (1 = not at all risky, 5 = extremely risky). A higher score indicates a higher level of perceived risk.

5) *Perceived benefit toward MMR vaccine*. A single item adopted from prior studies (e.g., Alhakami & Slovic, 1994) was used to assess overall perceived risks toward MMR vaccination.

"Based on what you know, how BENEFICIAL do you think the MMR vaccine is?" (1 = not at all effective, 5 = extremely effective). A higher score indicates a higher perceptions of benefit.

6) *Positive affect toward MMR vaccine.* A single item with bi-polar response options was used to measure participants' feelings about the MMR vaccine, "Based on what you know, how NEGATIVE or POSITIVE do you feel about MMR vaccine?" (1 = very negative, 5 = very positive). This item was adapted from previous studies (Evans et al., 2015). A higher score represents a more positive affect.

7) *Positive attitudes toward MMR vaccination.* Participants' beliefs and attitudes toward MMR vaccine were assessed by the MMR attitudes subscale from the Attitudes toward MMR vaccination scale by Brown et al. (2011). One of the original items was excluded due to context-specific wording. It finally yielded a total of six items in the current study. Its response option is a 5-point Likert scale ranging from *totally disagree* to *totally agree*. After reverse coding some items, a composite variable was created with a higher score represents pro-MMR vaccination. Reliability analysis shows poor reliability ($\alpha = .50$), which is similar to prior studies ($\alpha = .55$) (e.g., Camerini et al., 2019), but inconsistent with its original study suggesting acceptable reliability ($\alpha = .75$). See Appendix B for detailed items.

8) *Positive attitudes toward measles.* Participants' attitudes toward measles were assessed by one of the subscales from the Attitudes toward MMR vaccination scale proposed by Brown et al. (2011). A total of 5 items with a 5-point Likert (1 = *totally disagree*, 5 = *totally agree*) were presented to participants. After reverse coding a negatively worded item, a composite variable was created by averaging with a higher score representing more negative attitudes toward measles, in other words, pro-MMR vaccination. Reliability analysis in the current study suggests

poor reliability (α = .56), which is inconsistent with its original study suggesting acceptable reliability (α = .63).

9) *Subjective norms regarding MMR vaccination*. Adjusted from Ajzen (2011), subjective norms consist of two items; each item represents injunctive and descriptive aspect. Injunctive norm item is "Most people who are important to me think that I should have my child receive MMR vaccine" (1 = totally disagree, 5 = totally agree). Descriptive norm item is "Most parents like me have their child receive MMR vaccine" (1 = very unlikely, 5 = very likely). The two items were averaged to create a composite variable with higher scores suggesting higher subjective norms or greater beliefs that their significant others expect them to perform a behavior. Cronbach's alpha in the current study suggests acceptable reliability (α = .71).

10) *Perceived behavioral control toward MMR vaccination*. Adjusted from Ajzen (2011), perceived behavioral control consists of two items representing capacity and autonomy aspects. Capacity item is "I am confident that I can have my child receive MMR vaccine safely" (1= totally false, 5 = totally true). Autonomy item is "Having my child receive MMR vaccine is up to me" (1 = totally disagree, 5 = totally agree). Although prior studies found good reliabilities, some studies (e.g., Rountree & Prentice, 2021) found poor reliabilities between these two items (α = 0.50). Scholars have recommended conceptualizing perceived behavioral control as a dual-aspect variable (Shah et al., 2021; Yzer, 2012). For the current study, due to poor reliability (α = 20), the two items were analyzed separately.

Statistical Analysis

Data screening was conducted using R packages. Cases with more than 60% missing data were excluded. Missing data was less than 5% and was completely at random. Mahalanobis distance was conducted to identify potential influential cases. Thirteen cases were identified as

influential cases, but none were outliers. Analysis of Variance (ANOVA) and Regression assumptions was examined. Linearity, independence of errors, normality, and homoscedasticity of errors were met (See Appendix C). Rstudio was used to run all statistical analyses. Analysis of Variance and post hoc analysis with Bonferroni adjustment was implemented to investigate Research Question 1. Regression analysis and Johnson Neyman analysis technique were implemented to identify interaction effects and conditional interactions (i.e., regional significance), respectively, for Research Question 2 and 3.

CHAPTER IV

RESULTS

Participants

Out of 9,950 participants who completed prescreening questions, 473 target participants were invited to the full study. Twelve of those invited (2.5%) declined to participate in the study; 461 of them (97.5%) consented to participate in the current research. Among these 461 participants, 65.5% viewed vaccines in general as “maybe” safe and 34.5% as “not” safe. Additionally, 64% of them viewed MMR vaccine as “maybe” safe and 36% as “not” safe. Due to inadequate research funding, the data collection has been terminated before reaching the appropriate number of target participants. A total of 438 cases were retained after the data cleaning process.

Approximately 51.8% identified themselves as males and 44.5% as females. The majority of them are Caucasian (57.5%), followed by Asian (16.0%), African American (12.6%), American Indian (7.3%), Native Hawaiian (0.5%), and two or more races (2.7%), respectively. Most of the participants are Catholic/Christian (63.7%), followed by Hinduist (8.9%), Atheist (6.2%), Agnostic (6.2%), Islamic (5.3%), Buddhist (2.1%), and Jewish (1.1%). Regarding their political ideologies, 12.3% of participants reported themselves as ‘very conservative,’ 26.7% as ‘conservative,’ 28.1% as ‘neither liberal nor conservative,’ 24.4% as ‘liberal,’ and 6.4% as ‘very liberal.’ The majority of them are 18-30- and 31-40-year-old (47.7% and 42%, respectively), with a minority of those with 41-50- and 51-60-year-old (6.6% and 1.6%, respectively). Most of the final participants identified themselves as married (75.1%), followed by partnered (15.5%), separated (3.7%), divorced (2.5%), and widowed (0.9%). The average annual household income is $50,000-$59,999. The majority of participants have only one or two children (55.5% and

30.4%, respectively). In terms of education, almost half of them (45%) earned a bachelor's degree, followed by a master's degree (21%), partial college or no college degree (12.3%), high school degree (8.7%), professional degree (2.7%), and doctorate (0.7%). Most of the participants are full-time employees (62.3%), followed by self-employed (12.8%), and part-time employees (11%). See Table 1 for descriptive statistics and Table 2 for correlations between key variables.

Table 1. Descriptive Statistics of Key Variables.

Variables	*N*	Mean	*SD*
Moderators			
General conspiracy beliefs (GCB)	438	3.46	0.73
Vaccine conspiracy beliefs (VCB)	438	3.64	0.81
Outcomes related to MMR vaccination			
Vaccination intention: MMR vaccine	438	3.27	1.14
Positive affect: MMR vaccine	438	3.26	1.06
Perceived risks: Measles	437	3.39	1.07
Perceived risks: MMR vaccine	438	2.82	1.07
Perceived benefits: MMR vaccine	435	3.23	1.12
Vaccine hesitancy: MMR vaccine	434	2.71	0.78
Positive attitudes: MMR vaccine	434	3.51	0.57
Negative attitudes: Measles	434	3.50	0.62
Subjective norms: MMR vaccine	432	3.56	0.97
Behavioral control: MMR--Capacity	432	3.40	1.17
Behavioral control: MMR--Autonomy	432	4.09	0.97

Table 2. Correlations Between Key Variables.

	Key Variables	1	2	3	4	5	6	7	8	9
1	Fact									
2	Narrative	-.335*								
3	Hybrid	-.339*	-.335*							
4	General conspiracy beliefs (GCB)	.022	.048	.023						
5	Vaccine conspiracy beliefs (VCB)	.006	.009	.041	.615*					
6	Vaccination intention: MMR vaccine	-.018	.011	.127†	-.165*	-.278*				
7	Positive affect: MMR vaccine	-.019	.008	.134†	-.137†	-.239*	.684*			
8	Perceived risks: Measles	.013	.019	.082	-.011	-.081	.281*	.253*		
9	Perceived risks: MMR vaccine	-.053	.059	-.043	.187*	.346*	-.416*	-.372*	.049	
10	Perceived benefits: MMR vaccine	.000	.034	.130†	-.137†	-.172*	.649*	.648*	.302*	-.318*
11	Vaccine hesitancy: MMR vaccine	.040	-.045	-.093	.208*	.332*	-.751*	-.727*	-.299*	.457*
12	Negative attitudes: Measle	-.020	-.048	.108#	-.085	-.092	.432*	.400*	.414*	-.257*
13	Positive attitudes: MMR vaccine	-.025	.036	.050	-.268*	-.443*	.368*	.348*	.077	-.477*
14	Subjective norms: MMR vaccine	-.030	-.024	.072	-.107#	-.124*	.562*	.512*	.214*	-.257*
15	Behavioral control: MMR--Capacity	-.022	.051	.055	-.100#	-.196*	.588*	.575*	.224*	-.320*
16	Behavioral control: MMR--Autonomy	-.002	-.018	-.035	.060	.146†	-.004	.015	.143#	-.040

Note. * $p < .001$, † $p < 0.01$, # $p < .05$

Table 2 Continue.

	Key Variables	10	11	12	13	14	15
10	Perceived benefits: MMR vaccine						
11	Vaccine hesitancy: MMR vaccine	-.691*					
12	Negative attitudes: Measle	.422*	-.570*				
13	Positive attitudes: MMR vaccine	.350*	-.499*	.165*			
14	Subjective norms: MMR vaccine	.512*	-.643*	.399*	.270		
15	Behavioral control: MMR--Capacity	.528*	-.736*	.424*	.404*	.629*	
16	Behavioral control: MMR--Autonomy	.138†	-.029	-.126#	-.112#	.179*	.088

Note. * $p < .001$, † $p < 0.01$, # $p < .05$

Randomization Check

A total of 438 participants were successfully randomized into four experimental conditions including control (n = 107), fact (n = 111), narrative (n = 109), and hybrid (n = 111) messages. Chi-square tests showed no significant difference in gender, $\chi^2(12, N = 428) = 6.526$, $p = .887$, race, $\chi^2(18, N = 429) = 12.833$, $p = .801$, religion, $\chi^2(21, N = 427) = 19.856$, $p = .530$, political ideology, $\chi^2(12, N = 429) = 5.503$, $p = .936$, age range, $\chi^2(12, N = 429) = 6.426$, $p = .893$, marital status, $\chi^2(12, N = 428) = 12.672$, $p = .393$, number of children, $\chi^2(15, N = 429) = 18.624$, $p = .231$, income, $\chi^2(33, N = 428) = 31.589$, $p = .537$, education, $\chi^2(21, N = 429) = 10.161$, $p = .977$, employment status, $\chi^2(24, N = 426) = 22.128$, $p = .572$, and residential state $\chi^2(132, N = 427) = 107.324$, $p = .943$.

Manipulation Check

Information-Processing Questionnaire (IPQ): systematic (i.e., analytical) and heuristic (i.e., experiential) processing was used as a manipulation check. No significant effects of experimental conditions were found for both composites: systematic (i.e., analytical) processing [$F(3, 434) = 1.131$, $p = .336$] and heuristic (i.e., experiential) processing [$F(3, 434) = 0.835$, $p = .475$]. In other words, state information processing did not vary across message types.

However, when information processing styles were investigated at the item level, one item under the systematic subscale was found statistically significant [$F(3, 434) = 3.061$, $p = .028$]. The item is "I thought about how the information related to other things I know." Post hoc comparisons using Tukey HSD adjustment indicated mean difference between the narrative (M = 5.45, SD = 1.032) and the fact message (M = 4.99, SD = 1.462) conditions, $p = .043$. Interestingly, the narrative message was found to induce participants to report significantly higher systematic information processing style. However, neither of the fact, narrative, and

hybrid messages (M = 5.42, SD = 1.247) were found statistically different from the control condition (M = 5.20, SD = 1.377) for the aforementioned item, p = .644, .473, and .563, respectively.

Research Question 1 (RQ1): Among vaccine-hesitant parents, which type of message is effective in promoting outcomes related to MMR vaccination tendency, including a) greater vaccination intention, b) greater positive affect toward MMR, c) greater perceived risks toward measles, d) lower perceived risks toward MMR vaccine, e) greater perceived benefits toward MMR vaccine, f) lower vaccine hesitancy toward MMR vaccine, g) greater positive attitudes toward MMR vaccine, h) greater negative attitudes toward measles, i) greater subjective norms toward MMR vaccination, and j) greater behavioral control toward MMR vaccination?

One-way ANOVA identified a significant difference between experimental conditions on three outcomes related to vaccination tendencies with small effect sizes, including: 1) greater MMR vaccination intention, $F(3, 433) = 3.493$, $p = .016$, $\eta^2 = 0.024$; 2) greater positive affect toward MMR vaccination, $F(3, 434) = 3.801$, $p = .010$, $\eta^2 = 0.026$; and 3) greater perceived benefits toward MMR vaccination, $F(3, 431) = 5.077$, $p = .002$, $\eta^2 = 0.034$. See Table 3 for mean differences and statistical estimates across message conditions for each significant variable.

Nonetheless, there were no significant differences of experimental conditions on the following outcomes: 1) lowering MMR vaccine hesitancy [$F(3, 431) = 2.43$, $p = .065$]; 2) increasing perceived risk toward measles [$F(3, 433) = 2.221$, $p = .085$]; 3) lowering perceived risks toward MMR vaccine [$F(3, 434) = 1.037$, $p = .376$]; 4) increasing positive attitudes toward MMR vaccination [$F(3, 430) = 0.704$, $p = .550$]; 5) increasing negative attitudes toward measles [$F(3, 428) = 0.754$, $p = .520$]; 6) increasing subjective norms towards MMR vaccination [$F(3,$

428) = 0.754, p = .520]; and 7) increasing behavioral control in MMR vaccination for both capacity [F(3, 428) = 1.436, p = .232] and autonomy [F(3, 428) = 0.500, p = .682] aspects.

Table 3. Detailed Statistical Estimates for Each Significant Variable Across Message Conditions.

Significant Variable	Condition	*N*	Mean	*SD*	*SE*
Positive affect toward MMR vaccine	Control	107	3.03	0.95	0.09
	Fact	111	3.23	1.12	0.11
	Narrative	109	3.28	1.12	0.11
	Hybrid	111	3.50	1.00	0.10
	Total	438	3.26	1.06	0.05
Perceived benefits toward MMR vaccine	Control	107	2.91	1.07	0.01
	Fact	109	3.23	1.21	0.12
	Narrative	108	3.30	1.11	0.11
	Hybrid	111	3.48	1.01	0.10
	Total	435	3.23	1.12	0.05
MMR vaccination intention	Control	107	3.02	1.17	0.11
	Fact	110	3.23	1.17	0.11
	Narrative	109	3.29	1.05	0.10
	Hybrid	111	3.51	1.11	0.11
	Total	437	3.27	1.14	0.05

Post hoc analysis with Bonferroni adjustment method indicated that exposure to hybrid message (M = 3.51, SE = 0.11) significantly increased MMR vaccination intention compared to the no message exposure (M = 3.02, SE = 0.11), p = .008, but did not significantly increase the vaccination intention when compared to the exposure to fact (M = 3.23, SE = 0.11) and narrative (M = 3.29, SE = .11) messages (p = .382 and .839, respectively). Fact and narrative messages, on the other hand, were not significantly different in enhancing MMR vaccination intention than no message exposure (p = 1.000 and .502, respectively). In addition, fact and narrative messages were not different from each other in terms of enhancing vaccination intention, p = 1.000.

