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Breaking the stigma and cultural tightness: a sequential mixed-method evidence on health communication interventions through YouTube videos to ingrain pre-marital genetic testing behavior

Faryal Sohail¹, Syed Hassan Raza^{2✉}, Emenyeonu, C. Ogadimma³, Umer Zaman^{4✉}, Amjad Ali Shah¹, Nur Haniz Mohd Nor², Shumaila Khan⁵, Sajid ullah Khan⁶ & Sarra Ayouni⁷

The intersection of health communication and digital media is a growing research area. Yet, there remains a significant gap in understanding how digital health information influences behavior, particularly concerning genetic disorders in culturally tight societies. This study addresses the urgent need for improved public access to accurate health information, focusing on pre-marital genetic screening (hereafter PMGS) in Pakistan, where coverage of these issues remains limited. Using a sequential mixed-methods approach, this research investigates how health journalistic practices on digital platforms can shape preventive health behaviors. In Study 1, a content analysis of 96 vodcasts on genetic diseases from official news organization YouTube channels was conducted. The analysis revealed that the most frequently used frames were consequences and attribution of responsibility. A quasi-experiment was conducted with 420 respondents from Pakistan to explore the impact of these framing practices. The experiments examined how exposure to the dominant health frames identified in Study 1 affected preventive behaviors and attitudes toward PMGS. Results showed that frames highlighting perceived severity and response cost significantly influenced respondents' intentions to engage in preventive health behaviors, including pre-marital screening. It also provides new evidence on the persuasive potential of health vodcasts in reducing stigma and raising awareness about genetic disorders.

¹ Institute of Media and Communication Studies, Bahauddin Zakariya University, Multan, Pakistan. ² School of Media and Communication, Taylor's University, Subang Jaya, Malaysia. ³ College of Communication, University of Sharjah, Sharjah, United Arab Emirates. ⁴ Endicott College of International Studies (ECIS), Woosong University, Daejeon, Republic of Korea. ⁵ Institute of Computer Science & IT, University of Science and Technology Bannu, Bannu, Pakistan.

⁶ Department of Information Systems, College of Computer Engineering and Sciences, Prince Sattam bin Abdulaziz University, Alkharj, Saudi Arabia.

⁷ Department of Information Systems, College of Computer and Information Sciences, Princess Nourah bint Abdulrahman University, P.O. Box 84428, Riyadh 11671, Saudi Arabia. ✉email: sherazibzu@gmail.com; umerzaman@endicott.ac.kr

Introduction

Pre-marital screening has reduced the incidence of hereditary diseases such as sickle cell anemia and thalassemia, along with genetic blood disorders like hepatitis and HIV (AIO-taiby et al., 2023). It involves testing prospective spouses for infectious, genetic, and blood-transmitted disorders to minimize the risk of passing diseases to their offspring (Elhadi et al., 2023). Globally, between 3.5 and 5.9% of individuals are affected approximately by one of 7000 identified genetic conditions, most of which can be avoided through premarital genetic screening (Uzair et al., 2024). The World Health Organization describes PMGS as services designed to assist individuals and families in making informed marriage decisions and accessing support to cope with genetic disadvantages. Sustainable Development Goal 3 also proposes preventing unnecessary suffering, such as genetic disorders, from other noncommunicable, preventable diseases. Additionally, PMGS can detect and address behavioral and medical risk factors that affect pregnancy outcomes through treatment and prevention (Jairoun et al., 2024), eventually reducing the burden of hereditary disorders.

Genetic disorders account for 50% of child deaths in developed countries, 30% of pediatric hospital admissions, and 2-5% of live births (Malherbe et al., 2023). These disorders also hinder academic performance due to the health challenges faced by affected children (Subu et al., 2024). Although there are no official patient registries, it is estimated that 5-7% of the Pakistani population are carriers of beta-thalassemia, amounting to 9 million carriers (Soteriades et al., 2023). The situation in the global south is more ominous and is witnessing an increase in genetic disorder-related cases, putting more pressure on the already over-stressed public health systems.

Iqbal et al. (2022) noted that PMGS is more prevalent in South Asia due to a higher rate of consanguineous marriages within castes. Pakistan has one of the highest rates of about 65% of consanguineous marriages worldwide (Oniya et al., 2019). Thus, genetic mutations in Pakistan and the “heterogeneous composition” of Pakistan’s population, including a higher degree of “consanguineous marriages, have led to a prevalence of genetic disorders (Uzair et al., 2024). Owing to the high levels of consanguineous marriages in Pakistan, a genetic mutation database is created to recognize and monitor a wide range of mutations and the disorders they cause. Past studies indicated that Pakistan’s consanguineous marriages have been showing a consistently higher rate due to socio-cultural beliefs and financial benefits (Iqbal et al., 2022). This consistent pervasiveness of genetic mutation has led to a consistent increase in reported genetic disorder conditions like hemophilia in Pakistan. The prevailing scarcity of information due to a lack of awareness, counseling, screening programs for PMGS, and public stigma are contributory factors to genetic disorders.

Research in health communication has shown that message-framing approaches significantly influence health behaviors (Wang et al., 2024). However, there is a gap in the literature on how health behaviors are framed on digital platforms, especially in an era where authentic health information is sometimes misrepresented (Bauder et al., 2023). Understanding how people use digital media for health information (Lim et al., 2022) and how framing strategies can be employed to create persuasive messages that promote health behaviors, such as disease prevention and early detection, is crucial (Fernandez-Lores et al., 2024). Framing theory has been applied to various health issues, with studies exploring its impact on health communication and media influence (Afful-Dadzie et al., 2023). According to framing theory, communication reflects patterns of meaning shaped by selection and emphasis, and frames are culture-specific (McLeod et al., 2022).

Therefore, this research aims to analyze health vodcasts on genetic illnesses through the lens of framing theory to aid understanding and promote preventative behaviors. This is done firstly by addressing research gaps, where this study seeks to identify effective framing strategies utilized in YouTube videos (vodcasts) for enhancing preventive behavior, such as pre-marital genetic testing. Secondly, it assesses YouTube videos (vodcasts) in Pakistan that focus on genetic disorders and pre-marital screening to develop strategies for enhancing public health awareness. Few scholars in the past, such as Beniermann et al. (2023), have explored the attributes and influence of podcasts in health communication. Vodcasts remain a relatively underexplored medium. To our knowledge, no past study has used the exploratory sequential mixed method to explore the efficacy of health YouTube videos (vodcasts) in promoting PMGS. This raises a key question: what are the most common health frames used in vodcasts, and how can specific frames be persuasive? Based on this, this study proposes a research question to guide content analysis for this exploration.

RQ1: What are the leading frames used in health YouTube videos (vodcasts) promoting pre-marital genetic screening?

Thirdly, past research has underscored the paucity of coverage of alarming public health problems such as genetic diseases (Chavez-Yenter et al., 2023). Nonetheless, only a few studies have been limited to identifying media practices through content analysis (Navne, 2023; Park et al., 2025). With the rapid popularity of digital media and the migration of sizable viewership to platforms such as YouTube, some studies have focused on evaluating digital media-related content (Beniermann et al., 2023). On the other hand, recent studies have explored the characteristics and impact of health communication podcasting. Given that video podcasting is gaining popularity in health education (Wu et al., 2024). Peña (2022) implies that creating compelling health podcasts requires a deep understanding of the medium. Therefore, there is a need to address the identified gaps in the literature and provide recommendations for best practices. Neumark (2023) affirms that podcasting can effectively disseminate health information to the public through vodcasts, which remain underexplored. This raises the question: what health frames are commonly used in vodcasts, and how effective are they?

Therefore, this study, grounded in framing and protection motivation theory (henceforth PMT), offers a framework for analyzing health vodcasts on genetic diseases to raise awareness and influence preventative behaviors. Using the mixed method approach, this research first and foremost evaluates digital health vodcasts through the lens of framing theory to develop long-term strategies for public health promotion, focusing on the health frames commonly used in Pakistan to address genetic disorders. Furthermore, using the quasi-experiments, the research explores effective framing strategies that could improve the impact and persuasiveness of health vodcasts in promoting public health awareness in a culturally tight society. Consistent with the literature on the effectiveness of YouTube videos (e.g., vodcasts) in altering health behavior (Aubrey et al., 2020), this study investigates the efficacy of YouTube health vodcasts across the four experimental conditions and how it can diminish the possible effect of the cultural tightness. To our knowledge, this is a novel study that provides evidence on how health vodcasts can bridge the awareness gap on culturally sensitive topics and reduce the largely overlooked cultural tendencies that hinder PMGS among unmarried couples in Pakistan.

