



Unintended Effects of Risk Communication: Impacts of Message Fatigue, Risk Tolerance, and Trust in Public Health Information on Psychological Reactance

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ABSTRACT

How individuals experience unintended effects of risk messages is an understudied area. Focusing on three types of unintended effects (i.e., message fatigue, risk tolerance, and psychological reactance) associated with health risk communication, we conducted an online survey among Italian adults ($N = 507$) to investigate how perceived message fatigue and risk tolerance might induce psychological reactance and whether trust in public health information might mediate this relationship. Results from mediation models revealed: (a) greater message fatigue and risk tolerance increased psychological reactance; (b) greater message fatigue and risk tolerance led to distrust in government-shared health information; (c) trust in public health information mediated the effects of message fatigue and risk tolerance on psychological reactance. Theoretical and practical implications are discussed.

KEYWORDS: unintended effects of health risk communication, individual health, message fatigue, risk tolerance, psychological reactance, trust in public health information

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Communicating health risk messages is not always successful. Communication scholars have found that persuasive messages fail when recipients retain pre-existing attitudes, resist message content, or change behaviors in a direction opposite of the intended goal. Scholars have called this phenomenon the unintended effects of communication (Cho & Salmon, 2007). Although they agree on the importance of this concept in health risk communication, many scholars have largely focused on a few specific unintended effects: psychological reactance, boomerang effect, and message avoidance (e.g., Dillard & Shen, 2005). Investigating other types of unintended effects that might lead to detrimental consequences during health risk message persuasion is crucial. The aim of the current study is to broaden existing knowledge about factors that lead to ineffective health risk communication, extending the growing body of communication research about unintended effects. Two concepts central to the unintended negative effects of health risk communication include message fatigue and risk tolerance.

So et al. (2017) recently conceptualized and operationalized *message fatigue*. Although scholars have discussed this phenomenon for some time (e.g., Kinnick et al., 1996), the first to develop a reliable and valid scale for measuring message fatigue was So et al. Until then, the only existing scales either used a single item to measure message fatigue (Kinnick et al., 1996) or had not undergone systematic validation (Frew et al., 2013). Due to relatively new operationalization of message fatigue, few scholars have addressed the antecedents and outcomes of message fatigue (e.g., Kim & So, 2018; So & Alam, 2019; So et al., 2017). They called for additional research about the relationship between message fatigue and a specific type of active resistance (i.e., reactance) that occurs when people show opposition to or resist external persuasive attempts to preserve their freedom (Kim & So, 2018).

Next to message fatigue, another central unintended effect pointed out in various fields of literature is *risk tolerance*. In the more specific area of risk communication, Jun and Jin (2021) defined risk tolerance as the degree to which an individual tolerates a health hazard, manifested by how much one is unwilling to cope with preventive recommendations or measures despite

sufficient perceived risk severity. While scholars have explored risk tolerance levels in publics (Jun & Jin, 2021), the understanding of how such levels influence psychological reactance to health risk messages requires more research.

Acknowledging these research needs, we explored the unintended effects of health risk communication, as manifested in message fatigue and risk tolerance, and the influence of these variables on psychological reactance. Psychological reactance theory (PRT) (Brehm, 1966) illustrates why individuals resist or counter persuasive messages (Brehm & Brehm, 2013). Due to the natural characteristics of counter-persuasive reactions, PRT has been applied in health and risk areas to understand why and how individuals resist persuasive messages or engage in behaviors countering what the original messages intended to promote.

We also included *trust in public health information* as a key mediator. Trust in information depends on trust in information sources. Level of trust in health information sources (e.g., public health authorities) determines whether and how people process and accept health risk messages, ultimately affecting risk perception and responses to health-related messages (Thai et al., 2018; van der Weerd et al., 2011). Trust in responsible institutions is particularly relevant when people have difficulty in controlling or understanding risks and need to rely on experts and authorities for risk information and judgment (Huurne & Gutteling, 2008; Siegrist & Cvetkovich, 2000). People with higher levels of trust in public health authorities tend to trust the public health information they share and to comply with the recommended measures.

Therefore, focusing on these three types of unintended effects (i.e., message fatigue, risk tolerance, and psychological reactance) associated with health risk communication, we conducted an online survey among Italian adults ($N = 507$) to investigate how perceived message fatigue and risk tolerance might induce psychological reactance and whether trust in public health information might mediate this relationship. Our findings provide implications and insights that help advance health risk communication theory and practice.

Literature Review

Based on the previous studies focusing on detrimental unintended effects of health risk communication, three different types of unintended effects including message fatigue, risk tolerance, and psychological reactance were reviewed to posit a series of hypotheses.