Post hoc analysis using Bonferroni adjustment method showed that exposure to hybrid message (M = 3.51, SE = 0.10) resulted in significantly greater positive affect toward MMR vaccination, compared to no message exposure (M = 3.03, SE = 0.10), p = .005. Hybrid message,

on the other hand, did not significantly lead to greater positive affect, compared to fact (*M* = 3.23, *SE*= .10) and narrative (*M* = 3.28, *SE* = .10) message (*p* = .288 and .635, respectively). Fact and narrative messages did not significantly contribute to a greater positive affect toward MMR vaccination than no message exposure (*p* = .997 and .505, respectively). In addition, these two conditions were not significantly different from each other in enhancing positive affect toward MMR vaccination, *p* = 1.000.

Post hoc analysis with Bonferroni adjustment revealed that exposure to hybrid messages (*M* = 3.48, *SE* = 0.105) resulted in greater perceived benefits toward MMR vaccination, compared to no exposure (*M* = 2.91, *SE* = 0.106), *p* = .001. However, exposure to hybrid message did not lead to greater perceived benefit toward MMR vaccination, when compared to fact (*M* = 3.23, *SE* = 0.105) and narrative (*M* = 3.30, *SE* = 0.106) messages (*p* = .573 and 1.000, respectively). Fact and narrative messages did not lead to a greater perceived benefits toward MMR vaccination than no message exposure (*p* = .191 and .059, respectively). Additionally, these two conditions were not significantly different from each other in enhancing perceived benefits, *p* = 1.000.

In sum, post hoc analysis suggested that hybrid message was more effective than no message exposure (i.e., the control group) in enhancing MMR vaccination intention, positive affect toward MMR vaccine, and perceived benefits toward MMR vaccine. On the other hand, exposure to fact and narrative messages was not significantly different from exposure to no message and hybrid message.

Research Question 2 (RQ2): Considering vaccine conspiracy beliefs (VCB) as the moderator, which message and to what extent is effective in promoting the outcomes related to MMR vaccination tendency, including a) greater vaccination intention, b) greater positive affect toward

MMR, c) greater perceived risks toward measles, d) lower perceived risks toward MMR vaccine, e) greater perceived benefits toward MMR vaccine, f) lower vaccine hesitancy toward MMR vaccine, g) greater positive attitudes toward MMR vaccine, h) greater negative attitudes toward measles, i) greater subjective norms toward MMR vaccination, and j) greater behavioral control toward MMR vaccination?

Multiple regression analysis found no interaction effects between message types and the level of conspiracy beliefs in predicting most of the MMR vaccination tendency outcomes. However, multiple regression analysis shows significant interactions in the following models: a) narrative message interacts with VCB in predicting negative attitudes toward measles [$F(7,426) = 2.221$, $p = .032$, adjusted $R^2 = .019$], and b) hybrid message interacts with VCB in predicting subjective norms toward MMR vaccine [$F(7, 424) = 2.13$, $p = .040$, adjusted $R^2 = .018$]. See Table 4 for detailed estimates.

Interestingly, no significant regional interactions were detected when these two significant models were analyzed further by the Johnson Neyman analysis technique. These non-significant regional interactions in these models were also confirmed by MACRO PROCESS in SPSS—an add-in software specifically moderation and mediation models analysis. In other words, the interaction effects in these two models could potentially occur at some point beyond the range of 1-5 point-Likert scale of VCB.

Unsurprisingly, only main effects from vaccine conspiracy beliefs were found in predicting the following outcomes: 1) lower MMR vaccination intention, 2) lower positive affect toward MMR vaccination, 3) greater perceived risk toward MMR vaccination, 4) greater MMR vaccine hesitancy, and 5) lower positive attitudes toward MMR vaccination. However, the main effect of conspiracy beliefs in vaccination were not significant in predicting: 1) perceived risk

Table 4. Detail Estimates of Each Outcome Predicted by Message Types and Vaccine Conspiracy Beliefs (VCB) Using Multiple Regression Analysis for Simple Moderation.

	Dependent Variables					
	Vaccination intention	Positive affect: MMR	Perceived risks: measles	Perceived risks: MMR vaccine	Perceived benefits: MMR vaccine	MMR vaccine hesitancy
Constant	4.475	4.051	3.733	1.587	3.808	1.553
VCB	-0.408#	-0.288#	-0.156	0.366†	-0.254	0.364*
Fact	0.626	0.604	0.519	-0.505	0.541	0.013
Narrative	-0.251	0.507	-0.478	-0.792	0.400	-0.008
Hybrid	0.752	0.427	0.334	-0.496	0.392	-0.216
VCB*Fact	-0.104	-0.105	-0.074	0.084	-0.054	-0.037
VCB*Narrative	0.152	-0.064	0.203	0.218	0.003	-0.062
VCB*Hybrid	-0.056	0.024	0.014	0.080	0.058	-0.027
Observations	429	430	429	430	427	427
R^2	0.112	0.089	0.029	0.134	0.069	0.133
Adjusted R^2	0.097	0.074	0.014	0.119	0.053	0.119
Residual Std. Error	1.079	1.019	1.062	1.004	1.086	0.736
F statistic	7.688	5.987	1.854	9.406	4.486	9.336

Note. * $p < .001$, † $p < 0.01$, # $p < .05$

Table 4 Continue.

	Dependent Variables				
	Positive attitudes: MMR vaccine	Negative attitude: measles	Subjective norms	Behavioral control: capacity	Behavioral control: autonomy
Constant	3.990	4.423	3.285	4.073	3.826
VCB	-0.386*	0.229	0.069	-0.237	0.100
Fact	-0.166	-0.352	1.134	0.578	-0.666
Narrative	0.322	-0.930#	0.724	0.504	-0.146
Hybrid	-0.424	-0.577	1.475#	0.504	-0.843
VCB*Fact	0.065	0.110	-0.317	-0.114	0.153
VCB*Narrative	-0.054	0.260#	-0.203	-0.057	0.003
VCB*Hybrid	0.160	0.214	-0.361#	-0.051	0.183
Observations	426	426	424	242	242
R^2	0.216	0.027	0.034	0.051	0.031
Adjusted R^2	0.203	0.019	0.018	0.036	0.015
Residual Std. Error	0.558	0.678	0.957	1.149	0.966
F statistic	16.740	2.221	2.130	3.287	1.920

toward measles, 2) perceived benefits toward MMR vaccination, 3) negative attitudes toward measles, and 4) behavioral control in MMR vaccination.

In sum, the analysis RQ2 suggested that neither of the vaccination messages significantly influence the outcomes related to MMR vaccination tendency.

Research Question 3 (RQ3): Considering general conspiracy beliefs (GCB) as the moderator, which messages and to what extent are effective in predicting the aforementioned outcomes associated with MMR vaccination tendency?

GBC was found to interact with narrative messages in predicting two outcomes, including MMR vaccination intention [$F(7, 429) = 4.246$, $p < .001$, adjusted $R^2 = .050$] and positive affect toward MMR [$F(7, 430) = 4.288$, $p < .001$, adjusted $R^2 = .050$].

MMR vaccination intention is significantly predicted by the interactions between GBC and narrative message ($b = -.400$, $SE = 0.199$, $p = -.045$). See Figure 1 for interaction plot. JN analysis suggests that, compared to other types of messages, narrative message greater predicts MMR vaccination intention for individuals whose GBC is at -1*SD* (2.730, $b = 0.60$, $SE = 0.21$, $p = .00$) and at the mean (3.461, $b = 0.31$, $SE = 0.15$, $p = .04$). See Figure 2 for regional interaction between GBC and narrative message. In other words, exposure to narrative message could effectively increase vaccination intention among individuals who hold a low to average amount of general conspiracy beliefs.

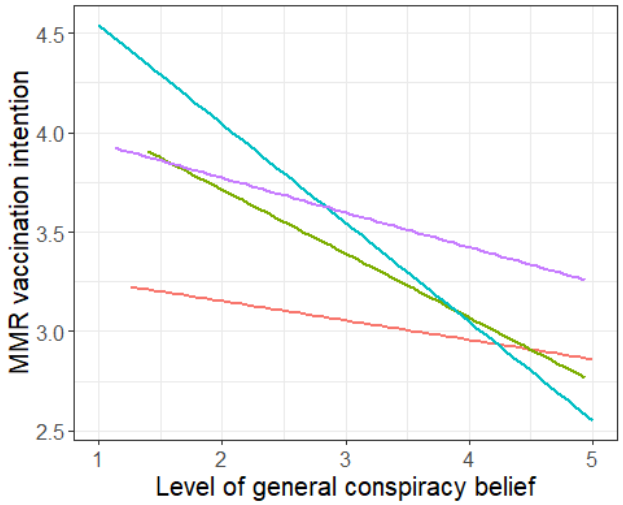


Figure 1. The interaction between message types and general conspiracy beliefs (GCB) in predicting MMR vaccination intention using multiple regression analysis.

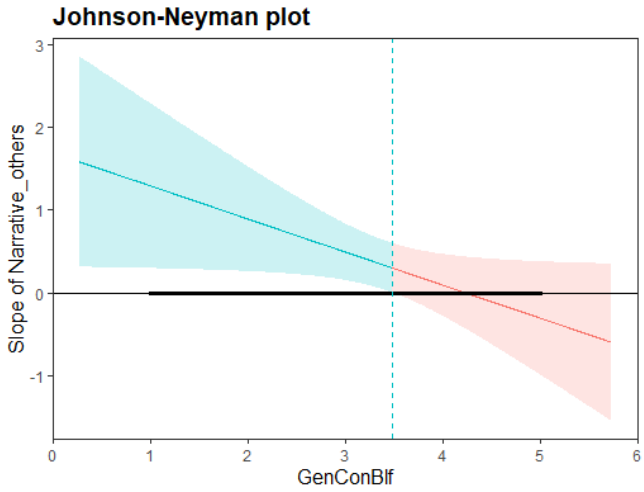


Figure 2. Regional significant interaction between narrative message and general conspiracy beliefs (GCB) in predicting MMR vaccination intention. 1 and 0 on the y-axis represent narrative and other message types, respectively.

Positive affect toward MMR vaccination is predicted by the interaction between GBC and narrative message (b = -0.371, SE = 0.186, p = .047). See Figure 3 for interaction plot. JN analysis suggests that, compared to other message types, narrative message greater predicts positive affect toward MMR vaccination at the levels of -1SD (b = 0.56, SE = 0.19, p = .00) and the mean (b = 0.29, SE = 0.14, p = .04). In other words, exposure to narrative message significantly raises positive affect toward MMR vaccination among individuals with low to average GBC. See Figure 4 for regional significance from JN analysis.

Additionally, controlling for GBC, the main effect of narrative message also detected in predicting lower MMR vaccine hesitancy and greater behavioral control toward MMR in capacity aspect. See Table 5 for detailed estimates of other MMR vaccination-related outcomes.

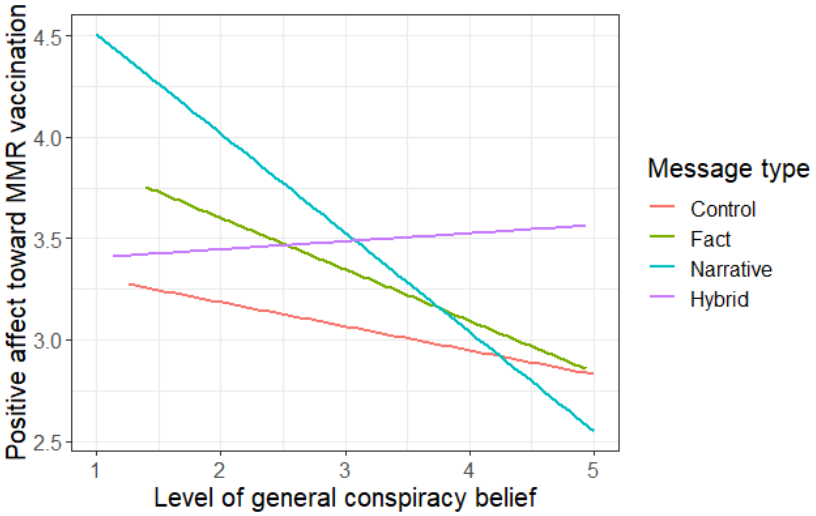


Figure 3. The interaction between message types and general conspiracy beliefs (GCB) in predicting positive affect towards MMR vaccination using multiple regression analysis.

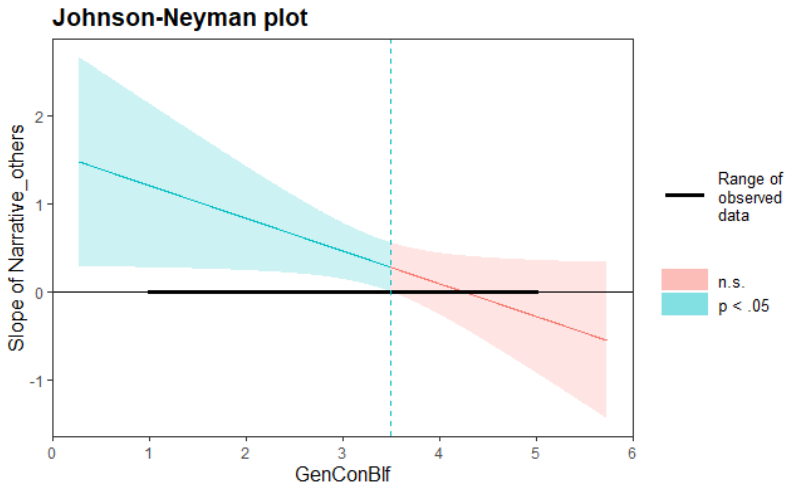


Figure 4. Regional significant interaction between narrative message and general conspiracy beliefs (GCB) in predicting positive affect toward MMR vaccination. 1 and 0 on the y-axis represent narrative and other message types, respectively.

In sum, narrative message is the only message format that influences two positive outcomes related to MMR vaccination tendency, including vaccination intention and positive affect toward MMR vaccine. However, the narrative message is significant only among VHPs with low to average GCB.

Table 5. Detail Estimates of Each Outcome Predicted by Message Types and General Conspiracy Beliefs (GCB) Using Multiple Regression Analysis for Simple Moderation.