Framing theory and substantive health frames in the digital age

Framing theory asserts that how information appears in the media influences how viewers perceive a topic. Viewers are

inclined to respond predictably to highlighted aspects of news stories (Shin et al., 2022; Lwin et al., 2023). In health communication, framing is fundamental for comprehending how the representation of health issues in the media affects audience reactions (Greenberg, 2022). Guenther et al. (2024) identified four phases where frames can be observed during communication: the text, the communicator, the recipient, and the culture. Kapuściński et al. (2022) explained that framing involves the intended choice and emphasis of identifiable aspects in a communication text; hence, framing can be deliberately employed to manipulate public health behaviors (Mulchandani et al., 2023; de Las Heras-Pedrosa, 2022). Researchers classify between episodic and thematic framing, as well as generic frames such as “attribution of responsibility,” “conflict,” “human interest,” “economic implications,” and “morality” (Almahallawi & Rahim, 2022). To this end, Raza et al. (2024) note that framing theory suggests communication is characterized by patterns of meaning communicated through selection and emphasis, and that substantive frames draw upon a culture’s patterns, values, and practices.

The rise of social media has significantly impacted news production and media consumption (Alzubi, 2023). Platforms like Facebook, Google, X (formerly Twitter), and YouTube have contributed to the global communication landscape, especially in shaping hegemonic narratives (Ridwanullah & Bala, 2022). The recent rise in health vodcast production and dissemination on YouTube help in supporting and promoting awareness among the public about stigma-related issues such as cousin marriages and PMGS. Given that vodcasts are portable video versions that combine audio with text, images, and video, they are valuable educational tools (Archila, 2024; Chaves-Yuste & de-la Peña, 2023) that can increase awareness of PMGS. This research aims to grasp the framing strategies and their efficacy employed in YouTube vodcasts produced by the leading channels in Pakistan.

Protection motivation theory (PMT) and health behaviors

Several psycho-social theories have been developed to predict, explain, and influence health-related behaviors. One such model is PMT, often used to anticipate individuals’ likelihood of engaging in preventive actions and evaluate various health behaviors (Liu & Jiang, 2023). PMT suggests that a person’s intention to engage in specific behavior is a primary motivating factor. Initially, PMT was designed to understand how fear influences health attitudes and actions. The cognitive mediation process begins once an individual becomes aware of a health concern (Liu & Jiang, 2023). PMT has since been applied broadly to health-related issues, including illness prevention and health promotion. Research shows a positive correlation between risk perceptions and proactive health behaviors (Fatima et al., 2023). Factors such as how information is framed, media coverage of the threat, and the perceived uncontrollability of a health issue also influence risk perception (Entradas et al., 2022). PMT has proven useful in understanding health-protective behaviors and developing social marketing campaigns for public health (Hakimi Hashjin et al., 2022).

PMT and media exposure

PMT is valuable for analyzing the impact of media exposure on illness prevention. Hedayati et al. (2023) used PMT to study effective health communication through media. This study addresses a gap by examining the effects of digital media exposure, particularly vodcasts and podcasts, on genetic disease prevention campaigns using pre-marital screening. Effective health communication through mass and social media can influence public attitudes and encourage preventive action. Sources of information such as fear appeals, observational learning, and

personal experiences contribute to individuals’ cognitive processes and protective motivation (Sarwar et al., 2023). Media representations of health risks affect perceptions of severity, vulnerability, response efficacy, and self-efficacy (Bigsby & Albarracín, 2022). Notably, perceived seriousness influences vulnerability.

Research shows that increased media coverage of health emergencies heightens public perceptions of severity and vulnerability. Individuals with more knowledge about potential dangers are also more likely to believe that their actions in response to health risks will be effective (Niu et al., 2022). Studies suggest strong intentions to change behavior are reliable predictors of actual behavior change. People who intend to modify their behavior are more receptive to information about genetic risks (Oliveri et al., 2022). Since the success of interventions is often greater when informed by theory, there is a need for more theory-based interventions in genetic information. Interventions in genetic screening should clarify when and why behavior modification is necessary.

Hypothesis development: perceived sensitivity: threat and coping appraisal

Several psycho-social theories have been developed to predict, explain, and influence health-related behaviors. One such model is PMT, which is valuable for analyzing the impact of media exposure on illness prevention. PMT suggests that a person’s intention to engage in specific behavior is a primary motivating factor (Muturi, 2022). Effective health communication through mass and social media can influence public attitudes and encourage preventive action (McCulloch & Perrault, 2020). Individuals with more knowledge about potential dangers are also more likely to believe that their actions in response to health risks will be effective (Niu et al., 2022). People who intend to modify their behavior are more receptive to information about genetic risks (Oliveri et al., 2022).

PMT provided insight into the threat appraisal that comprises internal and external rewards and perception of risk, such as perceived severity and sensitivity. These mechanisms enhance the possibilities of adaptive responses among individuals, such as protective actions. PMT’s first construct related to threat appraisal, perceived severity, refers to a person’s assessment of the likelihood of being exposed to a health risk (Melki et al., 2022). While perceived sensitivity is the assessment of the possibility that a person will be exposed to a health risk (Hassani et al., 2014), perceived sensitivity, a key component of threat assessment, involves evaluating the risks associated with certain behaviors (Rogers, 1983). The concept of perceived severity, frequently referred to as perceived seriousness, pertains to the negative consequences that an individual associates with a particular event or outcome. The consequences in question might be related to an expected health risk or an existing condition, such as a prior health issue (Tanner et al., 1991).

Put succinctly, perceived severity refers to an individual’s belief about the seriousness and potential consequences of a health condition and its social impacts. In the context of congenital diseases, this condition could be perceived as life-altering and burdensome for future generations and influences health-protective behaviour, especially in conservative cultures where genetic diseases carry social stigma (Zhang et al., 2015). In PMT theory, fear is an innate emotion and a stimulating condition that protects individuals from risks and deters engagement with threats. Moreover, fear can be viewed as a response triggered by perceived risky situations or stimuli in the environment, prompting protective actions (Moussaoui et al., 2021). However, it follows that the cognitive process of fear arousal assumes that

the risk of a threat is identified and understood for protective action. PMT demonstrates that fear arousal is significantly influenced by the perception of risk, which encompasses the severity of the threat, individual vulnerability, and the likelihood of the threat occurring (Tannenbaum et al., 2015). In the context of congenital diseases, fear involves the emotional response triggered by the threat of having a child with a congenital disorder, and fear may arise from the possibility of discovering genetic incompatibility and social rejection (Zhong et al., 2021). When health risks are perceived as significant, individuals are more likely to engage with health technology (Hilty et al., 2022). Individuals use health information to reduce or avoid risks, especially when they believe they are likely to encounter them. PMT factors can influence attitudes and behaviors toward pre-marital screening when the primary goal is to protect against genetic illnesses (Brown, 2023).

Understanding vulnerability is crucial for addressing health risks. Coping appraisal focuses on an individual's ability to respond to risks and the factors that increase the likelihood of an adaptive response, such as following behavioral recommendations. Self-efficacy, or the belief in one's ability to execute a recommended action, plays a central role in this process. Higher levels of self-efficacy and perceived response efficacy increase the likelihood of an adaptive response, though barriers (e.g., lack of resources) may prevent action. For example, individuals may fear pre-marital screening due to concerns about discovering a genetic condition or the challenges that may follow, hindering an adaptive response. PMT is grounded in two evaluation processes: threat appraisal and coping appraisal. Threat appraisal includes vulnerability—how much a person believes they are at risk—and severity, defined as the perceived likelihood of significant harm from a threat (Lin & Chang, 2023).

Response cost refers to the potential expenses—monetary, psychological, or time-related—incurred when adopting an adaptive behavior. In PMT, response cost is a key factor in determining whether individuals are motivated to protect themselves. Perceptions of response efficacy and self-efficacy must balance the perceived costs of an adaptive response. Access to reliable information can encourage individuals to engage in protective health behaviors, strengthening their adaptive responses over maladaptive ones (Huang et al., 2021). Studies show that people unaware of healthy coping strategies may engage in behaviors that undermine their goals, reinforcing undesirable actions (Ezati Rad et al., 2021a).

PMT is useful for predicting health-protective intentions and adaptive coping behaviors and understanding maladaptive responses. People may focus on reducing their anxiety about a perceived risk rather than addressing the actual health threat (Le et al., 2022). Those with low response efficacy, low self-efficacy, and high perceptions of severity and sensitivity are likelier to choose maladaptive coping strategies (Hedayati et al., 2023). Coping evaluation assesses an individual's responses to risks and the factors influencing their likelihood of adopting adaptive behaviors, such as following health advice. A higher probability of adaptive behavior occurs when a person believes in the effectiveness of the recommended action (response efficacy) and their ability to carry it out (self-efficacy). Although self-efficacy and response efficacy enhance adaptive responses, barriers like resource limitations (response costs) may hinder action. For instance, individuals fearing pre-marital screening might worry about discovering a genetic condition or facing difficulties after the test, which can prevent them from taking protective measures. PMT is grounded in two types of appraisals: threat and coping. Threat appraisal includes perceptions of vulnerability—the likelihood of being at risk—and severity—the perceived likelihood of harm from a threat (Lin & Chang, 2023).