Psychological Reactance

Scholars have long discussed psychological reactance as one of the common unintended effects in health and risk communication (Richards & Banas, 2015). PRT posits that when a persuasive message threatens one's freedom or autonomy to choose, an aversive motivational state, known as reactance, can help restore or protect one's sense of freedom (Brehm, 1966). Owing to the advance of PRT in communication studies, the operationalization of reactance proposed by Dillard and Shen (2005) shed light on the constructs of psychological reactance: "reactance is best understood as an intermingling of negative cognition and anger" (p. 160). Perceiving that a message is threatening freedom to choose generates reactance (i.e., feeling anger, counterarguing against the message content or source).

In studies about reactance in health risk communication, scholars have investigated various effects of reactance on message failure: message rejection (Miller & Quick, 2010), source derogation (Bessarabova et al., 2013), and boomerang effect (Kim et al., 2017). Few scholars have explored how psychological reactance relates to message fatigue and risk tolerance in the context of health risk communication. To close this research gap, our study integrates key constructs associated with unintended effects of health risk persuasion to uncover the psychological mechanism of the formation of unintended effects, via message fatigue and risk tolerance, respectively.

Message Fatigue

Message fatigue is a primary type of unintended resistance among recipients during message exposure. Although empirical research on message fatigue is scarce due to its recent conceptualization (So et al., 2017), a few scholars have examined such effects in

various communication settings to identify possible outcomes. In terms of outcomes, scholars have focused on the association between message fatigue and message processing (e.g., Kim & So, 2018; So et al., 2017). For example, So et al. tested how avoidance, annoyance, and information seeking related to message fatigue. In two experiments, they found that message fatigue positively related to message avoidance and annoyance but negatively related to information seeking. Adding external variables in the second experiment, they found that message fatigue positively related to desensitization and counterargument but negatively related to attention and message elaboration.

Message Fatigue and Psychological Reactance

Testing the effect of message fatigue on psychological reactance could shed light on negative reactions to health risk messages. Message fatigue is capable of creating psychological reactance because messages (e.g., health risk) often contain pressure (e.g., recommendation or advice) to encourage or discourage certain behaviors. The accumulation of this pressure might lead people to perceive that third parties are limiting freedom to choose how to behave. In only two studies have scholars focused on the connection between psychological reactance and message fatigue. Kim and So (2018) revealed that higher message fatigue led to an increase in individual reactance and inattention, in turn leading to resistance to adopting recommended behaviors. So and Alam (2019) found that greater pre-existing message fatigue led to fewer message-consistent and issue-relevant thoughts and more counterarguments. Based on these previous findings, we predicted that when individuals experienced message fatigue during exposure to a specific health risk topic, they would also experience psychological reactance:

H1: Message fatigue will have a positive relationship with psychological reactance.

Risk tolerance is another understudied psychological barrier that conceptually relates to reactance. We investigated the relationship between risk tolerance and reactance in terms of trust in governmental health information.

Risk Tolerance

Risk tolerance is the level of unwillingness, among publics who are susceptible to a particular risk (e.g., health risk), to adopt preventive behaviors to overcome a preventable risk that threatens their own health (Jun & Jin, 2021). This conceptualization derives from Covello and Sandman (2001), who showed that risk tolerance includes (a) expressing unwillingness to stop risky behaviors despite knowing their negative consequences and (b) showing indifference toward health messages by intentionally ignoring them.

One purpose of risk communication is to help risk bearers who suffer from the outcomes of risk generators (Coombs et al., 2019). When risk outcomes influence the behavior of risk bearers (Heath & O’Hair, 2009), discovering how risk tolerance manifests in risk bearing and whether any external factors might ease risk tolerating behavior is crucial to achieving effective risk communication. The first step is to determine the existing level of risk tolerance in target publics. Recently, a 13-item scale to measure risk tolerance was developed based on online survey data (Jun & Jin, 2021), identifying two dimensions of risk tolerance: (a) compulsive tendency toward risk-taking (CTRT), when publics have no intention to modify risky behaviors despite awareness of negative consequences; and (b) inertial resistance to risk prevention (IRRP), when publics do not care about health risk messages that promote behavioral change.

Risk Tolerance and Psychological Reactance

One way to integrate risk tolerance and psychological reactance is to consider more closely the two types of risk tolerance. First, when people experience CTRT, they do not want to feel bothered to modify their behaviors to be more risk preventive. One factor in psychological reactance is emotional response to perceived restrictions (Shen & Dillard, 2005). This response, which is a combination of anger and negative perception (LaVoie et al., 2017), corresponds to one of the measurements on the reactance scale: “I become frustrated when I am unable to make free and independent decisions” (Hong & Faedda, 1996, p. 177). People who experience high levels of CTRT are highly aware of the potential harm

of tolerating risk, but if they already know they will not take action to change, they might resist the risk message and even feel a threat to their personal freedom of choice when exposed to it.