	Dependent Variables					
	Vaccination intention	Positive affect: MMR	Perceived risks: Measles	Perceived risks: MMR vaccine	Perceived benefits: MMR vaccine	MMR vaccine hesitancy
Constant	3.348	3.425	3.185	2.557	3.433	2.278
GCB	-0.097	-0.119	0.048	0.099	-0.158	0.169
Fact	1.009	0.686	0.825	-0.705	0.642	-0.330
Narrative	1.689#	1.573#	0.573	-1.329#	1.253	-1.036#
Hybrid	0.774	-0.058	0.545	-0.821	0.490	-0.089
GCB*Fact	-0.224	-0.135	-0.171	0.150	-0.085	0.063
GCB*Narrative	-0.400#	-0.371#	-0.095	0.384#	-0.238	0.23
GCB*Hybrid	-0.077	0.158	-0.054	0.188	0.030	-0.057
Observations	429	430	429	430	427	427
R2	0.065	0.065	0.017	0.053	0.062	0.074
Adjusted R2	0.05	0.05	0.001	0.037	0.047	0.059
Residual Std. Error	1.107	1.032	1.068	1.049	1.090	0.761
F statistic	4.246	4.288	1.090	3.411	4.041	4.872

Note. * $p < .001$, † $p < 0.01$, # $p < .05$.

Table 5 Continue.

	Dependent Variables				
	Positive attitudes: MMR vaccine	Negative attitude: measles	Subjective Norms	Behavioral control: capacity	Behavioral control: autonomy
Constant	3.514	3.883	3.772	3.494	3.869
GCB	-0.267*	-0.139	-0.730	-0.079	0.093
Fact	-0.013	-0.354	0.202	0.301	-0.402
Narrative	0.347	-0.026	0.580	1.483#	-0.180
Hybrid	-0.521	-0.202	0.337	0.146	0.306
GCB*Fact	0.024	0.115	-0.060	-0.046	0.083
GCB*Narrative	-0.061	0.012	-0.164	-0.339	0.011
GCB*Hybrid	0.192	0.115	-0.051	0.043	-0.135
Observations	426	426	424	424	424
R2	0.091	0.023	0.019	0.031	0.012
Adjusted R2	0.076	0.007	0.003	0.015	-0.005
Residual Std. Error	0.600	0.683	0.965	1.907	0.975
F statistic	6.110	1.441	1.174	1.161	0.666

CHAPTER V

DISCUSSIONS AND IMPLICATIONS

Vaccine hesitancy is prolonged and internationally recognized as a public health issue, especially during the COVID-19 pandemic. One of the strongest attitudinal predictors shared among vaccine-hesitant individuals across cultures and continents is the belief in conspiracy theories (Hornsey et al., 2018). Subscribing to beliefs in conspiracy theories leads to public distrust toward governmental organizations, which in turn further contributes to international public crises (Connolly et al., 2019), such as anti-vaccination and rejection of climate change awareness. Conspiracy beliefs are widespread because those who subscribe to one conspiracy belief are likely to subscribe to other conspiracy beliefs (Goertzel, 1994).

Individuals subscribing to conspiracy beliefs are known for having high resistance to attitudinal correction (Vermeule & Suntein, 2009) and generally process information experientially (Andrade, 2020; Swami et al., 2014). To lessen vaccine hesitancy and anti-vaccination through effective messaging and communication, understanding how vaccine-hesitant individuals, particularly those with conspiracy beliefs, process health information and make a decision for health behavioral change is essential. While studies found that conspiracy beliefs can be reduced by analytically thinking (Swami et al., 2014), some studies suggested that matching health messages to individuals' information processing patterns yielded a greater behavioral change tendency (Latimer et al., 2007; Williams-Piehota et al., 2003).

In response to measles outbreaks in 2019 across 31 states of the United States which has been declared eliminated since 2000, the current study focuses on how vaccine-hesitant parents (VHPs) respond to different types of MMR vaccination message and how the messages that

promote different information processing styles contribute to changes in cognitive and affective constructs of health decision-making, as well as vaccination tendency outcomes.

Overall Findings

In the current study, the findings for RQ1 show that considering VHPs in general, the hybrid message outperforms no message exposure but is not significantly different from narrative and factual messages in predicting MMR vaccination intention, positive affect toward MMR vaccine, and perceived benefits toward MMR vaccination with small effect sizes ($\eta 2$ = 0.024, 0.026, and 0.034, respectively). Additionally, there were no significant differences in types of messages in predicting lower MMR vaccine hesitancy, greater perceived risk toward measles, lower perceived risks toward MMR vaccine, greater positive attitudes toward MMR vaccination, greater negative attitudes toward measles, greater subjective norms towards MMR vaccination, and greater behavioral control in MMR vaccination for both capacity and autonomy aspects.

For RQ2, the current study found that, when vaccine conspiracy beliefs (VCB) were considered as a moderator, none of the vaccination tendency outcomes were significantly predicted by types of messages. In other words, VHPs with VCB were not influenced by any of the messages. However, only the main effects of VCB were found to negatively predict vaccination tendency outcomes, such as decreasing vaccination intention, decreasing positive affect toward MMR vaccine, and increasing perceived risks toward MMR vaccine.

The results from RQ3 suggests that, when general conspiracy beliefs (GCB) was considered as the moderator, the narrative message became the outperforming message format, compared to the fact and hybrid messages, which were not different from no message exposure, in predicting greater MMR vaccination intention and greater positive affect toward MMR

vaccination. Additionally, narrative message effectiveness was only found among individuals with low (i.e., less than -1*SD*) to average conspiracy beliefs. However, there were no significant differences in types of messages increasing perceived benefits toward MMR vaccination, lowering MMR vaccine hesitancy, increasing perceived risk toward measles, lowering perceived risks toward MMR vaccine, increasing positive attitudes toward MMR vaccination, increasing negative attitudes toward measles, increasing subjective norms towards MMR vaccination, and increasing behavioral control in MMR vaccination for both capacity and autonomy aspects.

Overall, the current study shows that while hybrid message is more effective among general vaccine hesitant parents, narrative message is more effective in increasing vaccination tendency outcomes among vaccine hesitant parents with low to average amount of general conspiracy beliefs. Unsurprisingly, neither of the messages are effective in persuading vaccine hesitant parents with vaccine conspiracy beliefs.

Hybrid Message Effectiveness for Vaccine Hesitant Parents (VHPs)

The current findings suggested that hybrid message is the most effective message format in enhancing MMR vaccination intention, positive affect toward MMR vaccine, and perceived benefits toward MMR vaccine among general VHPs. Fact and narrative messages, on the other hand, are not different from each other, hybrid message, and no exposure conditions. Their effectiveness falls in between the hybrid message and no message exposure.

The current finding is consistent with prior studies suggesting that hybrid message is the most effective message format for increasing vaccination intention (Nan et al., 2015; Okuhara et al., 2018). Interestingly, while the current study found no significant difference between hybrid versus non-hybrid (i.e., narrative and statistical) messages—similar to Okuhara et al.'s findings, the study by Nan et al. detected the difference between these two groups. This might occur due

to the difference in experimental design that Nan et al.'s study has no true control group (i.e., no exposure) and therefore resulted in the difference in standard errors between groups and statistical modeling.

Additionally, although prior systematic or meta-analyses (e.g., Allen & Preiss, 1977; Baesler & Burgoo, 1994; Taylor & Thompson, 1982; Zebergs et al., 2015) may suggest either statistical or narrative message as a more effective health behavioral communication strategy, our study suggests that statistical (i.e., factual) and narrative messages are equally effective, yet less effective compared to hybrid message, in increasing vaccination intention, which is consistent with the study by Nan et al. (2015). The mixed findings and polarization of message effectiveness for health communication across prior systematic and meta-analyses might happen due to the differences in data collection protocol. Some studies might categorize hybrid message into the same group as narrative message. Such practice could lead to the overestimation of narrative message effectiveness. In fact, the confusion in the definition of "narrative message" exists even in recent articles (e.g., Okuhara, 2018; Okuhara et al., 2020). It is necessary to detangle narrative (i.e., a story without statistical information) and hybrid (i.e., a story with factual or statistical information) messages from each other.

Although the current study is consistent with prior studies supporting hybrid message effectiveness, the hybrid vaccination promotion message in the current context impacted health behavioral constructs differently. While Nan et al. (2015) found hybrid message promoting HPV vaccination increased perceived risk of HPV infection, the current study found non-significant changes in perceived risk toward measles. The non-significant perceived risk toward the disease of the current study may occur due to the differences in the prevalence of those two diseases:

human papillomavirus versus measles. As measles was announced as eradicated from the U.S. approximately two decades ago, parents might overlook the risk of measles infection.

Interestingly, while Nan et al. (2015) did not find a significant direct influence of hybrid message on HVP vaccination intention, the current study found a significantly greater MMR vaccination intention after hybrid message exposure—consistent with Okuhara et al.'s study. However, the significant vaccination intention in the current study is not beyond expectation. Hybrid message consists of scientific facts and first-person narratives that facilitate both analytical and experiential modes of information processing, respectively. The influence of hybrid message can be explained via dual-information processing theories as follows. The experiential mode responds to narratives about the character's affects (i.e., feelings) toward measles and MMR vaccination, and the analytical mode processes didactic information represented by numbers and statistics. This evidence is supported by novel decision-making studies suggesting that individuals tend to make the best decision when relying on both analytical and experiential modes simultaneously (Frankish, 2010; Slovic et al., 2004; Epstein, 2012).

It is worth noting that the three vaccination tendency outcomes that were influenced by hybrid message in the current study are either fully or partially affective-related constructs, including positive affect, perceived benefits, and vaccination intention. However, the cognitive-related vaccination tendency outcomes remained non-significant even though the hybrid message should have prompted both analytical and experiential modes of information processing. This non-significance is not unexpected as a brief, one-time message exposure might not be able to directly provoke one's existing thoughts toward a vaccination, especially MMR vaccine as the most skeptical childhood vaccine. However, based on the significant correlations between cognitive-related outcomes (e.g., vaccine hesitancy, negative attitudes toward measles, subjective

norms, behavioral controls) and the two significant affective-related outcomes (i.e., positive affect and perceived benefits toward MMR vaccination), it is highly likely that there are indirect effects of hybrid message exposure in predicting those cognitive-related outcomes through the mediation of affective-related constructs. In other words, cognitive-related outcomes for MMR vaccination tendency among general VHPs can be induced by promoting affective-related constructs, which in turn may induce cognitive constructs associated with vaccination.

Narrative Message Effectiveness for Vaccine Hesitant Parents with General Conspiracy Belief (GCB)

The current findings suggest that a narrative message can effectively increase some MMR vaccination tendency outcomes, including vaccination intention and positive affect toward vaccination, only among VHPs with low to average level of GCB. However, none of the messages effectively persuade VHPs with VCB, regardless of the belief intensity. These findings suggest that there are differences in information processing patterns and resistance to persuasion among GCB and VCB although prior studies tend to conceptualize individuals with conspiracy beliefs as a monolithic group (Stojanov & Halberstad, 2019; Suntein & Vermeule, 2009).

The effectiveness of a narrative message in promoting positive vaccination tendency outcomes among VHPs with low to average GBC in the current study is consistent with prior studies suggesting that individuals with conspiracy beliefs are likely to better process information via experiential mode compared to analytical mode (Swami, 2014; van Prooijen et al., 2018). In contrast to cognitive psychology studies suggesting that conspiracy beliefs can be lessened by inducing individuals to think logically or debunk the beliefs rationally (Jolley & Douglas, 2014; Swami, 2014), the current study suggests that vaccination promotion messages presented in either factual (i.e., purely scientific/statistical information) or hybrid (i.e.,

scientific/statistical information with narrative) format, which prompts analytical mode of information processing, does not significantly improve vaccination tendency outcomes and are not different than reading no message. This piece of fact could explain why the majority of anti-vaccination content on social media platforms are first-person narratives portraying vaccination side effects (Finnegan et al., 2018; Shelby & Ernst, 2013) and why vaccine hesitancy and anti-vaccination remain prevalent these days despite free, accessible knowledge about vaccination distributed via online media.

The reason that individuals with conspiracy beliefs are more prone to experiential information processing is possibly due to their existential motive—one of the main psychological motives behind the beliefs in conspiracy theories. When an individual feels powerless, anxious, and threatened, the person wants to gain a sense of control and stability, where subscribing to conspiracy theories has become a coping mechanism (Douglas et al., 2019). Existential motive is directly related to humans' survival instinct, which constantly prompts the experiential mode of information processing. Such nature of conspiracists' psychological motive explains why they are highly likely to process information experientially and, therefore, are more responsive to the vaccination promotion narrative in the current study.

However, the current study did not find narrative vaccination promotion message effectiveness among VHPs with VCB, regardless of low or high level, and VHPs with high GBC in improving any of the vaccination tendency outcomes. This is highly likely that reading a vaccination promotion message, regardless of format, induces VHPs' perceived threats to their freedom of vaccination and, therefore, contributes to psychological reactance and boomerang effects. Reactance theory suggests that individuals developing psychological reactance, in

addition to feeling anger and hostility, may be more likely to continue performing the restricted behavior as a way to reestablish their freedom (Steindl et al., 2015).

Dual-Information Processing and Behavioral Change Theories for Health Decision Making

Although the theory of planned behavior has proven effective for public health promotion and intervention over decades, not everyone is responsive to this traditional approach. Vaccine-hesitant and anti-vaccination individuals are one of the minority populations who might need a non-conventional communication strategy.

Traditional health behavioral change theories assume humans as rational actors and make a decision based on logical reasons (Brewer, et al., 2007). Affect heuristic, on the other hand, suggests humans as affective thinkers and mostly make a decision based on intuition (Epstein, 2012; Slovic et al., 2004). Additionally, dual-information processing theory suggests that humans process information via two modes—analytically (decodes information from numbers and statistics) and heuristically (decodes information via sensory systems and narratives) (Epstein, 2012). The current study extends prior literature by investigating and competing for the validity of traditional health behavioral change theories in comparison to affect heuristic and information processing theories among vaccine-hesitant parents to seek the answer for why traditional health behavioral change theories do not work with them.

Overall, factual or scientific vaccination promotion message, which is expected to induce analytic information processing mode, does not influence the current study's vaccination tendency outcomes. On the other hand, for general VHPs and VHPs with GCB, hybrid and narrative messages consisting of affective-inducing components significantly predicted vaccination intention, positive affect towards vaccination, and a few other outcomes that are mostly affective-related constructs. This finding is consistent with the suggestions of a meta-

analysis by Zebergs and colleagues (2015) suggesting that narrative has a stronger impact on behavioral intention than attitude construct because intention is primarily affect-laden.