H1-2: When exposed to health frames, perceived severity (H1) and perceived sensitivity (H2) have a stronger positive effect on response efficacy.

H3-4: When exposed to health frames, perceived severity (H3) and perceived sensitivity (H4) have a stronger positive effect on fear.

According to PMT, three main factors influence fear appeals: (a) the likelihood of an event occurring due to a lack of protective measures, (b) the severity of the event, and (c) the perceived efficacy of coping strategies to deal with the threat (Koehler et al., 2022). Rogers (1975) originally proposed that each factor initiates a cognitive process that influences protection motivation. In other words, a person's perception of danger, vulnerability, and belief in their response's effectiveness contribute to the impact of a fear appeal. These beliefs influence the motivation to adopt protective behaviors.

Fear is an emotional response triggered by perceiving a severe threat. Both the severity of the threat and a person's vulnerability to it are predictors of fear. Fear-based stimuli can encourage individuals to develop protective behaviors or discourage them from harmful actions (e.g., smoking). Simmig (2023) notes that fear is linked to an unpredictable and potentially fatal threat, heightening perceived risk. Fear intensifies when a threat is unfamiliar or the consequences are immediate. We hypothesize that fear of genetic illnesses and pre-marital screenings is driven by the perception of an unknown threat, creating negative emotions and doubt. Communication about potential risks, including perceived threats and coping strategies, is called a fear appeal.

H5-6: When exposed to health frames fear (H5) and self-efficacy have a stronger positive effect on response efficacy.

H7: Response cost negatively affects intention toward PMGS.

H8: Response efficacy positively affects intention toward PMGS.

Breaking the stigma: moderation role of cultural tightness-looseness

The PMGS is a stigma in countries like Pakistan. Past research indicates that people in Pakistan frequently show uncertainty and reluctance towards undertaking genetic screening owing to religious and cultural influences (Jaffar et al., 2021). Uzair et al. (2024) note that cultural beliefs are one of the most significant contributors that inform public reluctance to undergo genetic screening. They found that around 28% of individuals have apprehensions about genetic screening owing to socio-cultural beliefs. People are reluctant, and their ability to participate in pre-genetic screening might be linked to cultural deviations in the intensity of social norms. Previous research in psychology has long demonstrated the influence of social norms—implicit or explicit cultural or social standards, rules, values, and stigmas that induce behavioral patterns—for managing actions (Gelfand et al., 2021). Nonetheless, nations around the globe differ largely in their observance of these social regulations (Gelfand et al., 2011).

Previous literature has verified that tighter cultures have persistent values, stigmas, and social penalties for deviancy compared to looser Western cultures, such as the USA or European nations, which have feebler normative constraints and are considerably lenient (Gelfand et al., 2021). Tight cultures like Pakistan tend to act according to these values and have more stigmas in adherence to new behaviors such as pre-marital screening, unlike loose cultures that have openness. Cultural tightness-looseness relates to deep-rooted social structures and family institutional threats. Marriage is an important cultural and social institution, a sensitive topic in culturally tight societies. Well-established social constraints regulate it. The tightness-looseness theory tenets imply that several stigmas exist in societies owing to less flexible social norms.

However, the emergence of digital media platforms, particularly, has the ability, due to less control, to initiate debates on these issues. The social support theory also advocates that informational support is vital for adhering to behavioral cues (Frohlich & Zmyslinski-Seelig, 2012). Recently, several media outlets and health authorities, such as WHO, have been using digital platforms to promote awareness and education on sensitive topics in culturally tight societies like Pakistan. Previous research affirms that adherence to the action cues delivered through digital health interventions (e.g., digital content) certainly enhances coping performance and self-care (Lin & Kishore, 2021). Likewise, plenty of literature supports using digital media content in developing positive health behaviors (Pfender & Devlin, 2023; Frohlich & Zmyslinski-Seelig, 2012). We argue that health communication content, such as YouTube videos, can play a vital role in diminishing the effect of stigmas associated with pre-marital genetic testing. The young, unmarried Pakistani couple might get informational support to help prevent PMGS. This research examines how exposure to digital media content serves as an effective health intervention strategy that can break PMGS stigma. It is therefore hypothesized that:

H9: When exposed to a YouTube video (vodcast) on PMGS, cultural tightness will not moderate the relationship between response efficacy and intention towards PMGS.

Materials and methods: study 1 content analysis

The study used a mixed-method design and involved two distinct studies. In the first study, a content analysis was carried out to assess the number of vodcasts disseminated from 2011-2023 on the official YouTube channels of news organizations. Vodcasts from Jan 1st, 2011, to Dec 31st, 2023, were chosen for analysis. Using YouTube channels, a census technique was applied to draw the entire research population based on keyword searches. Frames deducted and modified from Dan and Raupp (2018) were initially evaluated (see Table 1). Literature indicates that framing theory posits that communication is defined by coherent patterns of meaning that are articulated via actions of selection and emphasis. In health communication, substantive frames draw on the prevalent issues. The rationale for using Dan and Raupp's (2018) frames lies in the comprehensive nature of their study. For example, their frames include "substantive frames" that can provide an opportunity to evaluate the primary idea conveyed by the media content.

Furthermore, the frames also contain problem definitions, such as consequence frames, gain, loss, procedural frames, and moral evaluations, such as uncertainty frames. Therefore, this study utilized the comprehensive Dan and Raupp's (2018) framing scheme to critically understand genetic diseases' health and risk-related content. These frames reflect four functions: framing problem definitions, causal interpretations, treatment recommendations, and moral evaluations. As such, they provide deeper insights into risk information related to genetic diseases that guide genetic screening behavior based on the values and practices of a particular culture. This aligns with Entman's argument: "To frame is to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described." Finally, Dan and Raupp's (2018) frames are contextually designed for the health causal content. As such, this study primarily focused on visual content, such as digital journalistic practices covering genetic diseases and pre-marital screening. Google's search engine retrieved 96 vodcasts from the general to the specific order.

Vodcasts were filtered to include only YouTube videos (vodcasts) that provided information about genetic diseases and PMGS available on official media outlets' channels. Over a period of 13 years (2011-2023), only 15 media outlets' official YouTube channels disseminated 96 vodcasts on genetic diseases. These channels were selected because of their popularity and huge viewership and followers. For example, Geo News YouTube channel has 19.4 million (hereafter M) subscribers and was launched in 2007. While Ary News (15.2 M) 2013, Sama News (13.4 M) 2011, 24 News, Dunya News (9.05 M) 2009, Bbc Urdu (3.54 M) 2007, Urdu Point (9.51 M) 2014, Voa Urdu (0.66 M) 2008, 92 News Hd (6.11 M) 2015, Express (5.12 M) 2015, Dawn (2.17 M) 2009, Hum News (1.73 M) 2017, Aj News (1.65 M) 2016, and Bol News Aj News (1.65 M), subscribers established in 2017. All the videos on PMGS were chosen for analysis. After the unit of analysis was determined, data were extracted and coded, followed by a comprehensive analysis. The average time (Mean = 7.93) of the videos was with an SD of 6.58.

This research recruited two coders from the field of communication. The research team trained the coders to complete coding sheets and briefed them on the coding scheme and context of the study. This study employed Holsti's (1969) coefficient for intercoder reliability. For this reason, the study randomly selected

Table 1 Operational definitions of the substantive health frames.

Frame	Description
Consequence	YouTube videos (vodcast) describe the consequences related to the risk of genetic diseases and call to participate in PMGS.
Health severity	YouTube videos (vodcast) explain the impact of the risk of genetic diseases on human life as a whole and motivate people to participate in PMGS.
Human interest	YouTube videos (vodcast) depict the impact on the lives of those affected by Genetic Disorders and call to participate in PMGS.
Attribution of responsibility	YouTube videos (vodcast) delineate the health problems resulting from someone's actions (e.g., consanguineous marriages) and call to participate in PMGS.
Thematic	YouTube videos (vodcast) depict health conditions and institutional-level solutions as a cause and ask to participate in PMGS.
Uncertainty	YouTube videos (vodcast) depict uncertainty about the risks associated with genetic disease and pre-marital testing, and persuade participants to participate in PMGS.
Gain Frame	The YouTube videos (vodcast) explain only the benefits of espousing pre-marital testing and persuade them to participate in PMGS.
Loss Frame	YouTube videos (vodcast) explain only the demerits of not espousing pre-marital testing and motivate them to participate in PMGS.