Second, when people experience IRRP, they feel indifferent toward health risk messages or simply do not want to deal with those messages, leading to a decision to ignore them (Jun & Jin, 2021). Here, IRRP is similar to message avoidance and message fatigue (So et al., 2017). Message fatigue and message avoidance strongly correlate, and people sometimes avoid risk messages due to fatigue (So et al., 2017). However, while individuals who experience IRRP might not necessarily tolerate risk messages due to their repetitiveness, they remain indifferent, thinking that the risk will not actually affect them anytime soon. When people experience IRRP, due to their disinterest in and insensitivity to particular risk messages, they might develop negative emotions when exposed to them. They might also resist the advice and recommendations in the messages, an important conceptual dimension of psychological reactance (Shen & Dillard, 2005). Thus, we proposed the following hypothesis:

H2: Risk tolerance will have a positive relationship with psychological reactance.

H2a: CTRT will have a positive relationship with psychological reactance.

H2b: IRRP will have a positive relationship with psychological reactance.

Trust in Information and Unintended Effects of Risk Communication

According to Covello and Sandman (2001), trust in risk information or the information source plays a crucial role in effective risk communication. Even though distrust is an obstacle to the persuasive effects of risk communication, practitioners underestimate the role of trust in unintended effects (Covello & Sandman, 2001). Trust in information has a significant impact on attitude toward a risk and the outcomes of risk communication by agencies and institutions in charge of managing potential risk (van der Weerd et al., 2011; Vaske et al., 2007). Particularly important is trust in

the managing agencies and institutions (e.g., government) responsible for providing risk messages, making decisions, and acting to solve problems. Glik (2007) added that the “communication process must contain elements of trust, credibility, honesty, transparency, and accountability for the sources of information” to be effective (p. 35). When trust exists, people tend to have confidence in the risk management ability of agencies and institutions, and accept the issue-related information delivered by them. Therefore, individuals with higher levels of trust in the ability of responsible agencies and institutions to manage risk tend to trust the public health information that they issue and are more likely to comply with public health warnings and recommended measures (Siegrist et al., 2003; van der Weerd et al., 2011). Based on this finding, the factors that might impede social trust in public health information are worth investigating.

Relationship between Trust in Information, Message Fatigue, and Risk Tolerance

Message fatigue might negatively relate to trust in public health information. Previous findings indicate that message fatigue positively related to desensitization, source derogation, and counterargument negatively related to attention and message elaboration (e.g., Kim & So, 2018; So & Alam, 2019; So et al., 2017). For example, So et al. (2017) found that the perception that a message is overly repetitive can result in negative cognitive processing during message exposure (e.g., source derogation and counterargument). In this regard, one’s devaluation of a message and its source due to message fatigue might increase distrust in the organization sharing the messages. Kim and So (2018) found that individuals who perceived higher message fatigue toward anti-obesity messages led to an increase in reactance and inattention, which in turn led to a decrease in adopting recommended behavior. Similarly, So and Alam (2019) tested how preexisting message fatigue gives rise to forms of resistance. Specifically, they found that the greater preexisting message fatigue toward anti-obesity messages was associated with fewer message-consistent thoughts and issue-relevant thoughts while with greater numbers of counterarguments. Bearing in mind that message fatigue might have detrimental

effects on attitude toward the message and source of the message during message processing, we posited that individuals with fatigue toward health risk messages might experience many forms of resistance, which may lead to lower trust level toward the message senders or sources.

Furthermore, trust in public health information might negatively relate to risk tolerance as well. When people experience both CTRT and IRRP, they do not care about risk messages and neglect them despite knowing the potential harm in doing so (Jun & Jin, 2021). Previous findings indicate that people who trust agencies and institutions that manage risk tend to trust the health information they share and behave accordingly, especially when they struggle with controlling or understanding the risk (Huurne & Gutteling, 2008; Siegrist & Cvetkovich, 2000). Based on people's more risk-preventive behaviors, when they have more trust in the government (Feng et al., 2014), we expect that risk tolerance might undermine the positive effect of trust in information shared by experts and authorities. With high levels of risk tolerance, people intentionally ignore health risk messages and avoid changing risky behavior (Covello & Sandman, 2001; Jun & Jin, 2021) despite knowing the negative consequences; as a result, they are likely to be less risk-preventive, inducing lower levels of trust in information from governmental sources. Therefore, in the context of individual health risk and information communicated by government health departments, we posited the following relationships:

H3: Message fatigue will have a negative relationship with trust in information shared by government health departments.

H4: Risk tolerance will have a negative relationship with trust in information shared by government health departments.

H4a: CTRT will have a negative relationship with trust in information shared by government health departments.

H4b: IRRP will have a negative relationship with trust in information shared by government health departments.

Mediating Role of Trust in Public Health Information

Along with the direct effects of message fatigue and risk tolerance on psychological reactance and trust in public health information,

we investigated how message fatigue and risk tolerance and trust in information might interact using the two-factor theory proposed by Berlyne (1970) and Stang (1974). The two-factor theory posits that two opposing factors, habituation (i.e., learning process) and satiation, determine stimulus evaluation after repeated exposure. As Zajonc (1968) and Berlyne (1970) hypothesized in their studies about mere exposure effect, repeated exposure might strengthen positive affect due to greater familiarity and lower uncertainty (i.e., habituation). In contrast to Zajonc's approach, some other scholars proposed a second process: Higher levels of exposure might initiate a negative response, decreasing positive affect toward the stimulus (i.e., satiation).