Traditional persuasive and health communication theories might not consider the findings in the current study as an effective communication strategy. Traditional dual-information processing theories in the realm of persuasive communication (e.g., heuristic-systematic model and elaboration likelihood model) posit that when one processes information systematically or analytically, one is more likely to retain information longer, and their attitudes are less likely to be swayed (Chaiken, 1980; Petty & Cacioppo, 1986). Therefore, one of the main goals of persuasive communication is to encourage people to engage in processing information analytically. Similarly, traditional health behavioral change models, including the Theory of Planned Behavior applied in the current study, suggest that cognitive-related constructs (e.g., attitudes, subjective norms) are always the predictors of behavioral intention, which in turn further predicts actual behavioral change. In fact, the relationship between cognitive related-constructs and behavioral change was recently found to be bi-directional (Kroesen et al., 2017). In other words, one's behavioral change could happen without having strong cognitive attitudes toward a certain behavior. However, such strong cognitive attitudes could develop after the person has tried changing their behavior. Therefore, vaccination promotion messages with narrative components are considered an effective, persuasive communication strategy because it significantly improves vaccination intention, which is the nearest stage before vaccination acceptance. Once VHPs agree to have their child accept MMR vaccination and find it goes well, it is likely that they would have less vaccine hesitancy, more positive attitudes toward vaccination, and more confidence in vaccine safety.

However, it is incorrect to suggest that hybrid and narrative messages are not effective in inducing cognitive constructs. As mentioned above, it is highly likely that hybrid or narrative messages could indirectly predict multiple cognitive-related constructs via the mediation of affective-related outcomes. Therefore, it is necessary to induce the right affect-related constructs prior to promoting the right cognitive-related health outcomes as it will further predict intentions and actual change in health behavior. In other words, promoting a health behavioral change guided by traditional health behavior theories might not be an effective approach for individuals with attitudinal resistance, including those with vaccination hesitancy and conspiracy beliefs. However, to persuade behavioral change among these high attitudinal resistant people, increasing positive affect toward the target health behavior and negative affect toward the particular disease should be prioritized.

Implications for Health Communication

The current study, to my knowledge, is the first and only study that investigates the effectiveness of childhood vaccination promotion messages—specifically targeting parents with vaccine hesitancy who have a 0-to-6-year-old child. Additionally, the study also aims to understand the information processing patterns of vaccine-hesitant individuals, especially those with conspiracy beliefs, through MMR vaccination topic.

According to the current findings suggesting factual or scientific vaccination promotion message did not perform differently than no message exposure, the first and foremost implication for health communicators and public health professionals is that designing messages consisting of merely factual and scientific information is not an effective communication strategy to promote vaccination among VHPs although it works well with the general public. On the other hand, the effective communication strategy for general VHPs and VHPs with general conspiracy

beliefs is to create messages using hybrid and narrative messages, respectively, to persuade their vaccination decision making.

Despite the current findings showing that narrative message cannot induce MMR vaccination intention and positive affect toward the vaccine among VHPs with vaccine conspiracy beliefs (VCB) but can effectively improve vaccination tendency outcomes among VHPs with low to average general conspiracy beliefs (GCB), it does not mean that VHPs with VCB is unchangeable. Conspiracy beliefs are contagious in nature. Once a conspiracy belief is subscribed, the others will follow (Douglas et al., 2019; Goertzel, 1994). As such, it is possible that once an aspect of conspiracy belief is resolved, the other aspects should be lessened and likely to be resolved, too. Therefore, health communicators and interventionists could take the first step in encouraging vaccination intention among VHPs with VCB by lessening general conspiracy beliefs, which appear to be easier to tackle down compared to VCB.

CHAPTER VI

LIMITATIONS AND FUTURE RESEARCH

There are several important limitations and opportunities for future research to note within this study. First, the current study failed to capture the significance of manipulation check through the Information-Processing Questionnaire, which consists of systematic (i.e., analytical) processing and heuristic (i.e., experiential) processing styles. Fact, narrative, and hybrid messages were expected to significantly enhance the state of information processing through systematic, heuristic, and both dimensions, respectively. However, neither of the two dimensions was significantly predicted by the messages. Interestingly, after investigating measurement error, the items were loaded into two factors and suggested great reliability for both factors, consistent with previous studies (e.g., Gaspar et al., 2016; Lu, 2015). As such, the failure in capturing manipulation check has occurred not because of measurement validity but potentially due to the inappropriate context in applying the measurement. Future studies could capture the two states of information processing style by using a single, simple item to capture each dimension.

Second, the two items of perceived behavioral control toward vaccination representing capacity and autonomy aspects could not be averaged as a single composite due to poor reliability, although they have shown great reliability in other studies (e.g., Ajzen, 2011). This poor reliability might happen due to the topic of the current study—childhood vaccination. Adulthood vaccination acceptance might allow individuals to have their own autonomy in accepting vaccination (i.e., autonomy aspect) and to be aware of vaccine side effects within their body (i.e., capacity aspect), which in turn allows the two aspects of perceived behavioral control to be averaged as a single composite. On the other hand, for childhood vaccination acceptance, although parents' autonomy remains the same (i.e., parents can choose if their child will get a

vaccination or not), parents might have less sense of capacity as their child has less self-awareness and are less capable of communication about vaccine side effects happening in the child's body. Future studies using the Theory of Planned behavior could further explore measurement application across different contexts.

Third, the current study is slightly underpowered in terms of sample size due to funding limitations. Using G*power, a priori power analysis for ANCOVA with a small to medium f effect size, .05 error, and .80 power suggested at least 489 participants. However, a total of 438 were retained after prescreening and data cleaning processes. Although post hoc power analyses suggested excellent power analysis (1- β error probabilities > 0.80) for all of the significant models, the relationships between vaccination promotion messages and other vaccination tendency outcomes, both affective and cognitive aspects, could have been more pronounced if sample size would have been larger. To illustrate, in the current study, the interaction effects between narrative message and general conspiracy beliefs (GCB) on perceived benefits toward MMR vaccination was found regional significant at the *-1SD* and at the mean cutoff point using JN analysis, but showed non-significant in t-statistic of multiple regression analyses. This non-significant t-statistic likely happened due to underpowered statistics. Therefore, future studies should increase sample size in order to detect clearer relationship patterns through both JN analyses and t-statistic in multiple regression models.

Fourth, the current study did not investigate the nuance within each message type (i.e., statistic and narrative messages), which may yield different research results and conclusions. To further explain, the current study's stimuli focus on the first-person point of view narrative versus dry statistic and scientific information and did not investigate the variations among types of messages, such as the third-person narrative and affect-laden statistic. A recent meta-analysis

(Chen & Bell, 2021) found that, compared to third-person point of view narrative, first-person point of view narrative significantly increased health message effectiveness by raising perceived susceptibility to health threats. Similarly, statistical information presented in a more affective understandable and evaluable way, such as using stars representing the goodness and badness of a healthcare service, is also found to lower the burden of the analytical system and promote better decision-making (Hibbard & Peters, 2003). Therefore, future studies may investigate the nuance of message effectiveness within and among types of the messages, such as first-person point of view narrative versus affective quantifiable statistic message in vaccination.

Fifth, the current study did not capture specific elements of narrative message (i.e., the stimuli) contributing to message design effectiveness because the study focuses on information processing patterns and the connections between traditional health theories and affect heuristic theory. However, the narrative and hybrid stimulus in the current study portrayed a vaccine-hesitant mother's experience in successfully accepting childhood vaccination with small side effects from the first-person perspective. In addition, developed from mothers' experiences shared on social media platforms, the narrative contains several emotions, such as worried, guilt, relieved. Therefore, it is unclear which narrative aspects are the effective element for message design targeting vaccine-hesitant parents or individuals with conspiracy beliefs. Future research could investigate further by comparing different aspects of messages, such as inducing guilt versus fear emotion messages, portraying first- versus third-person narrative, experiencing a few versus multiple side effects in a child after vaccination, and self-identifying as a vaccine-hesitant parent versus an anti-vaccination parent.

Sixth, the current study is a cross-sectional experiment, which can capture only a short-term effect after message exposure. However, little is known about how long the message effect

will last due to its one-time exposure research design and its small effect size in nature. Therefore, future studies should conduct a longitudinal experiment with or without multiple message exposures in order to capture clearer message effectiveness in the long run.

Seventh, the current study did not capture and identify the psychological mechanisms that likely happen after reading the narrative and hybrid messages. Future studies should measure and determine which psychological mechanism contributes to which vaccination tendency outcomes. The psychological mechanisms could be detected through mediation analysis. However, while a cross-sectional experiment cannot assume the causality between the mediators (i.e., psychological variables) and the outcomes (i.e., behavioral intention or behavioral change), a longitudinal experiment could enable such causality. As such, to strengthen the causality assumption and capture the activated psychological mechanisms after message exposure, a future study could conduct a longitudinal research design with mediation analysis.

Eighth, the current study focuses on the Theory of Planned Behavior only. Health behavioral change constructs from the Health Believe Model (HBM), another classic health behavioral change theory, were not included. Future studies should examine how affect heuristic theory and dual information processing theory could complement the HBM in promoting vaccination decision-making.

APPENDIX A

STIMULI

Condition 1: Fact-based Messages

Elements	Messages
Intro about parents' vaccine hesitancy	Some parents do not want to vaccinate their child against measles because they believe that measles is no longer prevalent in the U.S. and that MMR vaccine is unsafe.
Measles Prevalence	In fact, measles is common outside the U.S. and is imported every year by unvaccinated Americans who travel abroad. Measles is a serious respiratory disease that is especially dangerous among babies and young children. Despite a declaration of measles elimination from the U.S. in 2000, 3 out of every 10 children younger than 5 years old who had measles has been hospitalized due to measles' complications during 2001-2013. Most of these children are unvaccinated.
Measles Contagiousness	Measles is an extremely contagious disease caused by a virus. It spreads through the air when an infected person coughs or sneezes and can stay in the air for up to 2 hours. One can get infected by simply being in a room where an infected person once was. If one person has measles, up to 9 out of 10 unvaccinated people around the person will become infected.
Measles Complications	Complications can include deafness, pneumonia, lifelong swelling brain damage, and death. These complications tend to occur among children aged less than 5 years old relative to older populations.
MMR vaccine effectiveness	The MMR vaccine is an effective way to protect young children against measles. About 97% of children who have been vaccinated against measles for two doses do not get infected even exposed to the measles virus. Only 3% of vaccinated children may become infected after measles exposure but with a milder illness.
MMR vaccine side effects	Most children do not have any side effects from the MMR shot. In case they do, the side effects are usually mild and may include fever and skin reactions where the shot was given, and the symptoms tend to quickly resolve. Serious side effects are rare. They may include febrile seizure, pneumonia, brain swelling, or temporary low platelet count. Those symptoms, however, also occur among unvaccinated children who are naturally infected by measles. Plus, some of the MMR vaccine serious side effects such as febrile seizures and low platelet count usually resolve without treatment.
MMR vaccine safety	The MMR vaccine and its ingredients, especially thimerosal, do not cause autism. Thimerosal, a mercury-based preservative, was completely removed since 2001 before being officially proved to be unharmful. The belief about MMR vaccine and thimerosal as a cause of autism in children

	have occurred because signs of autism typically show up at the age which children are recommended to receive the MMR vaccine.
Conclusion	Therefore, getting an MMR vaccine, which contains a weakened and unharmful live virus, is a safer way to induce immunity relative to getting natural measles infection.

Total word count: 434

Some parents do not want to vaccinate their child against measles because they believe that measles is no longer prevalent in the U.S. and that MMR vaccine is unsafe.

In fact, measles is common outside the U.S. and is imported every year by unvaccinated Americans who travel abroad. Measles is a serious respiratory disease that is especially dangerous among babies and young children. Despite a declaration of measles elimination from the U.S. in 2000, 3 out of every 10 children younger than 5 years old who had measles has been hospitalized due to measles' complications during 2001-2013. Most of these children are unvaccinated.

Measles is an extremely contagious disease caused by a virus. It spreads through the air when an infected person coughs or sneezes and can stay in the air for up to 2 hours. One can get infected by simply being in a room where an infected person once was. If one person has measles, up to 9 out of 10 unvaccinated people around the person will become infected. Complications can include deafness, pneumonia, lifelong swelling brain damage, and death. These complications tend to occur among children aged less than 5 years old relative to older populations.

The MMR vaccine is an effective way to protect young children against measles. About 97% of children who have been vaccinated against measles for two doses do not get infected even exposed to the measles virus. Only 3% of vaccinated children may become infected after measles exposure but with a milder illness. Most children do not have any side effects from the MMR shot. In case they do, the side effects are usually mild and may include fever and skin reactions where the shot was given, and the symptoms tend to quickly resolve. Serious side effects are rare. They may include febrile seizure, pneumonia, brain swelling, or temporary low platelet count. Those symptoms, however, also occur among unvaccinated children who are naturally infected by measles. Plus, some of the MMR vaccine serious side effects such as febrile seizures and low platelet count usually resolve without treatment.

The MMR vaccine and its ingredients, especially thimerosal, do not cause autism. Thimerosal, a mercury-based preservative, was completely removed since 2001 before being officially proved to be unharmful. The belief about MMR vaccine and thimerosal as a cause of autism in children have occurred because signs of autism typically show up at the age which children are recommended to receive the MMR vaccine.

Therefore, getting an MMR vaccine, which contains a weakened and unharmful live virus, is a safer way to induce immunity relative to getting natural measles infection.

Condition 2: Hybrid-based Messages

Elements	Messages
Intro about parents' vaccine hesitancy	**A doctor has recommended Alex, my child, to receive an MMR vaccine.** I did not want Alex to get the shot because I thought measles is no longer prevalent in the U.S. and that MMR vaccine is unsafe.
Prevalence	**One day, an incident changed my mind. My best friend's child got infected with measles after the family got back from travelling abroad. I never knew that** measles is common outside the U.S. and is imported every year by unvaccinated Americans. Measles is a serious respiratory disease that is especially dangerous among babies and young children. **I used to think that my child would be safe because** measles was eliminated from the U.S. in 2000. In fact, **even 13 years after the measles elimination,** 3 out of every 10 children younger than 5 years old who had measles has been hospitalized due to measles' complications.
Contagiousness	Measles is an extremely contagious disease caused by a virus**. Someone in the same trip with my friend, who appeared to be simply under the weather, was later found to be infected by measles. My friend's child got infected just because the person** coughed and sneezed. Measles can stay in the air for up to 2 hours**. That being said, my child, Alex,** can get infected by simply being in a room where an infected person once was. If one person has measles, up to 9 out of 10 unvaccinated people around the person will become infected, **and one of those could happen to be my child.**
Complications	**I would be heartbroken to see Alex developing** measles complications like deafness, pneumonia, lifelong swelling brain damage, and death. **My child is vulnerable because** the complications tend to occur among children aged less than 5 years old relative to older populations.
MMR vaccine effectiveness	**Learning how easy it is for Alex to get measles made me uncomfortable. Although I was not confident in the MMR vaccination, I have tried to research about it. What I found is that** the MMR vaccine is an effective way to protect young children against measles. About 97% of children who have received two doses of MMR vaccine do not get infected when exposed to the measles virus. Only 3% of vaccinated children may become infected after measles exposure but with a milder illness.
MMR vaccine side effects	**I have talked to my friends who have vaccinated their kids. Most of the kids did not have any** side effects from the shot. **Their doctors told my friends that** in case their kids experience side effects, the symptoms are usually mild and may include fever and skin reactions where the shot was given. These reactions usually go away quickly. **My friends' kids also did not suffer from** serious side effects such as febrile seizure, pneumonia, brain swelling, or temporary low platelet count. **In fact, those**

	side effects rarely happen among vaccinated kids. If they do, some side effects such as febrile seizures and low platelet count usually resolve without treatment and have no long-term effects. **Knowing this information made me feel relieved**. **One thing that I wanted to share to parents, though, is that** these serious MMR vaccine side effects actually occur among unvaccinated children who are naturally infected by measles.
MMR vaccine safety	Another **misbelief that I used to have is the link between the MMR vaccine and autism.** The MMR vaccine and its ingredients, especially thimerosal, do not cause autism. **Plus,** thimerosal, a mercury-based preservative, was completely removed since 2001, **even** before being officially proved to be unharmful. The **mis**belief that MMR vaccine and thimerosal cause autism in children has occurred because signs of autism typically show up at the age which children are recommended to receive the MMR vaccine.
Conclusion	**After weighing between the risk of measles infection and MMR vaccine side effects,** getting an MMR vaccine, which contains a weakened and unharmful live virus, is a safer way **for my child** to induce immunity relative to natural measles infection**. It's been over a year from the day that I finally decided to protect Alex against measles by vaccinating her with the MMR vaccine. And it was like that information that I read. Alex barely had any reactions except a mild fever and little rash. Nothing is better than seeing her grow up happy and healthy.**

Note: The bolded messages indicate the differenced from the fact-based condition.