Table 2 Health Frames.																	
Frames	Ary News	Geo News	Sama News	Urdu Point	24 News	Dunya News	Bbc Urdu	Voa Urdu	92 News Hd	Express	Dawn	Hum News	Aj News	Bol News	Digital Channel	Total Frames	
Consequence	1	0	0	0	0	0	1	0	8	0	0	1	1	1	22	35 (36.5%)	
Health severity	1	0	0	0	0	0	1	0	0		0	0	0	1	1	4 (4.2%)	
Human interest	0	1		2	0	0	1	0	0	0	0	1	1	3	1	10 (10.4%)	
Attribution of responsibility	0	0	0	1	1	2	1	2	1	0	0	1	0	4	8	21 (21.87%)	
Thematic	0	0	0	0	0	1	0	0	0	0	1	0	0	4	1	7 (7.3%)	
Uncertainty	0	0	0	0	0	1	0	0	2		0	5	1	0	9	18 (18.7%)	
Medical	0	0	0	0	0	0	0	0	0	0	1	0	0	0		1 (1.03%)	
Gain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Loss	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total	2	1	0	3	1	4	4	2	11	0	2	8	3	13	42	96	

20 Vodcasts out of 96, exceeding the suggested minimum 10 percent sample required for intercoder reliability. In total, coders evaluated 20 observations (20.83%). Each coder evaluated 10 vodcasts and coded them after carefully examining the operational definitions. The coefficient and proportion of agreement between coders were calculated using Holsti’s (1969) formula. The results suggested a 0.80 coefficient, as reported in the equation: PAo or PoA (Proportion of the agreement) = 2 A (number of Agreements) / N1 (observations coder 1) + N2 (observations coder 2), that is 16 /10 + 10 = 0.8 (Coefficient).

Study 1: results. Content analysis was employed to evaluate the frequency of the frames used in the health vodcast broadcast on YouTube between 2011 and 2023 on the official channels of selected media outlets. The representation of health frames by digital channels showed a particular framing pattern regarding genetic diseases, particularly due to the lack of PMGS and how often they appeared on leading Pakistani digital news channels, as shown in the following report. The results in Table 2 (see channel-wise analysis) revealed the four leading frames: consequence, human interest, attribution of responsibility, and uncertainty. These frames were used to carry out a series of quasi-experiments presented in Study 2.

Method: study 2 quasi-experimental design. Following the content analysis, this research performed a quasi-experiment using a cross-sectional design to explore and evaluate the message-consistent effect of the four most frequently used frames in the YouTube videos (vodcasts) that emerged in Study 1. Building on the above scenario, participants were conveniently grouped into four conditions and exposed to the different stimuli (e.g., Youtube video/ vodcast), which were recognized based on these framings: (1) Human interest, (2) Consequence, (3) Uncertainty, and (4) Attribution of responsibility. Overall, 420 adults (male = 230 (54.80%) and female = 190 (45.20%)) were enlisted from 15th January 2023 to 14th March 2023 through online messages, emails, and announcements. All participants were unmarried and aged 18–24 (230 = 54.76%), 25–29 (160 = 38.10%), 30–34 (18 = 4.28%), and 35–44 (12 = 2.86%). Regarding educational level, 34 (8.10%) had primary qualifications, 89 (21.19%) had high school certification, 117 (27.86%) had college degrees, 110 (26.19%) had undergraduate-level degrees, and 70 (16.66%) had master’s or higher degrees. Regarding employment status, 318 were employed (75.72%) and 102 were unemployed (24.28%). Lastly, concerning living area status, 287 (68.33%) lived in urban areas, and 133 (31.67%) lived in rural areas. An equal no of 105 participants were non-randomly assigned to view a specific YouTube video (vodcast) framed message chosen from Study 1. The quasi-experimental method was used due to the topic’s sensitive nature; therefore, an invitation to join the online quasi-experiment was sent out using different social media platforms and emails. Four types of

questionnaires were developed based on various stimuli. Once participants agreed to join, informed consent was obtained, and they were requested to verify the inclusion criteria, such as age 18 or above and their marital status. Once the participants agreed, they viewed the relevant framed vodcast and completed the questionnaire. Furthermore, this study followed the Helsinki ethical guidelines and guaranteed the confidentiality of the data collected from the respondents. They were assured that their identity would never be revealed, and data would be used for research analysis. Although the assignment to the conditions is non-random, the selection bias threat is minute due to the online data collection method. As such, no timeline or direct discussion was conducted with the respondents during the data collection. There were 420 participants in 04 conditions, *n* = 105, in an experimental group, far above the suggested smallest possible cut-off of 30 participants required for valid analyses, and the item-sample ratio criteria were therefore met (Memon et al., 2020).

Stimuli selection. To conduct the experiment, four YouTube videos (vodcasts) delineating four distinct frames (e.g., human interest, consequence, uncertainty, and attribution of responsibility) for motivating participation in PMGS were selected as a manipulation. The leading frames were identified in Study 1 using content analysis. However, for validation purposes, this research used the content validity rating (henceforth, CVR) method and used experts’ opinions to reconfirm the required frame for the experimental studies. To be brief, eight YouTube videos (vodcasts), 02 representing each frame, were forwarded to four academicians and four experts (e.g., advertising agency and public health campaign experts), accompanied by operationalizations (see Table 1) of all health frames. Furthermore, they were invited to rank each YouTube video (vodcast) on a four-point Likert scale, anchoring 1 = inappropriate and 4 = most appropriate, without any impartial choice. This method is aligned with recommended CVR standards. Their feedback was calculated using Lynn’s (1986) content validity guidelines threshold, which was ranked based on the level of agreement between the expert raters. Four stimuli (e.g., YouTube vodcasts) were selected based on the highest-rated stimuli for a specific condition.

Measures. The participants were asked about their demographics, such as gender, age, income, education, and territory. Participants indicated responses on perceived sensitivity (four items). A sample question to measure perceived sensitivity was “If I have genetic incongruity with my partner, our children will have a genetic disorder.” The construct of fear was measured using three items, one example of which is “I am afraid of the process of the screening test.” The response cost was tapped through two items, a sample item of which is “The pre-Marital Screening test is very expensive.” While four items were used to tap response efficacy, one instance is “a pre-marital screening test is effective in taking necessary precautions to prevent genetic diseases in future

Table 3 Correlations.

Variables	Perceived sensitivity	Perceived Severity	Fear	Response Cost	Response Efficacy	Self-Efficacy	Cultural Tightness	Intention
Perceived sensitivity	1							
Perceived Severity	0.46	1						
Fear	0.13	0.46	1					
Response Cost	0.25	0.47	0.53	1				
Response Efficacy	0.37	0.33	0.09	0.12	1			
Self-Efficacy	0.15	0.16	0.04	−0.16	0.59	1		
Cultural Tightness	0.38	0.27	0.03	0.15	0.61	0.47	1	
Intention	0.18	0.13	0.05	−0.11	0.51	0.73	0.39	1

Table 4 Reliability.

Variables	α	Rho-A	Composite reliability	Average variance extracted
Cultural tightness-looseness	0.856	0.860	0.894	0.586
Fear	0.797	0.798	0.881	0.712
Intention	0.875	0.890	0.922	0.799
Perceived severity	0.739	0.644	0.805	0.579
Perceived sensitivity	0.763	0.704	0.810	0.516
Response cost	0.727	0.733	0.880	0.785
Response efficacy	0.893	0.895	0.925	0.757
Self-efficacy	0.906	0.923	0.925	0.639

children.” Three items were used to measure perceived severity. One of the samples is “The problems caused by genetic mismatch are threatening future children.” Intention towards PMGS was measured using three items, on example of which is “I intend to undergo pre-marital testing before getting married.” While self-efficacy (seven items) was deducted from previous literature on PMT (See Hassani et al., 2014; Romli et al., 2022). One sample item is “I can undergo a pre-marital genetic screening test.” The cultural tightness–looseness construct was measured using the six items adapted from the literature (Gelfand et al., 2021; Gelfand et al., 2011). A sample question to measure CTL was “People in Pakistan always comply with social norms and will judge pre-marital genetic screening.” All variables were measured on the five-point Likert scale: “1 =Strongly Disagree to 5= Strongly Agree.

Results study 2: structural equation modelling (SEM). This research employed Structural Equation to perform model fitness evaluations for the measurement model using PLS.3. The data was directly filled by the respondents on Google Forms after viewing the vodcasts on screen, and no missing values were found. As the study has used the PLS-SEM, as it does not assume normality, and there is no necessity for data normality and outliers’ analysis study proceeded with the main analysis. However, before the SEM, a correlation analysis was carried out on SPSS, and the results are reported in Table 3.