Numerous findings indicate the relationship between number of exposures and affective evaluation (Bornstein, 1989). Stang and O'Connell (1974) found that subjects initially liked a drawing of nonsense-work but that this effect weakened after 10 exposures. Number of exposures is likely to be a key factor in health and risk communication, for most audiences see information about a given issue more than once. Since most health risk messages are designed and disseminated by government agencies or organizations (i.e., The Centers for Disease Control and Prevention [CDC]), repeated exposure to similar messages might lead to aversive responses from publics (e.g., disliking and distrusting the message source or the message itself), potentially leading to other negative responses (e.g., reactance).

Regarding this issue, consumer behavior researchers have also examined the effects of information overload on various outcomes: feelings of satisfaction (Jacoby et al., 1974), feelings of distrust (Furner & Zinko, 2017), and subjective states (Jacoby et al., 1974). For instance, Furner and Zinko found an inverted U-shaped relationship between information overload and trust level. People showed lower trust when exposed to minimal information, their trust increased as information approached a moderate level, and decreased again when they perceived information overload. We predicted that publics reading similar and redundant messages over a prolonged period would experience a similar phenomenon.

Based on the two-factor theory and previous findings, we posited that when people experienced fatigue from information or

messages about a specific health risk, that fatigue would start to outweigh the benefits of uncertainty reduction, leading to trust reduction and, in turn, psychological reactance.

H5: Trust in information provided by government health departments will mediate the relationship between message fatigue and psychological reactance.

We also explored the mediating role of trust in information in the relationship between risk tolerance and reactance. The first dimension of risk tolerance, CTRT (Jun & Jin, 2021), carries the assumption that people already know the recommendation for becoming healthier but choose to take the risk. CTRT explains the tendency of publics tolerating risks even knowing what consequences they could have from not modifying their behaviors (Jun & Jin, 2021). Therefore, as explained by CTRT, publics who have been already familiar with certain risk information but decided to tolerate and not change their behavior, are likely to experience the information overload, since they are already fully aware of that specific health risk information. When exposed to information about a risk they are fully aware they are tolerating, people are likely to trust that information less, and if they have already made up their minds to tolerate the risk but continue encountering the information, they may enter a state of reactance.

The same is true for the second dimension of risk tolerance, IRRP (Jun & Jin, 2021), which involves the feeling of indifference toward risk information. IRRP explains publics' pattern of risk tolerating by not caring about health risk messages (Jun & Jin, 2021). As a negative trust level was expected for publics with high message fatigue due to repeated exposures to health risk messages (So et al., 2017), when people experience IRRP and decide to ignore the messages concerning the health risk that they already know of, they are likely to experience low levels of trust in information. When publics feel disinterested, experience indifference, and try to ignore the health risk messages that are not novel to them anymore, with their lowered levels of trust in information due to greater levels of risk tolerance, they could experience psychological reactance toward these health risk messages. Therefore, we posited the following hypothesis:

H6: Trust in information shared by government health departments will mediate the relationship between risk tolerance and psychological reactance.

H6a: Trust in information shared by government health departments will mediate the relationship between CTRT and psychological reactance.

H6b: Trust in information shared by government health departments will mediate the relationship between IRRP and psychological reactance.

Method

Survey Procedure and Participants

Through Qualtrics, we conducted an online survey from February to early March 2020 using a nationally representative adult sample in Italy. We screened participants using one question regarding self-reported general attitude toward vaccination: Those who were strongly against vaccination were not eligible to participate as their stance against vaccination was beyond the scope of the current study and might have confounded its results based on the proposed conceptual model (e.g., Streefland, 2001).

TABLE 1 Categories of Tolerated Individual Health Risks Participants Focused in Mind

Tolerated Individual Health Risks	Frequency (Percentage)
Getting flu [without taking flu vaccination]	57 (11.2%)
Getting HPV [without getting HPV vaccination]	24 (4.7%)
Getting other (non-HPV or non-HIV) sexually transmitted infections (STI) [through unsafe sexual behavior or without getting screenings]	27 (5.3%)
Other (non-STI or non-flu) infectious diseases	45 (8.9%)
Overweight and Obesity	86 (17.0%)
Depression or other mental health issues	37 (7.3%)
Tobacco use	117 (23.1%)
Alcohol-related harms	11 (2.2%)
Substance abuse	9 (1.8%)
Others	94 (18.5%)
TOTAL	507 (100.0%)

We used 507 responses for data analysis (51.5% male). Ages varied considerably: 18–24 (8.9%), 25–34 (14.0%), 35–44 (19.1%), 45–54 (20.3%), 55–64 (13.2%), and 65+ (24.5%). Regarding education level, most had some college (59.2%), followed by college degree (22.5%), high school degree (13.4%), post-graduate study (4.5%), and some high school or lower (0.4%). For self-reported income, 41.8% reported earning less than € 15,000, 52.3% between € 15,000 and € 50,000, 4.3% between € 50,000 and € 90,000, and 1.6% more than € 90,000. About 39.9% of the participants resided in northern Italy, 17.8% in central Italy, and 39.3% in southern Italy.