Total word count: 702

A doctor has recommended Alex, my child, to receive an MMR vaccine. I did not want Alex to get the shot because I thought measles is no longer prevalent in the U.S. and that MMR vaccine is unsafe.

One day, an incident changed my mind. My best friend's child got infected with measles after the family got back from travelling abroad. I never knew that measles is common outside the U.S. and is imported every year by unvaccinated Americans. Measles is a serious respiratory disease that is especially dangerous among babies and young children. I used to think that my child would be safe because measles was eliminated from the U.S. in 2000. In fact, even 13 years after the measles elimination, 3 out of every 10 children younger than 5 years old who had measles has been hospitalized due to measles' complication.

Measles is an extremely contagious disease caused by a virus. Someone in the same trip with my friend, who appeared to be simply under the weather, was later found to be infected by measles. My friend's child got infected just because the person coughed and sneezed. Measles can stay in the air for up to 2 hours. That being said, my child, Alex, can get infected by simply being in a room where an infected person once was. If one person has measles, up to 9 out of 10 unvaccinated people around the person will become infected, and one of those could happen to be my child. I would be heartbroken to see Alex developing measles complications like deafness,

pneumonia, lifelong swelling brain damage, and death. My child is vulnerable because the complications tend to occur among children aged less than 5 years old relative to older populations.

Learning how easy it is for Alex to get measles made me uncomfortable. Although I was not confident in the MMR vaccination, I have tried to research about it. What I found is that the MMR vaccine is an effective way to protect young children against measles. About 97% of children who have received two doses of MMR vaccine do not get infected when exposed to the measles virus. Only 3% of vaccinated children may become infected after measles exposure but with a milder illness. I have talked to my friends who have vaccinated their kids. Most of the kids did not have any side effects from the shot. Their doctors told my friends that in case their kids experience side effects, the symptoms are usually mild and may include fever and skin reactions where the shot was given. These reactions usually go away quickly. My friends' kids also did not suffer from serious side effects such as febrile seizure, pneumonia, brain swelling, or temporary low platelet count. In fact, those side effects rarely happen among vaccinated kids. If they do, some side effects such as febrile seizures and low platelet count usually resolve without treatment and have no long-term effects. Knowing this information made me feel relieved. One thing that I wanted to share to parents, though, is that these serious MMR vaccine side effects actually occur among unvaccinated children who are naturally infected by measles.

Another misbelief that I used to have is the link between the MMR vaccine and autism. The MMR vaccine and its ingredients, especially thimerosal, do not cause autism. Plus, thimerosal, a mercury-based preservative, was completely removed since 2001, even before being officially proved to be unharmful. The misbelief that MMR vaccine and thimerosal cause autism in children has occurred because signs of autism typically show up at the age which children are recommended to receive the MMR vaccine.

After weighing between the risk of measles infection and MMR vaccine side effects, getting an MMR vaccine, which contains a weakened and unharmful live virus, is a safer way for my child to induce immunity relative to natural measles infection. It's been over a year from the day that I finally decided to protect Alex against measles by vaccinating her with the MMR vaccine. And it was like that information that I read. Alex barely had any reactions except a mild fever and little rash. Nothing is better than seeing her grow up happy and healthy.

Condition 3: Narrative-based Messages

Elements	Messages
Intro about parents' vaccine hesitancy	A doctor has recommended Alex, my child, to receive an MMR vaccine. I did not want Alex to get the shot because I thought measles is no longer prevalent in the U.S. and that MMR vaccine is unsafe.
Prevalence	One day, an incident changed my mind. My best friend's child got infected with measles after the family got back from travelling abroad. I never knew that measles is common outside the U.S. and is imported every year by unvaccinated Americans. *Measles is especially dangerous among babies and young children.* I used to think that my child would be safe because measles was eliminated from *the U.S. In fact, a number of young children like our babies* who had measles have been hospitalized due to measles' complications.
Contagiousness	*Measles is extremely contagious*. Someone in the same trip with my friend, who appeared to be simply under the weather, was later found to be infected by measles. My friend's child got infected just because the person coughed *and sneezed. That being said,* my child, Alex, can get infected by simply being in a room where an infected person once was. *If one person has measles, almost all of* unvaccinated people around the person will become infected, and one of those could happen to be my child.
Complications	I would be heartbroken to see Alex developing measles complications like deafness, pneumonia, lifelong swelling brain damage, and death. Alex is vulnerable because the complications tend to *occur among young children* relative to older populations.
MMR vaccine effectiveness	Learning how easy it is for Alex to get measles made me uncomfortable. Although I was not confident in the MMR vaccination, I have tried to research about it. What I found is that the MMR vaccine is an effective way to protect young children against measles. *Just a small number of children* who have received two doses of MMR vaccine *may still get infected* when exposed to the measles virus and will have a milder illness *relative to unvaccinated ones.*
MMR vaccine side effects	I have talked to my friends who have vaccinated their kids. Most of the kids did not have any side effects from the shot. Their doctors told my friends that in case their kids experience side effects, the symptoms are usually *mild, like fever and skin reactions*. These reactions usually go away quickly. My friends' kids also did not suffer from *serious side effects such as febrile seizures and low platelet count.* In fact, those side effects rarely happen among vaccinated kids. If they do, *the side effects* usually resolve without treatment and have no long-term effects. Knowing this information made me feel relieved. One thing that I wanted to share to parents, though, is that these serious MMR vaccine side effects actually occur among unvaccinated children who are naturally infected by measles.

MMR vaccine safety	Another misbelief that I used to have is the link between the MMR vaccine and autism. *The MMR vaccine and its ingredients do not cause autism. The suspected ingredients* was completely removed *long ago*, even before being officially proved to be unharmful.
Conclusion	After weighing between the risk of measles infection and MMR vaccine side effects, *getting an MMR vaccine is a safer way* for my child to induce immunity relative to natural measles infection. It's been over a year from the day that I finally decided to protect Alex against measles by vaccinating her with the MMR vaccine. And it was like that information that I read. Alex barely had any reactions except a mild fever and little rash. Nothing is better than seeing her grow up happy and healthy.

Note: The italicized and underlined messages indicate the differences from the narrative-based condition.

Total word count: 591

A doctor has recommended Alex, my child, to receive an MMR vaccine. I did not want Alex to get the shot because I thought measles is no longer prevalent in the U.S. and that MMR vaccine is unsafe.

One day, an incident changed my mind. My best friend's child got infected with measles after the family got back from travelling abroad. I never knew that measles is common outside the U.S. and is imported every year by unvaccinated Americans. Measles is especially dangerous among babies and young children. I used to think that my child would be safe because measles was eliminated from the U.S. In fact, a number of young children like our babies who had measles have been hospitalized due to measles' complications.

Measles is extremely contagious. Someone in the same trip with my friend, who appeared to be simply under the weather, was later found to be infected by measles. My friend's child got infected just because the person coughed and sneezed. That being said, my child, Alex, can get infected by simply being in a room where an infected person once was. If one person has measles, almost all of unvaccinated people around the person will become infected, and one of those could happen to be my child.

I would be heartbroken to see Alex developing measles complications like deafness, pneumonia, lifelong swelling brain damage, and death. Alex is vulnerable because the complications tend to occur among young children relative to older populations.

Learning how easy it is for Alex to get measles made me uncomfortable. Although I was not confident in the MMR vaccination, I have tried to research about it. What I found is that the MMR vaccine is an effective way to protect young children against measles. Just a small number of children who have received two doses of MMR vaccine may still get infected when exposed to the measles virus and will have a milder illness relative to unvaccinated ones.

I have talked to my friends who have vaccinated their kids. Most of the kids did not have any side effects from the shot. Their doctors told my friends that in case their kids experience side

effects, the symptoms are usually mild, like fever and skin reactions. These reactions usually go away quickly. My friends' kids also did not suffer from serious side effects such as febrile seizures and low platelet count. In fact, those side effects rarely happen among vaccinated kids. If they do, the side effects usually resolve without treatment and have no long-term effects. Knowing this information made me feel relieved. One thing that I wanted to share to parents, though, is that these serious MMR vaccine side effects actually occur among unvaccinated children who are naturally infected by measles.

Another misbelief that I used to have is the link between the MMR vaccine and autism. The MMR vaccine and its ingredients do not cause autism. The suspected ingredients was completely removed long ago, even before being officially proved to be unharmful.

After weighing between the risk of measles infection and MMR vaccine side effects, getting an MMR vaccine is a safer way for my child to induce immunity relative to natural measles infection. It's been over a year from the day that I finally decided to protect Alex against measles by vaccinating her with the MMR vaccine. And it was like that information that I read. Alex barely had any reactions except a mild fever and little rash. Nothing is better than seeing her grow up happy and healthy.

APPENDIX B

MEASUREMENT

Moderators

The Generic Conspiracist Beliefs (GCB) scale (Brotherton, French, & Pickering, 2013; 1-Definitely not true, 5-Definitely true)

1. The government is involved in the murder of innocent citizens and/or well-known public figures, and keeps this a secret
2. The power held by heads of state is second to that of small unknown groups who really control world politics
3. Secret organizations communicate with extraterrestrials, but keep this fact from the public
4. The spread of certain viruses and/or diseases is the result of the deliberate, concealed efforts of some organization
5. Groups of scientists manipulate, fabricate, or suppress evidence in order to deceive the public
6. The government permits or perpetrates acts of terrorism on its own soil, disguising its involvement
7. A small, secret group of people is responsible for making all major world decisions, such as going to war
8. Evidence of alien contact is being concealed from the public
9. Technology with mind-control capacities is used on people without their knowledge
10. New and advanced technology which would harm current industry is being suppressed
11. The government uses people as patsies to hide its involvement in criminal activity
12. Certain significant events have been the result of the activity of a small group who secretly manipulate world events
13. Some UFO sightings and rumors are planned or staged in order to distract the public from real alien contact
14. Experiments involving new drugs or technologies are routinely carried out on the public without their knowledge or consent
15. A lot of important information is deliberately concealed from the public out of self-interest

Conspiracy Beliefs in Vaccination (Shapiro et al., 2018; 1-strongly disagree, 7-strongly agree)

1. Vaccine safety data is often fabricated
2. Immunizing children is harmful and this fact is covered up
3. Pharmaceutical companies cover up the dangers of vaccines
4. People are deceived about vaccine efficacy
5. Vaccine efficacy data is often fabricated
6. People are deceived about vaccine safety
7. The government is trying to cover up the link between vaccines and autism

Manipulation Checks

Information Processing Questionnaire (Smerecnik, Mester, Candel, de Vries & de Vries, 2012; 1-strongly disagree, 7-strongly agree)

Systematic (i.e., analytic) processing items

1. I thought about what actions I myself might take based on what I read
2. I found myself making connections between the information and what I've read or heard about elsewhere
3. I thought about how the information related to other things I know
4. I tried to think about the importance of the information for my daily life
5. I tried to relate the ideas in the information to my health

Heuristic (i.e., experiential) processing items

6. I skimmed through the story
7. I did not spend much time thinking about the information
8. The scenario did not contain useful information on which I based my decision
9. While reading the information I did not think about the arguments presented in the information
10. The information contained too many conflicting viewpoints

Dependent Variables

Vaccine hesitancy in MMR vaccine (Shapiro, et al., 2018; 1-strongly disagree, 5-strongly agree)

1. MMR vaccine is important for my child's health (R)
2. Getting MMR vaccine is a good way to protect my child/children from Measles, Mumps, and Rubella (R)
3. MMR vaccine is effective (R)
4. Having my child vaccinated is important for the health of others in my community (R)
5. MMR vaccine offered by the government program in my community is beneficial (R)
6. The information I receive about MMR vaccine from the vaccine program is reliable and trustworthy (R)
7. Generally I do what my doctor or health care provider recommends about MMR vaccine for my child/children (R)
8. New MMR vaccine carries more risks than older MMR vaccine
9. I am concerned about serious adverse effects of MMR vaccines

Vaccine hesitancy in COVID-19 vaccine (Shapiro, et al., 2018; 1-strongly disagree, 5-strongly agree)

1. COVID-19 vaccine is important for my child's and my health (R)
2. Getting COVID-19 vaccine is a good way to protect my child/children and myself from COVID-19
3. COVID-19 vaccine is effective (R)
4. Having my child and myself vaccinated is important for the health of others in my community (R)

5. COVID-19 vaccine offered by the government program in my community is beneficial (R)
6. The information I receive about COVID-19 vaccine from the vaccine program is reliable and trustworthy (R)
7. Generally I do what my doctor or health care provider recommends about COVID-19 vaccine for myself and my child/children (R)
8. New COVID-19 vaccine carries more risks than older COVID-19 vaccine
9. I am concerned about serious adverse effects of COVID-19 vaccines

Attitudes toward MMR vaccination (Brown et al., 2011; 1-strongly disagree, 5-strongly agree)

MMR vaccination beliefs scale items

1. MMR vaccination has serious side effects (R)
2. MMR vaccination will protect my child against measles
3. I have seen or heard about bad reactions to MMR vaccination (R)
4. MMR vaccination is too much for my child's body to cope with (R)
5. I'd prefer to give single measles, mumps and rubella shots (R)
6. I have not given my other children MMR vaccination (R)
7. I would feel very bad if my child had a reaction to MMR vaccination