Hair et al. (2021) noted that the goodness of fitness of PLS-SEM is not yet established; however, this was reported in this study for the results ‘ transparency. Furthermore, unlike covariance SEM, the PLS approach does not rely on overall goodness of fit indices such as dG. However, indices such as “SRMR or NFI” are utilized to evaluate the model’s fitness. The current study results showed adequate model goodness on required standard fitness indices SRMR and NFI after deleting one item from CTL 7 related to cultural tightness: dG = 0.34,

NFI = 0.909, and SRMR = 0.073. The PLS-SEM characterizes a robust causal–predictive method as emphasized and designed by Hair et al. (2021) and suitable for this study.

Furthermore, based on multiple reliability indices (see Table 4), the analysis revealed adequate reliability. The item loading is accessible in Fig. 1. After evaluating reliability, the study used the Fornell-Larcker Criterion to determine the discriminant validity (see Table 5). The finding satisfies the cut-offs established by earlier research.

Hypothesis testing. The study’s hypotheses were tested using the PLS path analysis multi-group analysis once all validity and reliability requirements had been met. The multi-group approach can facilitate the investigation of the hypotheses under various experimental situations. The results of the multi-group analysis also determined the route variance and significant group variances ($p > 0.05$). The results in Table 6 and Figs. 2–5 confirmed the variations in the variables’ effects caused by the exposure of the various frames. The respondents were exposed to four health frames, and the results were verified. When respondents were exposed to four health frames used in four different vodcasts, the effect of the perceived severity (H1) on response efficacy and fear (H3) remained significant across all groups, and H1 was supported. However, the effect of perceived sensitivity on response efficacy (Groups 1 and 4) and fear (Groups 1 and 2) was insignificant, leading to the rejection of H2 and H4 across some groups.

Moreover, the findings disapprove of the postulation of H5 as fear did not affect response efficacy in any condition. At the same time, self-efficacy significantly affects the response efficacy across all conditions. However, those exposed to the uncertain health frames showed a higher extent of response efficacy, which supports H6. While response cost and response efficacy significantly affect the intention towards (PMGS), leading to approval of H7 (partially supported) and H8 (fully supported),

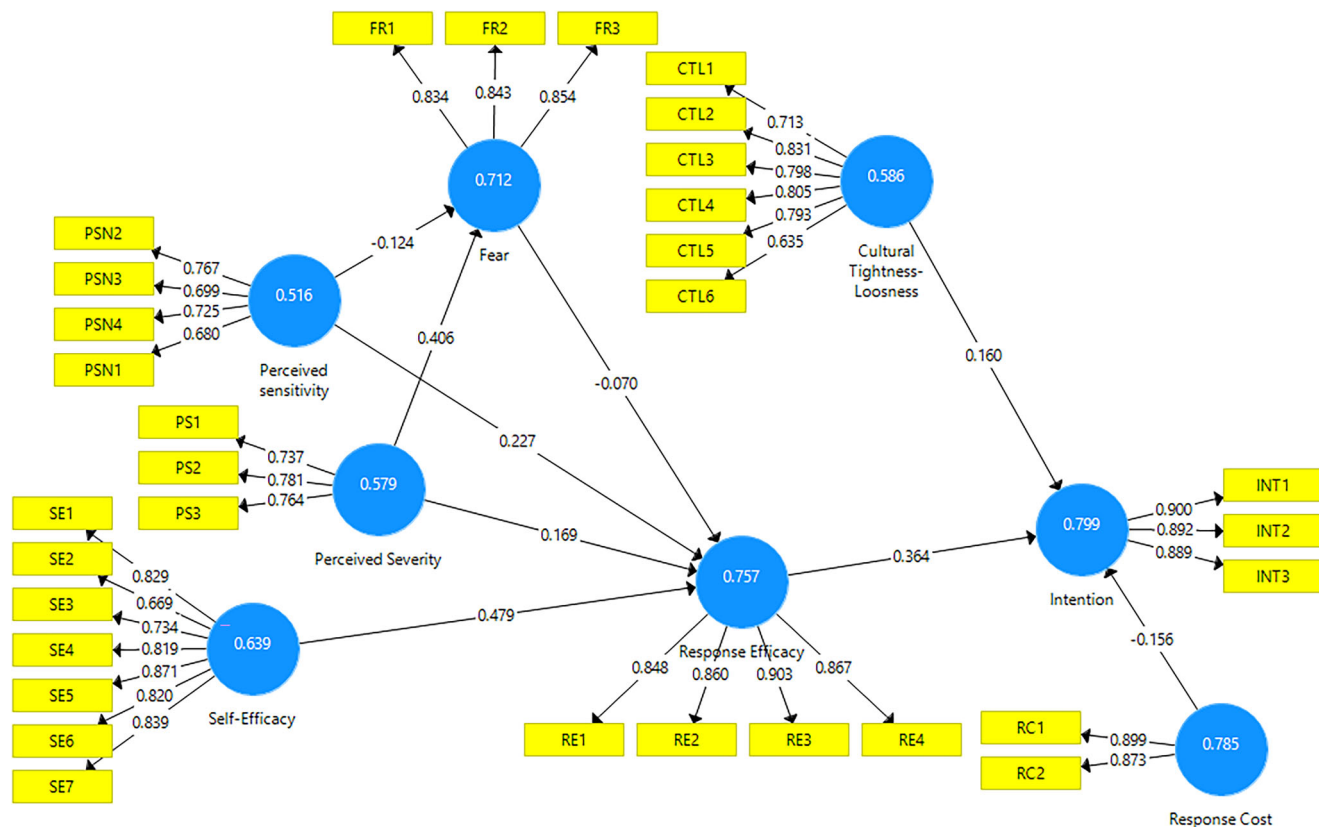


Fig. 1 Overall measurement model.

Table 5 Discriminant validity.							
Variables	CTL	Fear	PMGS	PS	PSN	RC	RE
CTL	0.765						
Fear	0.000	0.844					
Intention	0.389	0.054	0.894				
Perceived severity	0.290	0.367	0.122	0.761			
Perceived sensitivity	0.345	0.006	0.150	0.318	0.719		
Response cost	−0.018	0.527	−0.207	0.236	−0.017	0.886	
Response efficacy	0.623	0.009	0.484	0.300	0.320	−0.134	0.870
Self-efficacy	0.042	0.733	0.686	0.223	0.100	−0.343	0.593

the moderation role of CTL was found to be insignificant, and H9 was not supported (see Appendix 1 in the supplementary file for more detailed statistics). Lastly, we ran an analysis after adding the control variables of age, education, and income; the results revealed no significant influence of the control variables. The following section thoroughly discusses the results with group comparisons.

Among the participants of Group 1 who viewed the health frame of interest, perceived severity significantly affected response efficacy and fear; hence, H1 and H3 were supported. The effect of perceived sensitivity on response efficacy and fear was insignificant, leading to the rejection of H2 and H4. Also, the findings rejected the postulation of H5 as fear did not affect response efficacy compared to self-efficacy, which supports H6. Nonetheless, response cost and response efficacy significantly effect the intention towards (PMGS), leading to approval of H7 and H8 (see Fig. 2).

Among the participants of Group 2 who viewed the consequence frame, findings suggested a significant effect of perceived severity on fear; hence, H3 was supported. The analysis

also supported H6, which postulated that self-efficacy influences response efficacy. The findings showed a significant effect of perceived severity and sensitivity on response efficacy; hence, H1 and H2 were supported. The perceived sensitivity didn't significantly affect response efficacy and fear; hence, H4 was rejected (see Fig. 3). Furthermore, response cost and efficacy were significant in determining the intention toward (PMGS), leading to the approval of H7 and H8.

The following outcomes were obtained from exposure to the media health frame of uncertainty frame (GROUP 3). The findings showed that the perceived severity had no discernible impact on response efficacy. On the other hand, perceived severity and sensitivity significantly influenced fear, supporting hypotheses H2 and H3. Results showed that fear had not been considerably impacted by perceived sensitivity on response efficacy, and H4 was rejected. (see Fig. 4). The findings also indicated that fear does not affect response efficacy; accordingly, H5 was not supported. The analysis also supported H6, which anticipated the effect of self-efficacy on response efficacy.