Instrument

Prior to the beginning of the survey questionnaire, participants read a definition for “risk” in the context of individual health risk. To assess everyone’s experience regarding a specific health risk that was relevant and important to their individual well-being, we adopted an approach used by previous scholars in understanding risk management responses for various risk topics in different cultural contexts (Cornia et al., 2016; Peters et al., 1997) and instructed participants to focus on one specific health risk instead of providing them a specific risk topic. Specifically, we asked participants to think of a health risk they were currently tolerating that fit the following criteria: (a) “you are aware of and worried about it personally,” (b) “you know that there are ways to overcome the danger of this health risk by following recommended behaviors,” and (c) “you choose to tolerate this health risk by ignoring or refusing to modify your behaviors.” Participants then indicated which of the 10 individual health risk categories best described the health risk they had in mind (see Table 1). Conducting our survey in this way revealed categories of the primary health risks relevant to the participants and created opportunities to compare participant responses based on those categories (Peters et al., 1997).

Participants then responded to a set of items regarding the individual health risk they had in mind: (a) level of fatigue from messages concerning the health risk, (b) level of risk tolerance for the health risk, (c) level of psychological reactance to messages

concerning the health risk, and (d) level of trust in information concerning the health risk.

Measures

All items were measured using a 7-point Likert-type scale (1 = strongly disagree, 7 = strongly agree) unless otherwise noted.

Message Fatigue. We used a 17-item scale from So et al. (2017) to measure fatigue toward health risk messages. Sample items included “I have lost track of the amount of times I have heard that this risk is a serious problem” and “I have heard enough about how important it is to stay healthy” ($M = 3.71$, $SD = 1.02$, Cronbach’s $\alpha = .94$).

Risk Tolerance. We used a 13-item scale to measure risk tolerance (Jun & Jin, 2021; see Table 2). To measure CTRT, eight items were used ($M = 3.51$, $SD = 1.27$, Cronbach’s $\alpha = .92$) and five items were used to measure IRRP ($M = 2.79$, $SD = 1.22$, Cronbach’s $\alpha = .93$). Sample items and confirmatory factor analysis (CFA) loadings for both factors are available in Table 2.

Psychological Reactance. We used a 14-item scale adapted from Hong and Page (1989) to measure reactance. Sample items included “I find contradicting others stimulating” and “When something is prohibited, I usually think that’s exactly what I’m going to do” ($M = 3.95$, $SD = .96$, Cronbach’s $\alpha = .89$).

Trust in Public Health Information. We measured trust in public health information using a 4-item scale adapted from Vaske et al. (2007). Sample items included “I trust the government health department to provide the best available information on my health issues” and “I trust the government health department to provide truthful information about safety issues related to my health.” Participants responded according to a 7-point Likert-type scale (1 = strongly disagree, 7 = strongly agree; $M = 4.52$, $SD = 1.52$, Cronbach’s $\alpha = .97$).

TABLE 2 Items in Risk Tolerance Measure and CFA Factor Loadings

Items	CFA Factor Loadings
Factor 1: Compulsive Tendency toward Risk-Taking (CTRT)	
I did it anyways, even though I knew it was an unhealthy choice.	0.77
I know that what I chose is not a smart decision, and it is not healthy, but I had to pursue it.	0.70
There is a risk in my choice, but I am willing to take that risk, even though it is not really good for myself.	0.75
Even though I know the risk of doing what I do, I would still do it.	0.82
Even though I know what I do is bad, I cannot give up.	0.73
I know what I am doing is bad and harmful, but I do not take actions to change.	0.76
I choose to indulge despite knowing this choice is bad for me.	0.83
When I receive the health message to pursue the recommended behavior, I willingly take the risk and tell myself that "I will eventually do that."	0.89
Factor 2: Inertial Resistance to Risk Prevention (IRRP)	
I ignore the risks that are described in the health messages.	0.83
I did not really care that much about the effects of risks I am taking.	0.81
If I read the recommended health message, I would feel disinterested, because I know I will not modify my behavior.	0.87
If I read the recommended health message, I would feel insensitive, because I know I will not modify my behavior.	0.87
I am going to choose this less healthy behavior regardless.	0.84

Results

To assess the main effects of message fatigue and risk tolerance on psychological reactance and mediation effect of trust in public health information, a series of mediation analyses were conducted. We tested hypotheses using the Hayes (2013) PROCESS Macro model 4 and 5000 bootstrap estimates to construct 95% bias-corrected confidence interval effect (Preacher et al., 2007). In the first mediation analysis, we entered message fatigue as the independent variable. In the second mediation analysis, risk tolerance

served as the independent variable. Both analyses included trust in public health information as mediator and psychological reactance as the dependent variable.