Measles beliefs scale items

8. Measles is a serious illness
9. I have seen or heard about bad cases of measles
10. Without MMR vaccine, it is likely that my child will catch measles
11. It is better to get natural immunity by catching measles (R)
12. I would feel very bad if my child caught measles

Attitudes toward COVID-19 vaccination (Brown et al., 2011; 1-strongly disagree, 5-strongly agree)

COVID-19 vaccination beliefs scale items

1. COVID-19 vaccination has serious side effects (R)
2. COVID-19 vaccination will protect my child and myself against COVID-19
3. I have seen or heard about bad reactions to COVID-19 vaccination (R)
4. COVID-19 vaccination is too much for myself and my child's body to cope with (R)
5. I'd prefer to not give a COVID-19 shot (R)
6. I would feel very bad if my child or myself had a reaction to COVID-19 vaccination

COVID-19 beliefs scale items

7. COVID-19 is a serious illness
8. I have seen or heard about bad cases of COVID-19
9. Without COVID-19 vaccine, it is likely that my child or myself will catch COVID-19
10. It is better to get natural immunity by catching COVID-19 (R)
11. I would feel very bad if my child or myself caught COVID-19

Subjective norms regarding MMR vaccination (Ajzen, 2011; 1-strongly disagree, 5-strongly agree)

1. Most people who are important to me think that I should have my child receive MMR vaccine
2. Most parents like me have their child receive MMR vaccine

Subjective norms regarding COVID-19 vaccination (Ajzen, 2011; 1-strongly disagree, 5-strongly agree)

1. Most people who are important to me think that I should have my child receive the COVID-19 vaccine
2. Most parents like me have their child receive COVID-19 vaccine

Perceived behavioral control toward MMR vaccination (Ajzen, 2011; 1-strongly disagree, 5-strongly agree)

1. I am confident that I can have my child receive MMR vaccine
2. Having my child receive MMR vaccine is up to me

Perceived behavioral control toward COVID-19 vaccination (Ajzen, 2011; 1-strongly disagree, 5-strongly agree)

1. I am confident that I can have my child receive COVID-19 vaccine safely
2. Having my child receive COVID-19 vaccine is up to me

Demographic Variables

1. What is your gender?
    a. Male
    b. Female
    c. Non-binary
    d. Other:_____
    e. Prefer not to answer

2. What is your ethnicity?
    a. Hispanic or Latino or Spanish origin
    b. NOT Hispanic or Latino or Spanish origin

3. What is your race?
    a. Caucasian or White
    b. Black or African American
    c. Asian
    d. American Indian or Alaska Native
    e. Native Hawaiian or Pacific Islander
    f. Two or more
    g. Other:_____

4. What is your religion?
    a. Catholicism/Christianity
    b. Judaism
    c. Islam
    d. Buddhism
    e. Hinduism
    f. Atheist
    g. Agnostic
    h. Other: _____

5. How would you identify your political ideology?
    a. Very liberal
    b. Liberal
    c. Neither liberal nor conservative
    d. Conservative
    e. Very conservative

6. Generally speaking, you usually think of yourself as_____
    a. Republicans
    b. Democrats
    c. Independents
    d. Other:_____

7. What is your age
    a. 18-20 years old
    b. 21-30 years old
    c. 31-40 years old
    d. 41-50 years old
    e. 51-60 years old
    f. 61-70 years old
    g. 70+ years old

8. What is your marital status?
    a. Married
    b. Widowed
    c. Divorced
    d. Separated

9. How many children do you have?
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5
    f. Other: please indicate_____

10. According to the above answer, please indicate how many of your children are male or female?
    a. _____male
    b. _____female
    c. Other (please indicate): _____

11. What is your annual household income?
    a. Less than $20,000
    b. $20,000 to $34,999
    c. $35,000 to $49,999
    d. $50,000 to $74,999
    e. $75,000 to $99,999
    f. Over $100,000

12. What is the highest level of school you have completed or the highest degree you have received?
    a. Less than a high school diploma
    b. High school degree or equivalent (e.g. GED)
    c. Some college, no degree
    d. Associate degree (e.g. AA, AS)
    e. Bachelor's degree (e.g. BA, BS)
    f. Master's degree (e.g. MA, MS, MEd)
    g. Professional degree (e.g. MD, DDS, DVM)
    h. Doctorate (e.g. PhD, EdD)

13. What is your current employment status?
    a. Student
    b. Retired
    c. Homemaker
    d. Self-employed
    e. Unable to work
    f. Employed full time (40 or more hours per week)
    g. Employed part time (up to 39 hours per week)
    h. Unemployed and currently looking for work
    i. Unemployed and not currently looking for work

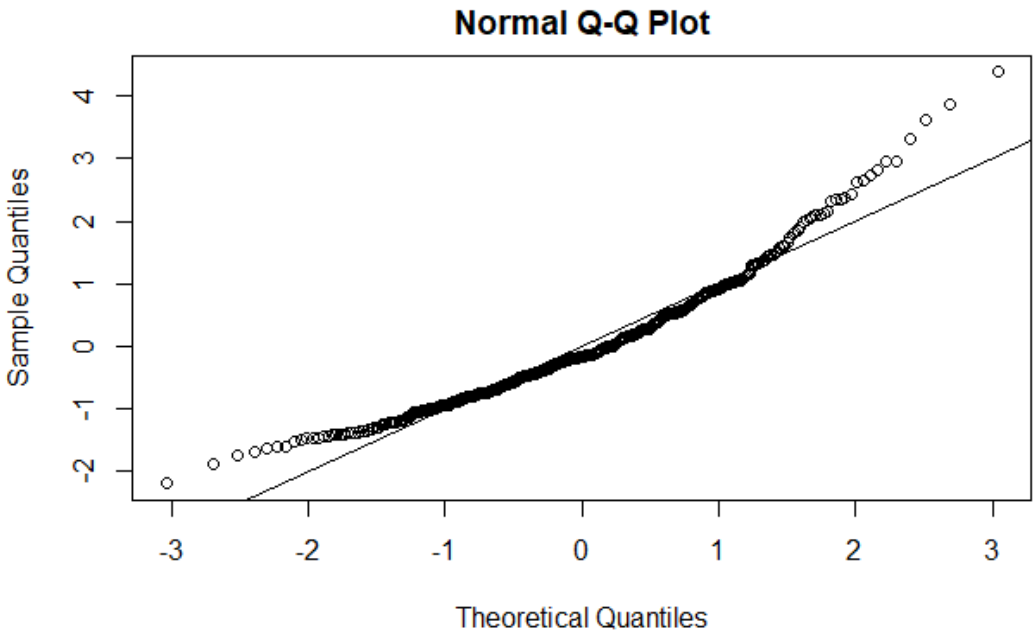
14. In what state or U.S. territory do you live?

Alabama
Alaska
Arizona
Arkansas
California
Colorado
Connecticut
Delaware
Florida
Georgia
Hawaii
Idaho
Illinois
Indiana
Iowa
Kansas
Kentucky
Louisiana
Maine
Maryland
Massachusetts
Michigan
Minnesota
Mississippi
Missouri
Montana
Nebraska
Nevada
New Hampshire
New Jersey
New Mexico
New York
North Carolina
North Dakota
Ohio
Oklahoma
Oregon
Pennsylvania
Rhode Island
South Carolina
South Dakota
Tennessee
Texas
Utah
Vermont
Virginia
Washington
West Virginia
Wisconsin
Wyoming

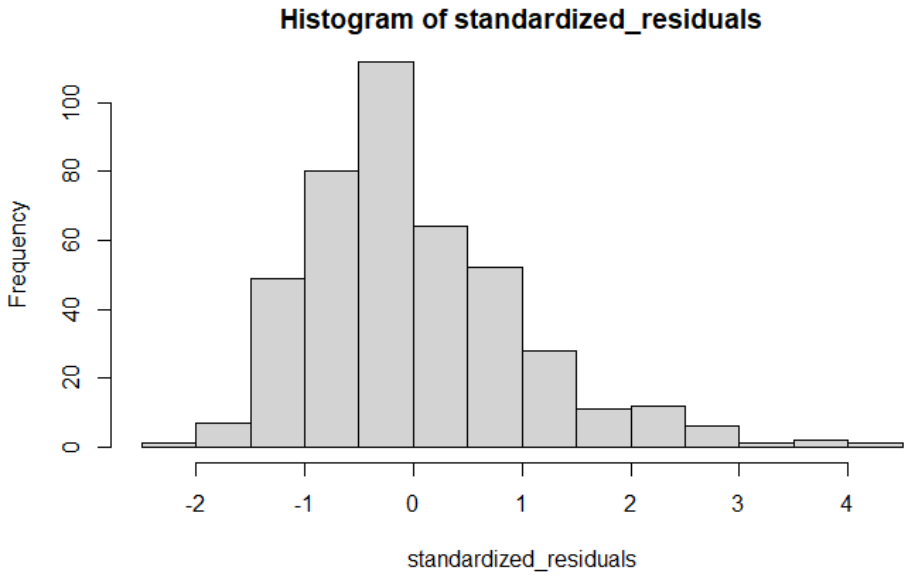
APPENDIX C

STATISTICAL ASSUMPTIONS

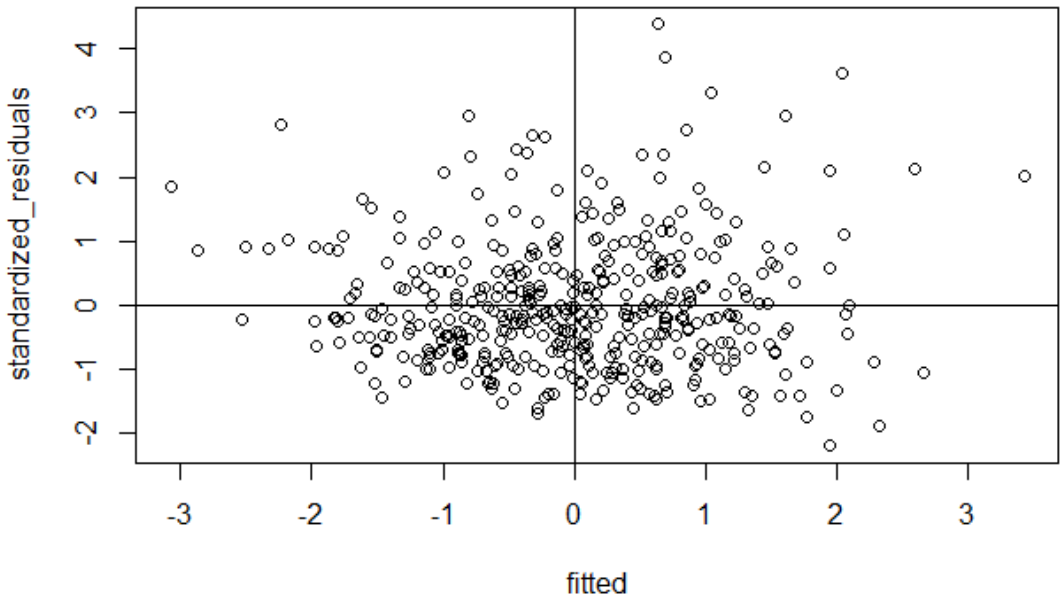
1. Linearity



2. Normality



3. Error of Homogeneity and Independence of Observations


standardized_residuals
4
3
2
1
0
-1
-2
-3
-2
-1
0
1
2
3
fitted

REFERENCES

Abalakina-Paap, M., Stephan, W. G., Craig, T., & Gregory, W. L. (1999). Beliefs in conspiracies. *Political Psychology, 20*(3), 637–647. doi:10.1111/0162-895X.00160

Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the Theory of Planned Behavior1. *Journal of Applied Social Psychology, 32*(4), 665–683. doi:10.1111/j.1559-1816.2002.tb00236.x

Ajzen, I. (2011). *Constructing a theory of planned behaviour questionnaire*. Retrieved from http://people.umass.edu/aizen/pdf/tpb.measurement.pdf

Akel, K. B., Masters, N. B., Shih, S.-F., Lu, Y., & Wagner, A. L. (2021). Modification of a vaccine hesitancy scale for use in adult vaccinations in the United States and China. *Human Vaccines & Immunotherapeutics, 17*(8), 2639–2646. doi:10.1080/21645515.2021.1884476

Alhakami, A. S., & Slovic, P. (1994). A psychological study of the inverse relationship between perceived risk and perceived benefit. *Risk Analysis, 14*(6), 1085–1096. doi:10.1111/j.1539-6924.1994.tb00080.x

Allen, M. , & Preiss, R.W. (1997). Comparing the persuasiveness of narrative and statistical evidence using meta-analysis. *Communication Research Reports, 14*(2), 125-131.

Andrade, G. (2020). Medical conspiracy theories: cognitive science and implications for ethics. *Medicine, Health Care and Philosophy, 23*(3), 505-518.

Baesler, E.J. , & Burgoon, J.K. (1994). The temporal effects of story and statistical evidence on belief change. *Communication Research, 21*(5), 582-602.

Ball, L. K., Evans, G., & Bostrom, A. (1998). Risky business: Challenges in vaccine risk communication. *Pediatrics, 101*(3), 453–458. doi:10.1542/peds.101.3.453

Benin, A. L., Wisler-Scher, D. J., Colson, E., Shapiro, E. D., & Holmboe, E. S. (2006). Qualitative analysis of mothers' decision-making about vaccines for infants: the importance of trust. *Pediatrics, 117*(5), 1532-1541.

Betsch, C., Schmid, P., Heinemeier, D., Korn, L., Holtmann, C., & Böhm, R. (2018). Beyond confidence: Development of a measure assessing the 5C psychological antecedents of vaccination. *PLOS ONE, 13*(12), e0208601.

Betsch, C., Renkewitz, F., Betsch, T., & Ulshöfer, C. (2010). The influence of vaccine-critical websites on perceiving vaccination risks. *Journal of Health Psychology, 15*(3), 446–455. doi:10.1177/1359105309353647

Betsch, C., Ulshöfer, C., Renkewitz, F., & Betsch, T. (2011). The influence of narrative v. statistical information on perceiving vaccination risks. *Medical Decision Making, 31*(5), 742–753. doi:10.1177/0272989x11400419

Beyerstein, B. L. (2001). Alternative medicine and common errors of reasoning. *Academic Medicine, 76*(3), 230–237. doi:10.1097/00001888-200103000-00009

Bicker, B. (2018). Recovering rational argument: A case study of MMR vaccine skeptics. In R. Lake (Ed.), *Recovering argument.* Routledge.

Boudry, M., & Braeckman, J. (2012). How convenient! The epistemic rationale of self-validating belief systems. *Philosophical Psychology, 25*(3), 341-364.