Table 6 Results.									
Paths	Group 1		Group 2		Group 3		Group 4		Decision
	β	p	β	p	β	p	β	p	
Perceived Severity -> Response Efficacy	0.250	0.018	0.169	0.010	0.012	0.941	0.539	0.007	H1 Fully Supported
Perceived sensitivity -> Response Efficacy	0.121	0.296	0.227	0.000	0.308	0.017	0.082	0.715	H2 Partially supported
Perceived Severity -> Fear	0.319	0.016	0.406	0.000	0.526	0.024	0.503	0.005	H3 Supported
Perceived sensitivity -> Fear	-0.215	0.299	-0.124	0.100	-0.317	0.015	0.539	0.007	H4 Partially supported
Fear -> Response Efficacy	-0.117	0.302	-0.070	0.209	0.005	0.972	-0.318	0.132	H5 Not supported
Self-Efficacy -> Response Efficacy	0.551	0.000	0.479	0.000	0.490	0.000	0.227	0.213	H6 supported
Response Cost -> Intention	-0.319	0.006	-0.156	-0.156	-0.100	0.449	-0.247	0.269	H7 Partially supported
Response Efficacy -> Intention	0.439	0.001	0.372	0.000	0.237	0.172	0.342	0.178	H8 Fully supported
Moderating Effect: CTL X RE -> Intention	0.120	0.168	0.014	0.792	0.050	0.609	-0.033	0.888	H9 Not supported

Note: Group 1 (Human Interest Frame), Group 2 = Consequence Frame, Group 3 = Uncertainty Media Frame, Group 4 = Attribution of Responsibility Frame, β = coefficient, p = Significance level, and Bold showing insignificant relationships.

Furthermore, response cost and efficacy were found to be insignificant in determining the intention toward (PMGS), leading to the rejection of H7 and H8.

The findings showed that fear and response efficacy were strongly influenced by perceived severity among the participants of Group 4 who were exposed to the health frame of attribution to responsibility; thus, H1 and H3 were supported. However, findings showed that perceived sensitivity did not significantly influence response efficacy and fear; therefore, H2 and H4 were unsupported. Furthermore, findings established that fear and self-efficacy did not affect response efficacy; therefore, H5 and H6 were unsupported. Similarly, the effect of response cost and response efficacy on intention towards (PMGS) was found to be insignificant. Hence, H7 and H8 were not supported (see Fig. 5). Lastly, the moderating effect of cultural tightness in the relationship between response efficacy and intention towards (PMGS) was found to be insignificant in all four groups, leading to the rejection of H9.

Discussion

To identify effective strategies for raising public awareness about genetic diseases, this study applies framing theory to evaluate health vodcasts. It also investigates the most common health frames used to discuss genetic disorders and identifies persuasive framing techniques for health vodcasting. In addition to framing principles, the study draws on the PMT, which explains how individuals are motivated to protect themselves from perceived threats. PMT suggests that the perceived severity of a threat drives the desire for protection. Engagement with a message and the motivation to protect oneself from harm are key components influenced by the framing of the information (Orr & Gordon, 2022).

This study chose digital channels owing to the increasing viewership of digital platforms such as YouTube among the youth in the Global South. Therefore, this research taps the prevailing framing strategies for promoting PMGS to better understand genetic disease prevention strategies. The present study explicitly explores the application of health behavior theory (e.g., PMT) and the theory of framing to get the principal idea of framing strategies of genetic disease messages in the media. This analysis improved our understanding of primary health frameworks, allowing us to better grasp the components of digital health communication, such as digital platforms, health-related messages, and how the communication for genetic diseases is framed. More specifically, the content analysis findings revealed how Vodcasts shape health communication messages on genetic illnesses and pre-marital testing (Afifi et al., 2023).

Besides, this study simplified the relationship between Entman's (2008) four framing functions and the content analysis of health frames. The framing strategies and ways the substantial health frames single out health problems were examined. How specific health frames are used and the focus of health information were also investigated. As was previously mentioned, most health frames focus on explaining the effects of genetic diseases and how PMGS may be used to avoid genetic illnesses. This study shows that given the details of content analysis of health frames, it is feasible to investigate and analyze the causes, offer solutions, and conduct a moral assessment of pre-marital testing to reduce the risk of genetic disorders.

As a result, genetic diseases were identified through the health frames of Vodcasts, which comprise the primary frames such as consequence and human-interest frame. These frames help address and comprehend emerging health issues. Moreover, framing theory has been used as a foundational framework in numerous social contexts and well-known research fields like

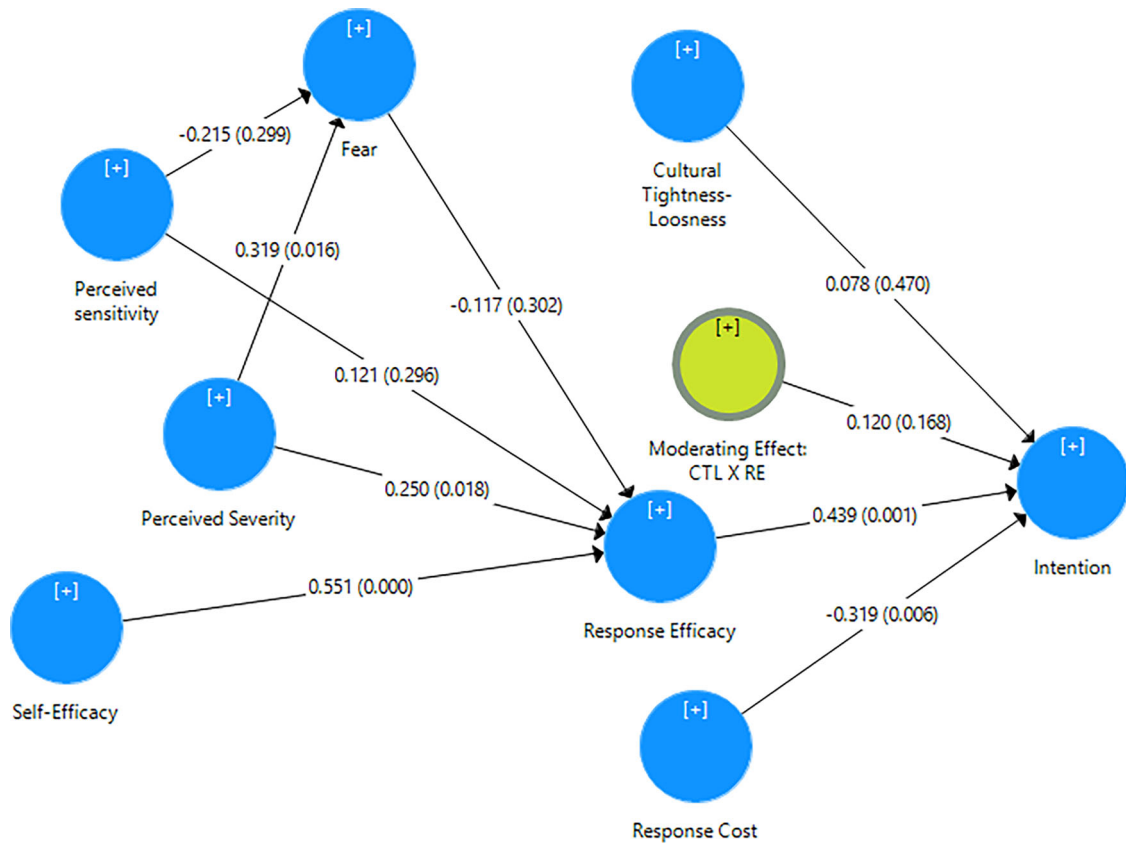


Fig. 2 Group 1 structural model.

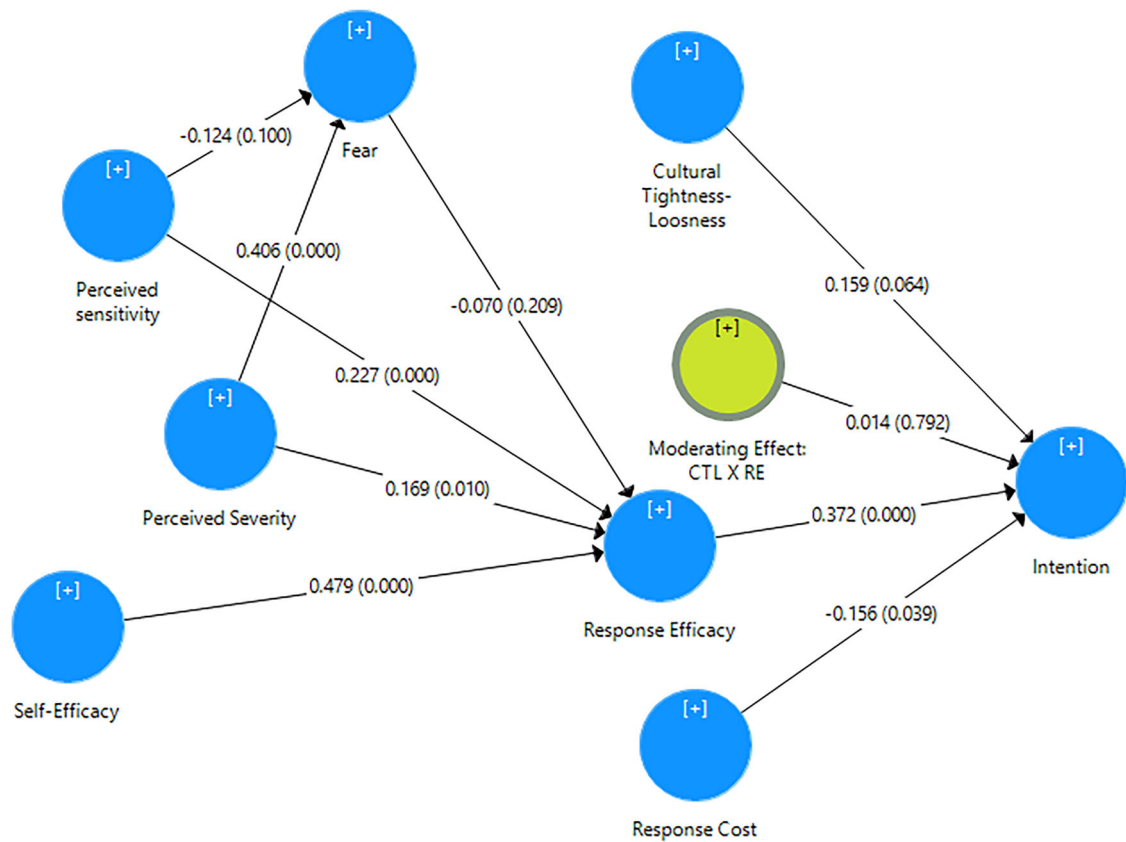


Fig. 3 Group 2 structural model.