Hypothesis Testing

H1 predicted that individuals with greater levels of message fatigue from a specific health risk would have greater psychological reactance to the same health risk topic. Message fatigue positively and significantly influenced psychological reactance, $b = .29$, $SE = .04$, $t(504) = 7.28$, $p < .001$, 95% CI [.21, .37], standardized $\beta = .31$, suggesting that psychological reactance was significantly greater when message fatigue was greater, supporting H1 (see Figure 1).

H2 predicted that individuals with greater levels of risk tolerance of a specific health risk would have greater psychological reactance to the same health risk topic. Risk tolerance (CTRT) positively and significantly influenced psychological reactance, $b = .20$, $SE = .03$, $t(504) = 6.32$, $p < .001$, 95% CI [.14, .27], standardized $\beta = .27$. Similarly, risk tolerance (IRRP) positively and significantly influenced psychological reactance, $b = .20$, $SE = .03$, $t(504) = 6.00$, $p < .001$, 95% CI [.14, .27], standardized $\beta = .26$, suggesting that psychological reactance was significantly greater when risk tolerance was greater, supporting H2a and H2b (see Figure 2).

H3 predicted that message fatigue would negatively relate to trust in public health information about a specific health risk. Message fatigue from a specific health risk was negatively associated with trust in public health information about the same health risk topic, $b = -.23$, $SE = .07$, $t(505) = -3.46$, $p < .001$, 95% CI [-.35, -.10], standardized $\beta = -.15$, supporting H3 (see Figure 1).

Findings were similar for H4, both types of risk tolerance negatively related to trust in public health information, CTRT: $b = -.11$, $SE = .05$, $t(505) = -2.03$, $p < .05$, 95% CI [-.21, -.00], standardized $\beta = -.09$, IRRP: $b = -.15$, $SE = .06$, $t(505) = -2.77$, $p < .01$, 95% CI [-.26, -.05], standardized $\beta = -.12$, supporting H4a and H4b (see Figures 2 and 3).

H5 proposed mediational pathways between message fatigue and psychological reactance through trust in public health information. An indirect effect of message fatigue on psychological reactance emerged (indirect effect = .02, $SE = .01$, 95% CI [.00,

.04]). When participants had greater message fatigue from a specific health risk, they had lower trust in public health information on that topic, $b = -.23$, $SE = .07$, $t(505) = -3.46$, $p < .001$, 95% CI $[-.35, -.10]$, standardized $\beta = -.15$, which negatively related to psychological reactance, $b = -.07$, $SE = .03$, $t(504) = -2.45$, $p < .05$, 95% CI $[-.12, -.01]$, standardized $\beta = -.10$, supporting H5 (see Figure 1).

For H6, two mediation analyses were conducted. An indirect effect of risk tolerance (CTRT) on psychological reactance through trust in public health information emerged (indirect effect = .01, $SE = .01$, 95% CI $[.00, .03]$). When participants had greater risk tolerance (CTRT) of a specific health risk, they had lower trust in public health information about that topic, $b = -.11$, $SE = .06$, $t(505) = -2.03$, $p < .01$, 95% CI $[-.21, -.00]$, standardized $\beta = -.09$, which was negatively associated with psychological reactance, $b = -.08$, $SE = .03$, $t(504) = -2.97$, $p < .01$, 95% CI $[-.13, -.03]$, standardized $\beta = -.13$, supporting H6a (see Figure 2). An indirect effect of risk tolerance (IRRP) on psychological reactance through trust in public health information emerged (indirect effect = .02, $SE = .01$, 95% CI $[.00, .03]$). When participants had greater risk tolerance (IRRP) of a specific health risk, they had lower trust in public health information about that topic, $b = -.15$, $SE = .06$, $t(505) = -2.77$, $p < .01$, 95% CI $[-.26, -.05]$, standardized $\beta = -.12$, which was negatively associated with psychological reactance, $b = -.08$, $SE = .03$, $t(504) = -2.78$, $p < .01$, 95% CI $[-.13, -.02]$, standardized $\beta = -.12$, supporting H6b (see Figure 3).

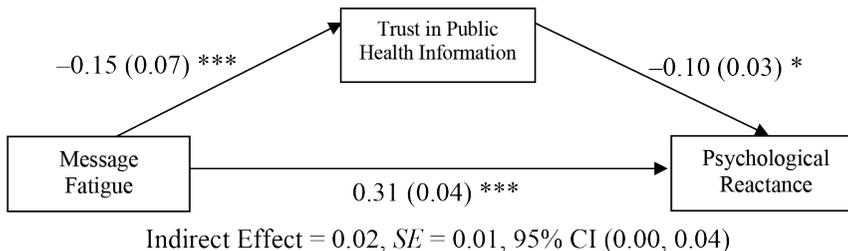


FIGURE 1 Results of mediation analysis examining relative indirect effect of message fatigue on psychological reactance through trust in public health information.