Braddock, K., & Dillard, J. P. (2016). Meta-analytic evidence for the persuasive effect of narratives on beliefs, attitudes, intentions, and behaviors. *Communication Monographs*, 83(4), 446–467. https://doi.org/10.1080/03637751.2015.1128555

Brewer, N. T., Chapman, G. B., Gibbons, F. X., Gerrard, M., McCaul, K. D., & Weinstein, N. D. (2007). Meta-analysis of the relationship between risk perception and health behavior: The example of vaccination. *Health Psychology, 26*(2), 136–145. doi:10.1037/0278-6133.26.2.136

Brewer, N. T., Chapman, G. B., Rothman, A. J., Leask, J., & Kempe, A. (2017). Increasing vaccination: Putting psychological science into action. *Psychological Science in the Public Interest, 18*(3), 149-207.

Brotherton, R., French, C. C., & Pickering, A. D. (2013). Measuring belief in conspiracy theories: The generic conspiracist beliefs scale. *Frontiers in psychology, 279*. doi:10.3389/fpsyg.2013.00279

Brown, K. F., Shanley, R., Cowley, N. A. L., van Wijgerden, J., Toff, P., Falconer, M., Ramsay, M., Hudson, M. J., Green, J., Vincent, C. A., Kroll, J. S., Fraser, G., & Sevdalis, N. (2011). Attitudinal and demographic predictors of measles, mumps and rubella (MMR) vaccine acceptance: Development and validation of an evidence-based measurement instrument. *Vaccine, 29*(8), 1700–1709. doi:10.1016/j.vaccine.2010.12.030

Byrne, C., Walsh, J., Kola, S., & Sarma, K. M. (2011). Predicting intention to uptake H1N1 influenza vaccine in a university sample. *British Journal of Health Psychology, 17*(3), 582–595. doi:10.1111/j.2044-8287.2011.02057.x

Camerini, A. L., Diviani, N., Fadda, M., & Schulz, P. J. (2019). Using protection motivation theory to predict intention to adhere to official MMR vaccination recommendations in Switzerland. *SSM-population health, 7*, 100321.

Centers for Disease Control and Prevention. (2018). Vaccination coverage for selected diseases among children aged 19–35 months, by race, Hispanic origin, poverty level, and location of residence in metropolitan statistical area: United States, selected years 1998–2017. Retrieved from CDC website: https://www.cdc.gov/nchs/data/hus/2018/031.pdf

Centers for Disease Control and Prevention (CDC). (2022). Measles cases and Outbreaks [Website]. Retrieved from https://www.cdc.gov/measles/cases-outbreaks.html.

Chaiken, S. (1980). Heuristic versus systematic information processing and the use of source versus message cues in persuasion. *Journal of Personality and Social Psychology, 39*(5), 752–766. doi:10.1037/0022-3514.39.5.752

Chen, M., & Bell, R. A. (2021). A meta-analysis of the impact of point of view on narrative processing and persuasion in health messaging. *Psychology & Health*, 1-18.

Chou, W.-Y. S., & Budenz, A. (2020). Considering emotion in COVID-19 vaccine communication: Addressing vaccine hesitancy and fostering vaccine confidence. *Health Communication, 35*(14), 1718–1722. doi:10.1080/10410236.2020.1838096

Connolly, J. M., Uscinski, J. E., Klofstad, C. A., & West, J. P. (2019). Communicating to the public in the era of conspiracy theory. *Public Integrity*, *21*(5), 469-476. doi:10.1080/10999922.2019.1603045

Crocker, J., Luhtanen, R., Broadnax, S., & Blaine, B. E. (1999). Belief in US government conspiracies against blacks among black and white college students: Powerlessness or system blame? *Personality and Social Psychology Bulletin, 25*(8), 941–953. doi:10.1177/01461672992511003

Delehanty, A., Lee, J., Hooker, J. L., Cortese, J., & Woods, J. (2020). Exploring message framing to engage parents in early screening for autism spectrum disorder. *Patient Education and Counseling, 103*(12), 2525-2531.

Douglas, K. M., Sutton, R. M., Callan, M. J., Dawtry, R. J., & Harvey, A. J. (2016). Someone is pulling the strings: Hypersensitive agency detection and belief in conspiracy theories. *Thinking & Reasoning, 22*, 57–77. doi:10.1080/13546783.2015.1051586

Douglas, K. M., Sutton, R. M., & Cichocka, A. (2017). The psychology of conspiracy theories. *Current Directions in Psychological Science, 26*(6), 538–542. doi:10.1177/0963721417718261

Douglas, K. M., Uscinski, J. E., Sutton, R. M., Cichocka, A., Nefes, T., Ang, C-S., & Deravi, F. (2019). Understanding conspiracy theories. *Political Psychology, 41*(S1), 3-35. doi:10.1111/pops.12568

Dubé, E., Laberge, C., Guay, M., Bramadat, P., Roy, R., & Bettinger, J. A. (2013). Vaccine hesitancy: An overview. *Human Vaccines & Immunotherapeutics, 3*(8), 1763-1773. doi: 10.4161/hv.24657

Enders, A. M., Smallpage, S. M., & Lupton, R. N. (2018). Are all "Birthers" conspiracy theorists? On the relationship between conspiratorial thinking and political orientations. *British Journal of Political Science, 50*(3), 849–866. doi:10.1017/s0007123417000837

Epstein, S. (2012). Cognitive-experiential self-theory: An integrative theory of personality. (In H. Tennen & J. Suls, Eds.). *Handbook of Psychology, 2nd ed., Vol.5. Personality Section.* Hoboken, NJ, John Wiley & Sons, Inc.

Epstein, S., & Pacini, R. (1999). Some basic issues regarding dual-process theories from the perspective of cognitive–experiential self-theory. In S. Chaiken & Y. Trope (Eds.), *Dual-process theories in social psychology* (p. 462–482). The Guilford Press.

Evans, A. T., Peters, E., Strasser, A. A., Emery, L. F., Sheerin, K. M., & Romer, D. (2015). Graphic warning labels elicit affective and thoughtful responses from smokers: Results of a randomized clinical trial. *PLOS ONE, 10*(12), e0142879. doi:10.1371/journal.pone.0142879

Evans, J. S. B. T. (2011). Dual-process theories of reasoning: Contemporary issues and developmental applications. *Developmental Review, 31*(2-3), 86–102. doi:10.1016/j.dr.2011.07.007

Evans, J. S. B. T., & Stanovich, K. E. (2013). Dual-process theories of higher cognition. *Perspectives on Psychological Science, 8*(3), 223–241. doi:10.1177/1745691612460685

Evans, M., Stoddart, H., Condon, L., Freeman, E., Grizzell, M., & Mullen, R. (2001). Parents' perspectives on the MMR immunisation: a focus group study. *The British Journal of General Practice, 51*(472), 904-910.

Finnegan, G., Holt, D., English, P. M., Glismann, S., Thomson, A., Salisbury, D. M., Bogaerts, H., & Bonanni, P. (2018). Lessons from an online vaccine communication project. *Vaccine, 36*(44), 6509–6511. doi:10.1016/j.vaccine.2018.05.007

Floyd, D. L., Prentice-Dunn, S., & Rogers, R. W. (2000). A meta-analysis of research on protection motivation theory. *Journal of Applied Social Psychology, 30*(2), 407–429. doi:10.1111/j.1559-1816.2000.tb02323.x

Frankish, K. (2010). Dual-process and dual-system theories of reasoning. *Philosophy Compass, 5*(10), 914–926. doi:10.1111/j.1747-9991.2010.00330.x

Freed, G. L., Clark, S. J., Butchart, A. T., Singer, D. C., & Davis, M. M. (2010) Parental vaccine safety concerns in 2009. *Pediatrics,* 125, 654-659. doi:10.1542/peds.2009-1962

Garrett, R. K., & Weeks, B. E. (2017). Epistemic beliefs' role in promoting misperceptions and conspiracist ideation. *PLOS ONE, 12*(9), e0184733. doi:10.1371/journal.pone.0184733

Gaspar, R., Luís, S., Seibt, B., Lima, M. L., Marcu, A., Rutsaert, P., Fletcher, D., Verbeke, W., & Barnett, J. (2015). Consumers' avoidance of information on red meat risks: Information exposure effects on attitudes and perceived knowledge. *Journal of Risk Research, 19*(4), 533–549. doi:10.1080/13669877.2014.1003318

Gellin, B. G., Maibach, E. W., & Marcuse, E.K. (2000) Do parents understand immunizations? A national telephone survey. *Pediatrics*, 106, 1097-1102. doi:10.1542/peds.106.5.1097

Gerend, M. A., & Shepherd, J. E. (2012). Predicting Human Papillomavirus Vaccine uptake in young adult women: Comparing the Health Belief Model and Theory of Planned Behavior. *Annals of Behavioral Medicine, 44*(2), 293–293. doi:10.1007/s12160-012-9388-z

Goertzel, T. (1994). Belief in conspiracy theories. *Political Psychology, 15*, 731–742.

Gowda, C., & Dempsey, A. F. (2013). The rise (and fall?) of parental vaccine hesitancy. *Human Vaccines & Immunotherapeutics, 9*(8), 1755–1762. doi:10.4161/hv.25085

Gowda, C., Schaffer, S. E., Kopec, K., Markel, A., & Dempsey, A. F. (2013). Does the relative importance of MMR vaccine concerns differ by degree of parental vaccine hesitancy? *Human Vaccines & Immunotherapeutics, 9*(2), 430–436. doi:10.4161/hv.22065

Gust, D. A., Darling, N., Kenedy, A., & Schwartz, B. (2008). Parents with doubts about vaccines: Which vaccines and reasons why. *Pediatrics, 122*(4), 718-725. doi: 10.1542/peds.2007-0538

Hibbard, J. H., & Peters, E. (2003). Supporting informed consumer health care decisions: data presentation approaches that facilitate the use of information in choice. *Annual Review of Public Health, 24*(1), 413-433.

Hinyard, L. J., & Kreuter, M. W. (2007). Using narrative communication as a tool for health behavior change: A conceptual, theoretical, and empirical overview. *Health Education & Behavior, 34*(5), 777–792. doi:10.1177/1090198106291963

Hornsey, M. J., Harris, E. A., & Fielding, K. S. (2018). Relationships among conspiratorial beliefs, conservatism and climate scepticism across nations. *Nature Climate Change, 8*(7), 614–620. doi:10.1038/s41558-018-0157-2

Hotez, P., Nuzhath, T., & Colwell, B. (2020). Combating vaccine hesitancy and other 21st century social determinants in the global fight against measles. *Current Opinion in Virology, 41*, 1-7. doi: 10.1016/j.coviro.2020.01.001

Imhoff, R., & Lamberty, P. (2018). How paranoid are conspiracy believers? Toward a more fine-grained understanding of the connect and disconnect between paranoia and belief in conspiracy theories. *European Journal of Social Psychology, 48*, 909–926. doi:10.1002/ejsp.2494

Jolley, D. & Douglas, K. M. (2014). The social consequences of conspiracism: Exposure to conspiracy theories decreases intentions to engage in politics and to reduce one's carbon footprint. *British Journal of Psychology, 10*(1), 35-56. doi: 10.1111/bjop.12018

Jolley, D., & Douglas, K. M. (2017). Prevention is better than cure: Addressing anti-vaccine conspiracy theories. *Journal of Applied Social Psychology, 47*(8), 459–469. doi:10.1111/jasp.12453

Kata, A. (2012). Anti-vaccine activists, Web 2.0, and the postmodern paradigm – An overview of tactics and tropes used online by the anti-vaccination movement. *Vaccine, 30*(25), 3778–3789. doi:10.1016/j.vaccine.2011.11.112

Keeley, B. L. (2019). Of conspiracy theories. In *Conspiracy Theories* (pp. 45-60). Routledge.

Kempe, A., Saville, A. W., Albertin, C., Zimet, G., Breck, A., Helmkamp, L., Vangala, S., Dickinson, L. M., Rand, C., Humiston, S., & Szilagyi, P. G. (2020). Parental hesitancy about routine childhood and influenza vaccinations: A national survey. *Pediatrics, 146*(1): e20193852. doi:10.1542/peds.2019-3852

Kennedy, A., LaVail, K., Nowak, G., Basket, M., & Landry, S. (2011). Confidence about vaccines in the United States: Understanding parents' perceptions. *Health Affairs, 30*(6), 1151–1159. doi:10.1377/hlthaff.2011.0396

Kossowska, M., & Bukowski, M. (2015). Motivated roots of Conspiracies: The role of certainty and control motives in conspiracy thinking. In M. gowdlewicz, A., Cichocka & W. Soral (Eds.), *The psychology of conspiracy* (pp. 145-161). Routledge.

Kreuter, M. W., Holmes, K., Alcaraz, K., Kalesan, B., Rath, S., Richert, M., McQueen, A., Caito, N., Robinson, L., & Clark, E. M. (2010). Comparing narrative and informational videos to increase mammography in low income African American women. *Patient Education and Counseling, 81*(Suppl), S6–14. doi: 10.1016/j.pec.2010.09.008

Kroesen, M., Handy, S., & Chorus, C. (2017). Do attitudes cause behavior or vice versa? An alternative conceptualization of the attitude-behavior relationship in travel behavior modeling. *Transportation Research Part A: Policy and Practice, 101*, 190–202. doi:10.1016/j.tra.2017.05.013

Lantian, A., Muller, D., Nurra, C., Klein, O., Berjot, S., & Pantazi, M. (2018). Stigmatized beliefs: Conspiracy theories, anticipated negative evaluation of the self, and fear of social exclusion. *European Journal of Social Psychology, 48*, 939–954. doi:10.1002/ejsp.2498

Latimer, A. E., Katulak, N. A., Mowad, L., & Salovey, P. (2005). Motivating cancer prevention and early detection behaviors using psychologically tailored messages. *Journal of Health Communication, 10*(S1), 137-155.

Leman, P. J., & Cinnirella, M. (2013). Beliefs in conspiracy theories and the need for cognitive closure. *Frontiers in Psychology, 4*(378), doi:10.3389/fpsyg.2013.00378

Lu, H. (2014). Burgers or tofu? Eating between two worlds: Risk information seeking and processing during dietary acculturation. *Health Communication, 30*(8), 758–771. doi:10.1080/10410236.2014.899658

MacDonald, N. E. (2015). SAGE Working Group on Vaccine Hesitancy. Vaccine hesitancy: definition, scope and determinants. *Vaccine, 33*(34), 4161-4.

Maki, K. G. (2018). *Comparing narrative and statistical appeals in health behavior intentions* [Doctoral dissertation, The State University of New York]. Proquest Dissertations Publishing.

Marchlewska, M., Cichocka, A., & Kossowska, M. (2018). Addicted to answers: Need for cognitive closure and the endorsement of conspiracy beliefs. *European journal of social psychology, 48*(2), 109-117.