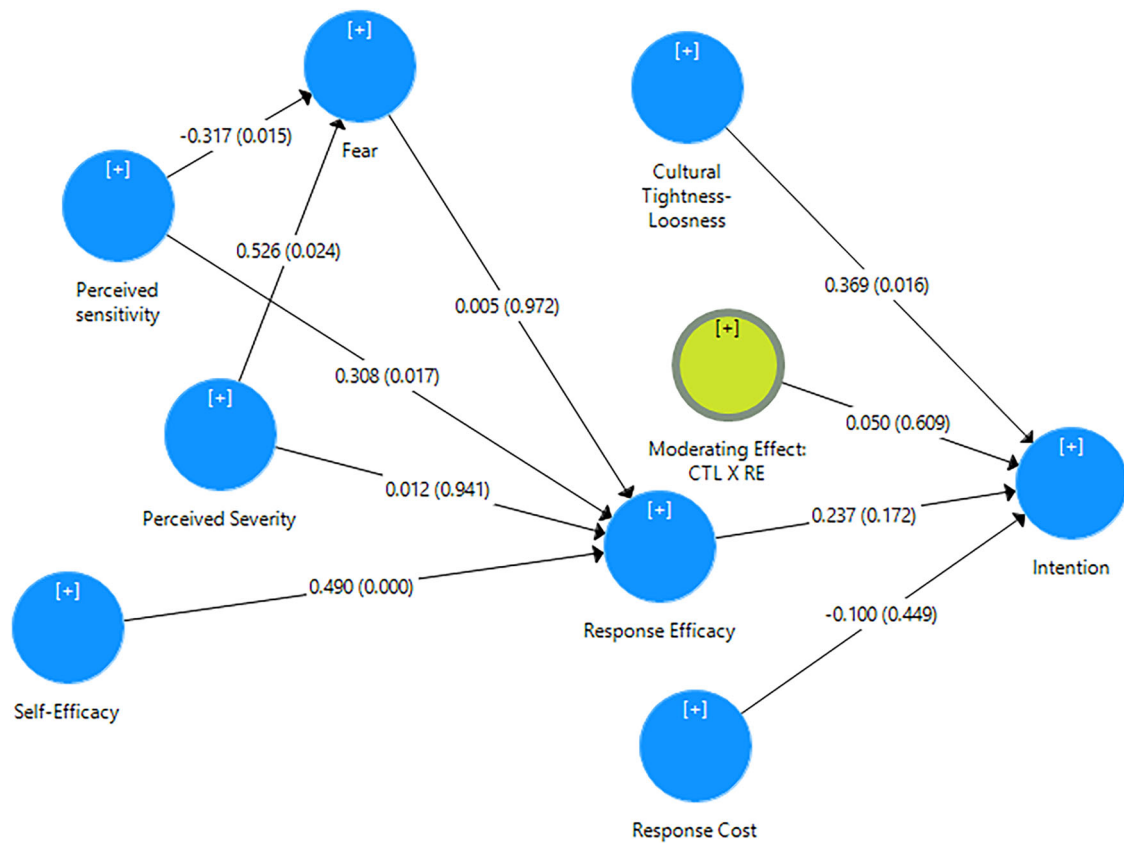


Fig. 4 Group 3 structural model.

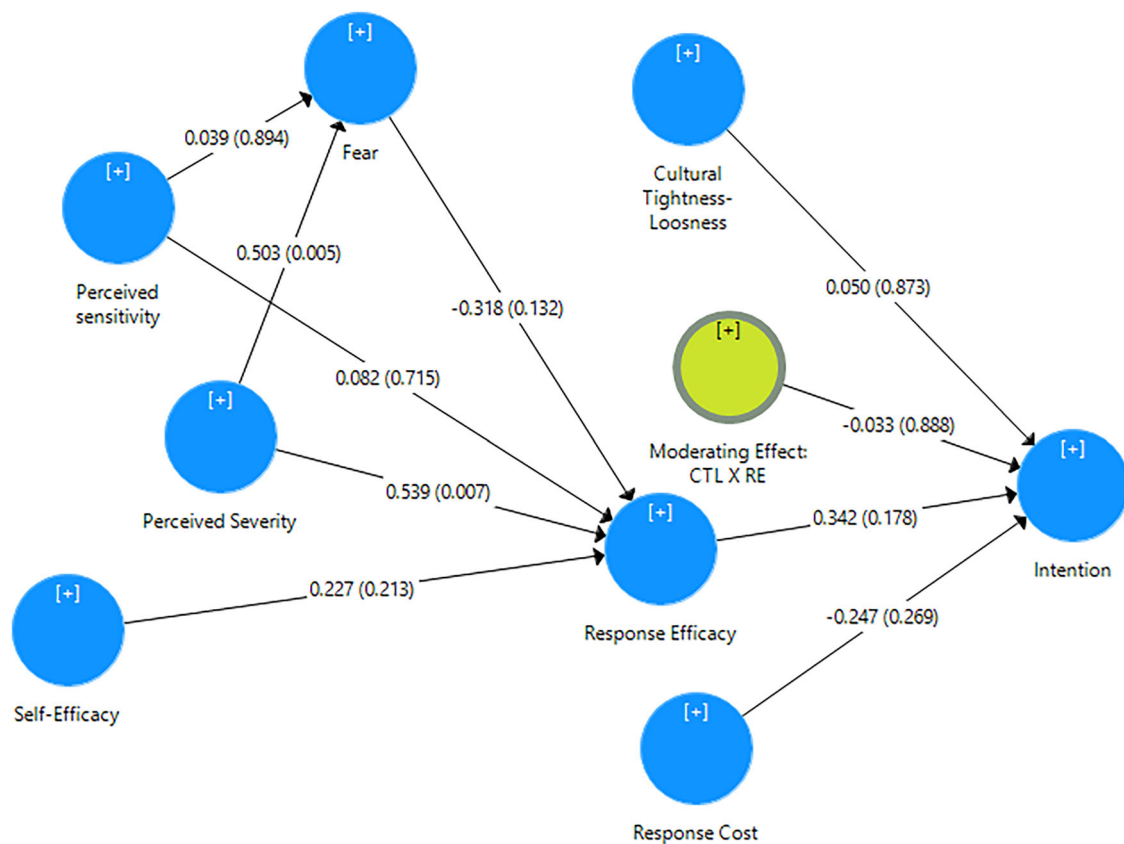


Fig. 5 Group 4 structural model.

media studies (Canto & Grunert, 2023). Theories and frameworks in this field of study are still useful. Upcoming scholars in the field of health communication must comprehend substantive health frames and consider how they relate to different health issues.

Meanwhile, the quasi-experiment in Study 2 revealed interesting findings. The participants of Group 1 viewed vodcasts containing human interest frames mainly related to the critical function of framing effect of defining the problem. In this group, the respondents were exposed to the video depicting the impact on the lives of those affected by genetic disorders and were encouraged to participate in genetic screening. Results revealed that participants' perceived severity significantly affected response efficacy and fear. Aligning with the notion of framing effects and past studies on risk communication framing, the Group 2 participants exposed to the problem-defining contexts showed similar patterns. They reported higher response efficacy and fear (Entradas et al., 2022).