Note: All coefficients are standardized. Numbers in the parentheses are standard errors. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$

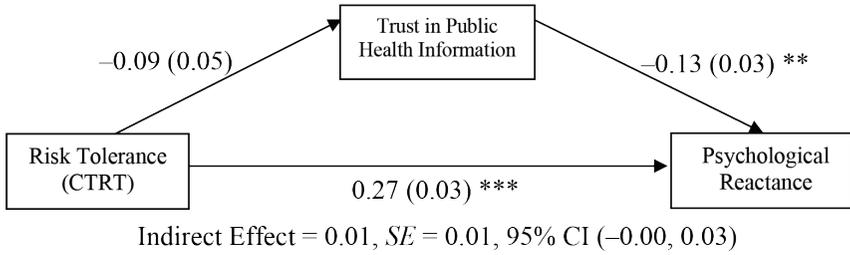


FIGURE 2 Results of mediation analysis examining relative indirect effect of risk tolerance on psychological reactance through trust in public health information.

Note: All coefficients are standardized. Numbers in the parentheses are standard errors. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$

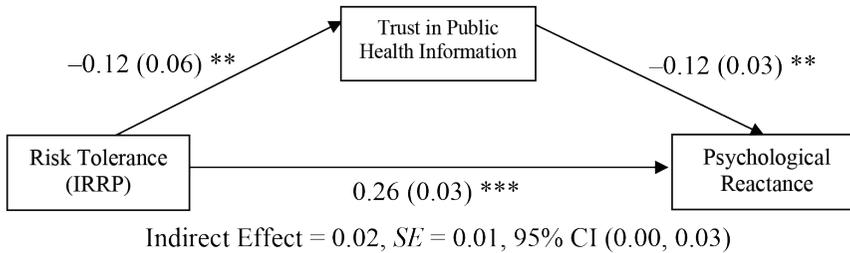


FIGURE 3 Results of mediation analysis examining relative indirect effect of risk tolerance on psychological reactance through trust in public health information.

Note: All coefficients are standardized. Numbers in the parentheses are standard errors. * $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$

Discussion

Despite numerous findings about the importance of the unintended effects of health risk communication, the way psychological barriers exert their impact on communication outcomes remains unclear. Scholars in health risk communication have largely focused on the intended effects of communication, such as increasing attention and risk perception (e.g., Dillard et al., 2018) and encouraging subsequent relevant behavior (e.g., Lee et al., 2020), but not on relevant unintended effects (e.g., message fatigue and risk tolerance). The unique contribution of the current study is our examination of unintended effects in health risk

communication as manifested through observed message fatigue and self-reported risk tolerance, both of which are relatively new and understudied concepts. In addition to providing practical recommendations for how Italian practitioners might overcome the psychological barriers of a health campaign to enhance the effectiveness of health persuasion, the insights drawn from the participants shed further light on unintended effects generated by psychological mechanisms involving various predictors and draw attention to individuals from other countries and regions who read about health threats yet exhibit reluctance to take preventive action.

Connecting Missing Dots in Risk Research: Message Fatigue, Risk Tolerance, and Trust

The primary aim of our study was to shed light on the aversive consequences of message fatigue and risk tolerance and how these negative consequences influence psychological reactance. As hypothesized, message fatigue and risk tolerance positively predicted psychological reactance. These findings are consistent with previous findings about message fatigue and risk tolerance: an aversive psychological state led to greater resistance to health risk messages (So et al., 2017). Our findings indicate that the message strategies health risk communicators use to increase risk perception can cause message fatigue and increase risk tolerance, generating other aversive responses such as psychological reactance. This finding has clear implications for health risk communication practitioners: they need to recognize the unintended effects of health risk communication and consider what individuals might find cogent and captivating, rather than communicating from the perspective of a public health authority.

Furthermore, we explored the mediating role of trust in public health information in the relationships between message fatigue and psychological reactance and between risk tolerance and psychological reactance. Many researchers have examined the impact of trust in information shared by the government (e.g., van der Weerd et al., 2011). Some researchers have discovered why trust in public health information helps encourage target behaviors (e.g.,

Hou & Shim, 2010), and some have revealed how trust in information affects the evaluation of risk perception (e.g., Huurne & Gutteling, 2008). However, the effects of psychological barriers on trust level and how different levels of trust in public health information might lead to unintended effects (e.g., psychological reactance) are largely unknown. Our findings extend the literature on message fatigue and risk tolerance by adding trust in public health information and uncovering trust as a consistent and significant mediator, offering additional practical implications. Level of trust in information shared by public health authorities could impede the effectiveness of health risk messages. Given that health risk information primarily comes from public health agencies at local and regional levels, negative responses (e.g., distrust or derogatory views) to undesired message exposure can compromise important channels of health communication.

