Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Vaccine 40 (2022) 1855–1863

Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

Immunity debt or vaccination crisis? A multi-method evidence on vaccine acceptance and media framing for emerging COVID-19 variants

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ARTICLE INFO

Article history:
Received 29 August 2021
Received in revised form 16 January 2022
Accepted 26 January 2022
Available online 1 February 2022

Keywords:
COVID-19 vaccination
Media
Vaccine hesitancy
Framing theory
Public acceptance for vaccination
Community health

ABSTRACT

Renewed COVID-19 outbreaks, stemming from the highly infectious Delta and Omicron variants, prompted rising fears of a 'pandemic among the unvaccinated'. To address this prevalent vaccination crisis, media framing communication strategies can amplify the scientific evidence on COVID-19 vaccines to reach diverse geographic and socio-economic communities. The critical role of media framing strategies to engage and encourage large populations regarding vaccine acceptance has been rarely studied, despite growing evidence on vaccine hesitancy. The present study used a multi-method approach (i.e., content analysis and quasi-experiments) that unpacked the framing practices employed by the mainstream media in Pakistan. The findings of the content analysis revealed that the media extensively used uncertainty, conflict, consequences, and action rather than new evidence and reassurance frames in its COVID-19 related campaigns. In a series of quasi-experiments involving 720 participants, we manipulated these six frames of COVID-19 related news coverage (i.e., uncertainty, conflict, consequences, action, new evidence, and reassurance) to investigate the underlying mechanism that influences vaccine acceptance. The findings established that the message-consistent effects of media frames manifesting fear (e.g., consequence and uncertainty) and action cues made receivers more supportive of vaccination. The present study findings theoretically address the calls for a more inclusive "community-health reporting model", besides offering new evidence on the media framing strategies to deliver more targeted, meaningful, and effective campaigns to raise public acceptance for COVID-19 vaccines.

1. Introduction

Despite the heartbreaking realities of the COVID-19 pandemic (i.e., approx. 207 million infected and 4.36 million deaths globally), a large segment of the global population remains reluctant to get vaccinated [1]. Accordingly, these unvaccinated populations continue to serve as a breeding grounds (i.e., variant factories), as they cause risk to everyone around them [2]. More recently, WHO technical advisory labeled a new variant "B.1.1.529," called the Omicron variant. This newly discovered infectious variant can possibly spread more rapidly than the prevailing known variants of the COVID-19 virus [3]. During the ongoing pandemic, the anti-vaccine movement, raging new COVID-19 variants (e.g., Delta and Omicron), and immunity debt have fueled skepticism towards the possibility of a worldwide vaccine-induced herd immunity. COVID-19 vaccines (e.g., AstraZeneca, Moderna, Pfizer/BioNTech, and Johnson & Johnson, etc.) approved by the World Health Organization and national health agencies (e.g., Food and Drug Administration in the United States) are now in the mass production stage with the goal of administering the largest vaccination campaign in human history. However, vaccine hesitancy continues to cast doubts and keeping herd immunity as a moving target [4].

Vaccine hesitancy is a problem nearly as old as vaccines themselves, and in recent years, scholars from multiple disciplines have taken a new interest in this topic [5]. Pakistan is a notable case with respect to vaccine hesitancy because it remains one of two

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https://doi.org/10.1016/j.vaccine.2022.01.055
0264-410X/

remaining countries where polio has not been eliminated [6]. Unsurprisingly, vaccine hesitancy remains even when new deadly pathogens emerge. High levels of distrust in the government and foreign-funded health initiatives, religious beliefs, and low levels of health access have contributed to COVID-19 vaccine hesitancy [7]. Although COVID-19 vaccination has proven safe and effective against COVID-19, acceptance of these campaigns has been problematic, predominantly in some developing nations, like Pakistan. This paper examines a potential intervention for countering COVID-19 vaccine hesitancy: media framing.

Media serve as a constant health awareness source and potential pivotal factor concerning public views [8]. Specifically, health news plays an imperative role by endorsing community health practices and consequences. Previous scholars documented three functions of health news, namely: (1) information surveillance, delineating health-related events to inform the public of ongoing health hazards; (2) interpretation, packaging the situation with respect to health hazards and issues; and (3) socialization, enlightening public actions to avoid the health hazards [9–11]. Consequently, news content is perhaps even more important than other media content due to its established role in augmenting health responsiveness and information about health concerns [12]. During a pandemic, media coverage about health issues increases many-fold to improve public responsiveness [13]. Framing theory explains the theoretical underpinning for community health practices of news reporting and their effects on community responsiveness [14]. This theory describes that health issues, such as pandemics, are "framed" to provide specific meanings, situational insights and applicable cues with the purpose of raising health awareness [15]. Moreover, media framing helps the public outline problems and prepares them to adopt appropriate responses. Health communication research has affirmed that the media-savvy public develops understanding about the situation and attains actionable cues accordingly [15]. Thus, the phenomenon of framing serves as the health communication strategy that potentially defines the public perception of the situation and response [8].