When respondents (group 3) were exposed to the frame related to making moral evaluations (e.g., frame-oriented uncertainty) that offered some cues about the risks associated with genetic disease and pre-marital testing. Theoretically, the uncertainty frame is inclined to alarm the public about the risk so that they can evaluate the intensity and result in following the issue and its prospects, considering uncertainty (Lammers et al., 2024). Past studies have highlighted that this is generally a helpful frame for public attention seeking towards the issue, especially when slight information is available about health risks. Our results align with previous literature (Orr & Gordon, 2022) and reflect a higher degree of fear and response efficacy reported by the respondents of this group. Therefore, it verified that past studies (see Chavez-Yenter et al., 2023) underpinning the presentation of volatile and uncertain health-related risk information could enhance the public fear.

On the other hand, the findings showed that fear and response efficacy are highly influenced by perceived severity among participants of Group 4 who viewed the health frame of attribution to responsibility. Theoretically, these findings corroborate earlier research on health framing, which advocates that the attribution of responsibility frame emphasizes causal interpretations of health-related risks (Lewis et al., 2024; Yousaf et al., 2022). This frame is mainly fervent on action-orientation, such as remedy suggestions for health issues. In this study, the vodcasts showed the respondents delineated genetic diseases as health problems stemming from actions like consanguineous marriages. The results revealed that the respondents perceived a higher degree of response efficacy, which in turn led to a higher intention to act upon the recommendations of genetic screening.

Furthermore, the results of all four conditions related to the development of response efficacy owing to fear had surprising outcomes but have research implications. In some groups, the perceived sensitivity raised fear about genetic diseases, and surprisingly, it did not affect the response efficacy. On the other hand, factors like perceived severity, self and response efficacy, and response cost remained vital factors in identifying the intention and protective behavior. Theoretically, these results have support as respondents revealed more inclination toward the applied, actionable, and severity-related facets of pre-genetic screening (Oliveri et al., 2022). For example, earlier research noted that the consequences and implications of health-related issues are vital, along with the messages containing reassurances and recommendations to cope with the health risks (Hove et al. 2015; Mehdi et al. 2025). In this way, this study provides suggestions for health communication experts to use actionable cues and inform them of the issue's severity. These framed messages or media content can direct the public to develop resilient responses. The results of this study indicated that, in most cases, unmarried

people are inclined towards understanding the severity of the health problem, which in turn influences their intention to act upon suggested remedies.

Finally, the most surprising results were about the insignificance of the moderating role of cultural tightness. Although the results of control variables such as educational level and age were insignificant, this is a critical factor in digital media. Recently, digital media has provided opportunities for the public to seek health information (Chang et al., 2025) and, to some extent, break the existing stigma. The public is now interested in understanding health issues, especially after COVID-19. Therefore, personal benefits and interests in maintaining health and wellness have increased, and our results are consistent with some recent literature (Mehdi et al. 2025) advocating the power of digital media in health awareness. Therefore, instead of depicting hypothetical scenarios, the media may emphasize the issue orientation by providing actionable recommendations and highlighting the seriousness of the health-related issue. Also, the results related to cultural tightness have an indirect link to the Pakistani context, where, recently, several organizations have raised awareness of genetic screening. As a result, the government is also planning legislation about genetic testing before marriage, and this issue has remained in public debate in recent times.

In a nutshell, the outcomes of the quasi-experimental study align with the PMT theory, which offers substantial support. For example, PMT recognizes the critical role of coping and threat appraisal. Consistent with PMT notions, most results showed that the variables of fear and individual response efficacy were impacted by perceived severity. People's intentions for PMGS against genetic disorders were similarly influenced by response cost. Therefore, it is evident that the degree of threat influences people's motivation to protect themselves against genetic illnesses. The cost and the potential benefits of PMGS for individuals and their family members also influence people's intentions to use PMGS.

Managerial implications. This research identifies effective message-framing strategies to address the ongoing public health challenge. It applies framing theory to assess vodcasts on genetic illnesses and pre-marital screening, examining the typical health frames used in Pakistan to discuss genetic diseases. The present study provides significant insights for public health authorities, healthcare administrators, and health communication strategists in Pakistan by integrating culturally relevant health vodcasts into community health initiatives, particularly those aimed at unmarried individuals, to address the information gap around genetic abnormalities and pre-marital screening. This enables stakeholders to utilize this health vodcasts study as visual shareable content on digital platforms, enabling the health sector to connect with young audiences that may be hesitant to participate in conventional counseling or health seminars owing to genetic disorders and pre-marital stigmas. Additionally, this research may equip potential couples with satisfactory, precise, and relevant information regarding genetic disorders as a considerable risk of having disabled future children that are highly associated with consanguineous marriages, especially in communities like Pakistan.

Beyond that, Pakistan's healthcare sector and NGOs may use this health vodcast study to foster discussions at various forums, including educational institutions and women's community organizations, where cultural challenges and constraints are more evident.

Overall, this study provides valuable actionable insights for health managers and communication professionals to design culturally sensitive public health campaigns to educate the public about the risk of congenital disorders and the importance of pre-

marital genetic screening. This initiative will target the misconceptions, stigma, and social concerns, particularly in conservative societies like Pakistan, using digital media and local language content. Based on the findings of this study, health education policymakers should integrate genetic counselling and screening services into existing primary healthcare infrastructure, especially in rural and under-resourced areas, for proper diagnosis and referral protocols for congenital disorders. This would require training of staff, developing referral protocols, and ensuring low-cost access to testing for early identification and prevention. Therefore, healthcare administrators should integrate genetic counseling and screening services into existing primary healthcare infrastructure, especially in rural and under-resourced areas.

This study contributes to the understanding that developing countries like Pakistan should collaborate with community leaders to promote the acceptability of pre-marital screening, dispel myths, and reduce stigma surrounding congenital disorders. In a nutshell, the health communication strategy discussed in this research enables decision-makers to encourage preventive healthcare behaviors, particularly among young people, so that a more educated and proactive public response to genetic health concerns can be cultivated.

Conclusion

In conclusion, this study conceptually filled a research gap by applying framing theory to health communication perspective, an area that was previously uncovered by other studies. The present study framework can guide government institutions and other health education stakeholders to create health awareness programs/messages to encourage behaviors that prevent genetic illnesses. In other words, by adopting the present research findings, the government and other stakeholders in health education can put a strong health protective plan in action to lower the risk of genetic illnesses. The study has a few limitations due to the non-randomization of sample selection, the study's experimental nature, and the topic's sensitivity. In future studies, can employ cross-sectional survey for improved generalization of the results.

Data availability

The data that support the findings of this study are included in this published article in the supplementary information.

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Author contributions

F.S., S.H.R., E.O., U.Z., A.A.S., N.H. and S.K., authors were involved in the formulation or evolution of overarching research aims, conceptualized the research ideas, wrote the first draft, supervised the project, data curation, administered the project, initiated the methodology, validated the research, management, coordination responsibility for the research activity planning, execution reviewed the manuscript. S.U.K. and S.A. were involved in conceptualizing the research ideas, writing the first draft, supervising the project, data curation, administering the project, supervising the project management, reviewing the manuscript, as well as playing a pivotal role in the acquisition of financial support for the project leading to this publication. All authors reviewed the manuscript.

Competing interests

The authors declare no competing interests.

Ethics approval and consent to participate

This study was performed in accordance with the ethical principles of the declaration of Helsinki and confirmed that all research was performed in accordance with relevant guidelines/regulations applicable when human participants are involved. The study was granted ethical approval by the Research Ethics Committee of the Institute of Media and Communication Studies, Bahauddin Zakariya University, Pakistan. No.MASS/13/2023 dated 9/01/2023. Data collection for this study commenced only after formal ethics approval was granted by the Research Ethics Committee on 9/01/2023. The committee approved conducting this research involving human participants to safeguard their rights, safety, and well-being. Approval was granted after evaluating the study designs, data collection tools, and procedures to ensure informed consent, participant anonymity, and the right to withdraw at any stage without penalty. The data was collected after approval, and no changes were made after approval from the Research Ethics Committee.

Informed consent

The informed consent was approved and endorsed by the Research Ethics Committee of the Institute of Media and Communication Studies, Bahauddin Zakariya University, Pakistan. No.MASS/13/2023 dated 9/01/2023 (Approval No. MASS/13/2023, dated 09/01/2023). Informed consent was obtained from participants in written form through an online consent form before the data collection (February–March 2023) and was administered by the principal researcher. All participants were adults capable of providing consent, and no vulnerable individuals or minors were included. Consent covered voluntary participation in responding to the questionnaire, the use of anonymized data for academic analysis and publication, and assurances of confidentiality, secure data storage in line with institutional and national research ethics guidelines, and the right to withdraw at any stage without penalty. Participants were fully informed that the research was interventional (quasi-experimental design and questionnaire), conducted for academic purposes only, carried no foreseeable risks, and guaranteed anonymity. The version of the consent form used was identical to the one approved by the ethics committee, and no changes were made to the protocol after approval. Consent for publication Not applicable.

Additional information

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Correspondence and requests for materials should be addressed to Syed Hassan Raza or Umer Zaman.

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