Overcoming Psychological Reactance: Evidence-Based Recommendations for Practitioners

Among the Italian participants in our study, tobacco use (23.1%) was the most tolerated health risk topic, followed by obesity (17.0%) and flu vaccination (11.2%). This finding implies that communicating similar messages regarding these health topics might not be a useful tactic in the same context; Italians seem already to be highly aware of risk information associated with these topics. To overcome the exhibited psychological reactance, health communication practitioners in Italy and other countries might need to target risk tolerance by emphasizing risk severity and issue urgency and incentivizing immediate action to mitigate individual risk (Jun & Jin, 2021). Meanwhile, practitioners need to be mindful not to overcommunicate about these risk issues using saturated media outlets or communication channels in order to minimize health message fatigue (So & Alam, 2019). In sum, to enhance the effectiveness of health persuasion regarding individual health topics that might cause message fatigue or be rendered ineffective by individual tolerance or unwillingness to change, practitioners need to design communication messages that are innovative, creative, and energizing, breaking down psychological barriers and opening smooth pathways to action and risk mitigation.

By examining how individuals tolerate and report message fatigue for specific health risk topics that they identify as most concerning, we provide evidence that supports tailoring health risk messages according to individual risk characteristics. Both scholars and practitioners in Italy and other countries should recognize which specific health risk topics might induce different feelings of message fatigue and risk tolerance among their populations and further gauge which communication strategies and tactics might most effectively mitigate the aversive communication effects exhibited among fatigued and risk-tolerant individuals. When planning and implementing different public health campaigns, for different health topics and target audiences, public health agencies should map them out and strategize about sequence and message doses over time. By doing so, they can reduce message overlapping and channel redundancy, minimizing unintended effects.

Practitioners in Italy and around the world should capitalize on the power of trust as a state, belief, or positive expectation (Rousseau et al., 1998). Our findings suggest that trust in public health information is a strong predictor of psychological reactance and a mediator between both the effects of message fatigue and risk tolerance on psychological reactance. In the context of risk communication, trust is often studied as a type of cognitive appraisal involving “an individual, rational assessment of behavior and emphasizing calculation, rationality, economic exchange, and risk” (Valentini, 2020, p. 86). This concept needs to further cultivation in the context of health risk messages and public health campaigns to reduce unintended effects and fully actualize the potential of trust to motivate positive evaluation and behavioral outcomes (e.g., public confidence and actions to lower health risk; see Valentini, 2020). This issue is more pressing than ever across a wide spectrum of individual health risks (e.g., individual health behaviors during the COVID-19 pandemic), as public trust has increasingly eroded due to perceptual discrepancies between publics and various organizations (Valentini, 2020). Public health agencies need to strengthen people’s trust in public health information, which, according to our findings, holds the key to overcoming risk tolerance and message fatigue and leading to lessened psychological reactance toward health recommendations.

Limitations and Future Directions

The limitations of this study open pathways to future research. First, the participants in this study were from Italy and might not be representative of the general population of other countries. Examining whether the relationships found in this study might apply to other nations or contexts would be worthwhile. Second, we used the Hong Psychological Reactance Scale (Hong & Page, 1989) to measure reactance. Although scholars largely agree on the reliability and validity of this scale (e.g., Dillard & Shen, 2005), scholars tend to operationalize psychological reactance as unfavorable cognition and emotion (e.g., Miller & Quick, 2010; Rains & Turner, 2007; Shen, 2015). Dillard and Shen offered a valid and useful tool for measuring psychological reactance, especially when the goal is to capture nuances from thought-listing data. Third, because our study focused on the phenomenon of psychological reactance, the impact of which on behavioral outcomes we did not measure, the observed effects of message fatigue, risk tolerance, and trust in public health information on reactance do not directly translate into positive or negative change in behavioral intention or actual behavior. To examine the effects of these new concepts (e.g., risk tolerance and risk message fatigue), scholars need to include the full spectrum of reactance, not only psychological but also motivational and behavioral outcome measures (i.e., behavioral intention as a measure of message acceptance or rejection).

Finally, other types of unintended effects of health risk communication need further examination. Different unintended effects, with or without further intervention, might jointly influence individual attitude toward a risk issue and public health information authorities, as well as motivation and actual behavior, which are the ultimate measures of success of any public health risk campaign. Bearing in mind that the aim of health risk communication is to change attitudes or behavior in a favorable way, various attitudinal variables could determine whether such unintended effects lead to a failure of persuasive communication. Because our data includes the prominent health risks our participants perceived, we will be able to compare, in future studies, perceived risk barriers based on the health risk categories they chose. Exploring these

attitudinal and motivational variables could help practitioners overcome psychological barriers during health risk communication and devise more effective messages and campaigns in Italy and countries around the world.

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