Health communication recognizes four purposes of media framing that are commonly employed, including defining a problem, identifying causes, making ethical judgments, and advocating for prevention [16]. Accordingly, community health news reporting practices during pandemics sought to modify the news frame by emphasizing causes of infection spread (e.g., no mask-wearing), threat aspects (e.g., deadly virus), and precautionary strategies (e.g., vaccination). However, community health experts are not persistently satisfied with journalistic routines [17] and health news reporting practices [15]. For instance, only emphasizing narration of the events (e.g., deaths, new cases) and reporting the conflicting statements, without considering the psychological and social contexts, can obfuscate public understanding of the issue [15]. Therefore, scholars' call for a "community health model of reporting," which cannot be implemented without systematically measuring the effects of the media health news coverage. In this area, past research remained limited, with some studies only identifying the frames employed in COVID-19 news [18,19].

Using content analysis, our research provides insights into how framing strategy can be employed. In addition, the quasi-experimental design illuminates which frames instill more effective cognitive processes, leading to message-consistent effects. We demonstrate that the framing theory provides a mechanism for considering how to pitch effective community health news. In addition to framing theory, this study draws upon the issue attention cycle and health belief model (hereafter HBM) to investigate the effect of media framing on public acceptance for COVID-19 vaccination. To this end, this study responds to timely calls for research to better understand the effectiveness of the media framing strategies employed during the COVID-19 pandemic and suggests how to improve community health reporting practices. It contributes to the literature on media framing of COVID-19 and its effect on COVID-19 vaccination from an emerging, non-western media system. Assuredly, the study provides evidence-driven recommendations for health journalists and public health practitioners to leverage health news to improve public acceptance for COVID-19 vaccines. The health news reporting COVID-19 variants and vaccination can integrate message-consistent frames to improve public health.

2. Theoretical Framework: The underlying mechanism of framing effect

Framing theory advocates that mechanisms of perceptual filtration influence individual predispositions [8]. Perceptual filtration involves evaluating a specific theme, issue, or thing based on a set of one's experiences and beliefs. Furthermore, perceptual filtration mechanisms can vary owing to information combination and intensity. Thereby, cumulative perceptual filtration functions as an underlying mechanism for formulating an individual's attitude about a particular topic or issue [14]. To illustrate, a combination of risk beliefs based on experience with adverse health effects might constitute one's attitude about COVID-19 vaccination. Thus, framing theory is valuable for understanding media effects; it considers how the combination of contrary messages may induce varied perceptual filtration [12]. Given the above prognosis, framing theory proposes that the probability of a framing effect on individuals' evaluation involves three cognitive mechanisms: availability, accessibility, and applicability [8]. Framing theory posits that the availability framing effect happens when the individual has retrievable memory about the issue, such as the coronavirus [20]. Individuals with higher intensity of belief, due to prior availability of information, will be affected more by the message using availability frames.

Previous research established that media information functions as a source of knowledge, which induces beliefs [12]. For example, coverage of COVID-19 can provide information that the community is at risk for the adverse effects of COVID-19 infection. In this scenario, people would pay attention to COVID-19 news, and framing intervention occurs due to beliefs about health concerns related to COVID-19. Since COVID-19 remained a salient issue in media, the precondition of available information was fulfilled [8]. Therefore, our research mainly emphasizes the subsequent phase toward effectively targeting framing effects: accessibility and applicability. Framing theory affirmed that the repeated media coverage (frequency) could affect judgments by enhancing the accessibility of the beliefs [8,12]. For example, when media frequently frame messages that COVID-19 infection is risky, this will induce risk perception among the community. Consequently, our content analysis explores which beliefs have been made accessible through news framing. In this regard, Valkenburg, Semetko, and De Vreese conclude that news frames exercise a significant effect on readers' thoughts and recall of issues and provide the audience direction on how to understand a specific issue framed in the news media [21]. Differently put, the frames that are dominant in media become easily accessible to the individuals. These frames affect the public acceptance of the COVID-19 vaccination. Hence, we pose a research question.

RQ: Which were the dominant frames in the media coverage of COVID-19?