Milne, S., Sheraan, P., & Orbell, S. (2000). Prediction and Intervention in health-related behavior: A meta-analytic review of protection motivation theory. *Journal of Applied Social Psychology, 30*(1), 106–143. doi:10.1111/j.1559-1816.2000.tb02308.x

Mikušková, E. B. (2017). Conspiracy beliefs of future teachers. *Current Psychology, 37*. doi:10.1007/s12144-017-9561-4

Montanaro, E. A., & Bryan, A. D. (2014). Comparing theory-based condom interventions: Health belief model versus theory of planned behavior. *Health Psychology, 33*(10), 1251–1260. doi:10.1037/a0033969

Motta, M., & Stecula, D. (2021). Quantifying the effect of Wakefield et al. (1998) on skepticism about MMR vaccine safety in the U.S. *PLOS ONE, 16*(8): e0256395. doi:10.31235/osf.io/7wjb2

Nan, X., Dahlstrom, M. F., Richards, A., & Rangarajan, S. (2015). Influence of evidence type and narrative type on HPV risk perception and intention to obtain the HPV vaccine. *Health Communication, 30*(3), 301–308. doi:10.1080/10410236.2014.888629

Offit, P. A. (2007). Thimerosal and vaccines — A cautionary tale. *New England Journal of Medicine, 357*(13), 1278–1279. doi:10.1056/nejmp078187

Okuhara, T., Ishikawa, H., Okada, M., Kato, M., & Kiuchi, T. (2018). Persuasiveness of statistics and patients' and mothers' narratives in human papillomavirus vaccine recommendation messages: a randomized controlled study in Japan. *Frontiers in Public Health, 6*, 105.

Okuhara, T., Ishikawa, H., Okada, H., Ueno, H., & Kiuchi, T. (2020). Dual-process theories to counter the anti-vaccination movement. *Preventive Medicine Reports, 20*, 101205.

Oliver, J. E., & Wood, T. J. (2014a). Conspiracy theories and the paranoid style(s) of mass opinion. *American Journal of Political Science. 58*(4), 952–966. doi:10.1111/ajps.12084

Oliver, J. E., & Wood, T. J. (2014b). Medical conspiracy theories and health behaviors in the United States. *JAMA Internal Medicine, 174*(5), 817–818. doi:10.1001/jamainternmed.2014.190

Olson, O., Berry, C., & Kumar, N. (2020). Addressing parental vaccine hesitancy towards childhood vaccines in the United States: a systematic literature review of communication interventions and strategies. *Vaccines, 8*(4), 590.

Orosz, G., Krekó, P., Paskuj, B., Tóth-Király, I., Bőthe, B., & Roland-Lévy, C. (2016). Changing conspiracy beliefs through rationality and ridiculing. *Frontiers in Psychology, 7*. doi:10.3389/fpsyg.2016.01525

Patel, M., Lee, A. D., Clemmons, N. S., Redd, S. B., Poser, S., Blog, D., Zucker, J. R., Leung, J., Link-Gelles, R., Pham, H., Arciuolo, R. J., Rausch-Phung, E., Bankamp, B., Rota, P. A., Weinbaum, C. M., Gastañaduy, P. A. (2019). *National update on measles cases and outbreaks — United States, January 1–October 1, 2019.* The Centers for Disease Control and Prevention (CDC). Retrieved from https://www.cdc.gov/mmwr/volumes/68/wr/mm6840e2.htm#contribAff

Petty, R. E. & Cacioppo, J. T. (1986). *Communication and persuasion: Central and peripheral routes to attitude change*. Springer.

Public Policy Polling (2013). *Conspiracy theory poll results*. Retrieved from http://www.publicpolicypolling.com/pdf/2011/PPP_Release_National_ConspiracyTheor

Radnitz, S., & Underwood, P. (2017). Is belief in conspiracy theories pathological? A survey experiment on the cognitive roots of extreme suspicion. *British Journal of Political Science, 47*(1), 113–129. doi:10.1017/S0007123414000556

Rodriguez, F., Rhodes, R. E., Miller, K. F., & Shah, P. (2016). Examining the influence of anecdotal stories and the interplay of individual differences on reasoning. *Thinking & Reasoning, 22*(3), 274–296. doi:10.1080/13546783.2016.1139506

Rountree, C., & Prentice, G. (2021). Segmentation of intentions towards COVID-19 vaccine acceptance through political and health behaviour explanatory models. *Irish Journal of Medical Science* (1971), 1-15.

Rozbroj, T., Lyons, A., & Lucke, J. (2019). Psychosocial and demographic characteristics relating to vaccine attitudes in Australia. *Patient Education and Counseling, 102*(1), 172–179. doi:10.1016/j.pec.2018.08.027

Ruiz, J. B., & Bell, R. A. (2021). Predictors of intention to vaccinate against COVID-19: Results of a nationwide survey. *Vaccine, 39*(7), 1080-1086.

Sallam, M., Dababseh, D., Eid, H., Al-Mahzoum, K., Al-Haidar, A., Taim, D., Yaseen, A., Ababneh, N. A., Bakri, F. G., & Mahafzah, A. (2021). High rates of COVID-19 vaccine hesitancy and its association with conspiracy beliefs: A study in Jordan and Kuwait among other Arab countries. *Vaccines, 9*(42). doi:10.3390/vaccines9010042

Salmon, D. A., Dudley, M. Z., Glanz, J. M., & Omer, S. B. (2015). Vaccine hesitancy: Causes, consequences, and a call to action. *Vaccine, 33*(4), D66-D71. doi: 10.1016/j.vaccine.2015.09.035

Shah, S. F. A., Ginossar, T., Bentley, J. M., Zimet, G., & McGrail, J. P. (2021). Using the Theory of Planned behavior to identify correlates of HPV vaccination uptake among college students attending a rural university in Alabama. *Vaccine, 39*(51), 7421-7428.

Shapiro, G. K., Holding, A., Perez, S., Amsel, R., & Rosberger, Z. (2016). Validation of the vaccine conspiracy beliefs scale. *Papillomavirus Research, 2*, 167–172. doi:10.1016/j.pvr.2016.09.001

Shapiro, G. K., Tatar, O., Dube, E., Amsel, R., Knauper, B., Naz, A., Perez, S., & Rosberger, Z. (2018). The vaccine hesitancy scale: Psychometric properties and validation. *Vaccine, 36*(5), 660–667. doi:10.1016/j.vaccine.2017.12.043

Shelby, A., & Ernst, K. (2013). Story and science: How providers and parents can utilize storytelling to combat anti-vaccine misinformation. *Human Vaccines & Immunotherapeutics, 9*(8), 1795–1801. doi:10.4161/hv.24828

Shen, F., Sheer, V. C., & Li, R. (2015). Impact of narratives on persuasion in health communication: A meta-analysis. *Journal of Advertising*, 44(2), 105–113. doi: 10.1080/00913367.2015.1018467

Siddiqui, M., Salmon, D. A., & Omer, S. B. (2013). Epidemiology of vaccine hesitancy in the United States. *Human Vaccines & Immunotherapeutics, 9*(12), 2643–2648. doi:10.4161/hv.27243

Slovic, P. (2007). If I look at the mass I will never act: Psychic numbing and genocide. *Judgment and Decision Making, 2*(2), 79-95.

Slovic, P., Finucane, M. L., Peters, E., & MacGregor, D. G. (2004). Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis, 24*(2), 311-322. doi:10.1111/j.0272-4332.2004.00433.x

Slovic, P., Monahan, J., & MacGregor, D. G. (2000). Violence risk assessment and risk communication: The effects of using actual cases, providing instruction, and employing probability versus frequency formats. *Law and Human Behavior, 24*(3), 271–296. doi: 10.1023/A:1005595519944

Slovic, P., Peters, E., Finucane, M. L., & MacGregor, D. G. (2005). Affect, risk, and decision making. *Health Psychology, 24*(4, Suppl), S35–S40. doi:10.1037/0278-6133.24.4.s35

Smerecnik, C. M., Mesters, I., Candel, M. J., De Vries, H., & De Vries, N. K. (2012). Risk perception and information processing: The development and validation of a questionnaire to assess self-reported information processing. *Risk Analysis: An International Journal, 32*(1), 54-66.

Smith, T. C. (2017). Vaccine rejection and hesitancy: A review and call to action. *Open Forum Infectious Diseases, 4*(3). doi:10.1093/ofid/ofx146

Ståhl, T., & Van Prooijen, J.-W. (2018). Epistemic rationality: Skepticism toward unfounded beliefs requires sufficient cognitive ability and motivation to be rational. *Personality and Individual Differences, 122*, 155–163. doi:10.1016/j.paid.2017.10.026

Stanovich, K. E., & West, R. F. (2000). Individual differences in reasoning: Implications for the rationality debate? *Behavioral and Brain Science, 23*, 645–726.

Stecula, D. A., Kuru, O., & Jamieson, K. H. (2020). How trust in experts and media use affect acceptance of common anti-vaccination claims. *Harvard Kennedy School (HKS) Misinformation Review.* doi:10.37016/mr-2020-007

Steindl, C., Jonas, E., Sittenthaler, S., Traut-Mattausch, E., & Greenberg, J. (2015). Understanding psychological reactance. *Zeitschrift für Psychologie, 223*(4), pp. 205-214.

Stojanov, A. (2015). Reducing conspiracy theory beliefs. *Psihologija, 48*(3), 251–266. doi:10.2298/psi1503251s

Stojanov, A., & Halberstadt, J. (2019). The Conspiracy Mentality Scale: Distinguishing between irrational and rational suspicion. *Social Psychology, 50*(4), 215–232. doi:10.1027/1864-9335/a000381

Strategic Advisory Group of Experts (SAGE) on Immunization (2014). *Report of the SAGE working group on vaccine hesitancy.* Retrieved from World Health Organization website: https://www.who.int/immunization/sage/meetings/2014/october/1_Report_WORKING_GROUP_vaccine_hesitancy_final.pdf

Sunstein, C. R., & Vermeule, A. (2009). Conspiracy theories: Causes and cures. *Journal of Political Philosophy, 17*(2), 202–227. doi:10.1111/j.1467-9760.2008.00325.x

Sutton, R. M., & Douglas, K. M. (2020). Conspiracy theories and the conspiracy mindset: Implications for political ideology. *Current Opinion in Behavioral Sciences, 34*, 118–122. doi:10.1016/j.cobeha.2020.02.015

Swami, V., Voracek, M., Stieger, S., Tran, U. S., & Furnham, A. (2014). Analytic thinking reduces belief in conspiracy theories. *Cognition, 133*(3), 572–585. doi:10.1016/j.cognition.2014.08.006

Tabacchi, G., Costantino, C., Napoll, G., Marchese, V., Crachiolo, M., Casuccio, A., Vitale, F., & ESCULAPIO working group. (2016). Determinants of European parents' decision on the vaccination of their children against measles, mumps and rubella: A systematic review and meta-analysis. *Human Vaccines & Immunotherapeutics, 12*(7), 1909-1923. doi: 10.1080/21645515.2016.115199

Tafuri, S., Gallone, M. S., Cappelli, M. G., Martinelli, D., Prato, R., & Germinario, C. (2014). Addressing the anti-vaccination movement and the role of HCWs. *Vaccine, 32*(38), 4860–4865. doi:10.1016/j.vaccine.2013.11.006

Taylor, S.E., & Thompson, S.C. (1982). Stalking the elusive "vividness" effect. *Psychological Review, 89*(2), 155-181.

Tomljenovic, H., Bubic, A., & Erceg, N. (2019). It just doesn't feel right – the relevance of emotions and intuition for parental vaccine conspiracy beliefs and vaccination uptake. *Psychology & Health, 35*(5), 538–554. doi:10.1080/08870446.2019.1673894

Uscinski, J., Douglas, K., & Lewandowsky, S. (2017). Climate change conspiracy theories. *Oxford Research Encyclopedia of Climate Science*. doi:10.1093/acrefore/9780190228620.013.328

van Prooijen, J.-W., & Acker, M. (2015). The influence of control on belief in conspiracy theories: Conceptual and applied extensions. *Applied Cognitive Psychology, 29*(5), 753–761. doi:10.1002/acp.3161

van Prooijen, J.-W., Douglas, K., & De Inocencio, C. (2018). Connecting the dots: Illusory pattern perception predicts belief in conspiracies and the supernatural. *European Journal of Social Psychology, 48*, 320–335.

Vermeule, C. A., & Sunstein, C. R. (2009). Conspiracy theories: Causes and cures. *Journal of Political Philosophy, 202*. doi:10.1111/j.1467-9760.2008.00325.x

Vitriol, J. A., & Marsh, J. K. (2018). The illusion of explanatory depth and endorsement of conspiracy beliefs. *European Journal of Social Psychology, 48*, 955–969.

Wagner, A. L., Masters, N. B., Domek, G. J., Mathew, J. L., Sun, X., Asturias, E. J., Ren, J., Huang, Z, Contreras-Roldan, I. L., Gebremeskel, B., & Boulton, M. L. (2019). Comparisons of vaccine hesitancy across five low- and middle-income countries. *Vaccines, 7*(4), 155. doi:10.3390/vaccines7040155

Wang, X., Chen, D., Xie, T., & Zhang, W. (2019). Predicting women's intentions to screen for breast cancer based on the health belief model and the theory of planned behavior. *Journal of Obstetrics and Gynaecology Research, 45(*12), 2440-2451. doi:10.1111/jog.14109.

Williams, D. M., Rhodes, R. E., & Conner, M. T. (2019). Conceptualizing and intervening on affective determinants of health behaviour. *Psychology & Health, 34*(11), 1267–1281. doi:10.1080/08870446.2019.1675659

Williams-Piehota, P., Schneider, T. R., Pizarro, J., Mowad, L., & Salovey, P. (2003). Matching health messages to information-processing styles: Need for cognition and mammography utilization. *Health Communication, 15*(4), 375-392.

Wong, L. P., Wong, P. F., & AbuBakar, S. (2020). Vaccine hesitancy and the resurgence of vaccine preventable diseases: The way forward for Malaysia, a Southeast Asian country. *Human Vaccines & Immunotherapeutics, 16*(7), 1511–1520. doi:10.1080/21645515.2019.1706935

Wood, M. J., Douglas, K. M., & Sutton, R. M. (2012). Dead and alive: Beliefs in contradictory conspiracy theories. *Social Psychological and Personality Science, 3*(6), 767–773. doi:10.1177/1948550611434786

World Health Organization (WHO). (2019). Ten threats to global health in 2019 [Website]. Retrieved from: https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019

Xiao, X., & Wong, R. M. (2020). Vaccine hesitancy and perceived behavioral control: A meta-analysis. *Vaccine, 38*(33), 5131–5138. doi:10.1016/j.vaccine.2020.04.076

Yzer, M. (2012). Perceived behavioral control in reasoned action theory: A dual-aspect interpretation. *The Annals of the American Academy of Political and Social Science, 640*(1), 101-117.

Zajonc, R. B. (1980). Feeling and thinking: Preferences need no inferences. *American Psychologist, 35*, 151–175.

Zebregs, S., Neijens, P., de Graaf, A., & van den Putte, B. (2015). The differential impact of statistical and narrative evidence on beliefs, attitude, and intention: A meta-analysis. *Health Communication*, 30(3), 282–289. https://doi.org/10.1080/10410236.2013.842528