The second part of the study examines the message-consistent applicable effect hypothesized in framing theory, the likelihood of drawing on accessible beliefs. Framing theory notes that the final phase of the framing effect is applicability [8,20]. Thus, framing

theory anticipates that media frames delineate several beliefs. However, people weigh the contending beliefs to evaluate their relevancy and applicability [22]. For instance, people evaluate the media framed messages about the COVID-19 vaccination benefits and precautionary behavior differently to decide their applicability. Consequently, when people encounter frames with competing beliefs (e.g., a vaccine can protect but has side effects), a deliberative evaluation process occurs. In this process, people use their retrievable and accessible information to decide which is more appropriate and actionable belief in a particular condition.

However, past health communication literature affirmed that factors such as argument, message relevancy, and fear appeals could increase the likelihood of health messages being deemed applicable [8,22]. Thus, drawing on the health behavior theories (e.g., HBM), the information can serve as a cue to trigger the health behavior [23]. Therefore, the other psychological factors, such as perceived risk or benefit, are also central in shaping the behavioral outcome [22]. Thus, the COVID-19 news framing effect would be mediated through these psychological factors involved in a deliberative process. Furthermore, extant research has established that individuals' beliefs and perceptions determine the message's consistent outcomes [12,15]. Accordingly, this study sought to unveil these underlying psychological mechanisms using theoretically rigorous tests on the message framing effect of COVID-19 news coverage. The study posited that the effect of the different frames used in COVID-19 news coverage would result in the diverse intensities of applicable outcomes (e.g., public acceptance for vaccination). Psychological theories, such as terror management theory (hereafter TMT), note that the information processing of risk-oriented information yields more applicable outcomes [24]. To illustrate this phenomenon, TMT notes that when people encounter fear or anxiety due to information, they adopt the actions in compliance with safety [25]. Consequently, there is more possibility of a higher level of consistent outcomes due to the messages framed to induce the risk among the public based on remedies and applicable behaviors, such as vaccination. Given that media framing can amplify one's information processing, people would have consistent framing beliefs (risk perception). The recall of severe risk of COVID-19 (fear of death) can induce human behaviors [25]. Based on the TMT notion and HBM, it is plausible that people have trouble detaching themselves from fear of dying [18,20]. Ergo, arguably, public responses to fear-oriented frames would lead towards acceptance of preventive actions with greater intensity than other frames and we hypothesize that:

H1: Risk Perception (RP) will mediate the relationship between media attention (hereafter MA) and public acceptance for COVID-19 Vaccine (hereafter PAV) under conditions of applicable remedial beliefs framed news.

H2: Benefit Perception (BP) will mediate the relationship between media attention and public acceptance of COVID-19 Vaccine under conditions of applicable remedial beliefs framed news.

3. Part 1: Method and materials

The study employed the multi-method technique by combining two quantitative methods (1) content analysis and (2) quasi-experiment. The mixed-method technique combines qualitative and quantitative methods, whereas the multi-method technique involves similar methods (e.g., qualitative or quantitative). Furthermore, for this multi-method research data was collected sequentially using two quantitative methods. First, the content analysis of the frames employed by the mainstream news media was used to provide a starting point for sequential quasi-experiments. Next, the six dominant frames used in the COVID-19 related news stories were chosen as the stimuli for the quasi-experiments details are discussed in the next sections.

As such, part 1 of the study employed content analysis to find frames regarding COVID-19 in the leading press of Pakistan. In this research, four leading Pakistani newspapers-- "The Nation," "Dawn," "Jang," and "Naw-e-Waqt,"--were selected for analysis. These newspapers were selected keeping in view an audience survey conducted to gauge media exposure of the public [26]. These newspapers are highly circulated and widely read among the public. We selected the time frame of the news stories published in the leading newspapers between March 2020 and August 2020, the peak of the (first) COVID-19 wave in Pakistan. Each news story was treated as a unit of analysis for this research. The selection of the COVID-19 related news stories as the unit of analysis is in line with the underlined research question, which aimed to identify dominant frames in media coverage of COVID-19. Different techniques can be used to identify frames in the communication text [27,28]. However, we used the frames proposed by Shih, Wijaya & Bossard [13]. In our study, two postgraduate students were trained to code the content. The inter-coder reliability between them, calculated using Holsti formula (reliability = 2 M/1 + N2), for all the frames was above. 85 The six frames with their conceptual definitions are listed in Table 1.

3.1. Part 2: Method and materials

We also conducted six quasi-experiments to examine and compare the consistent message influences of the six frames that emerged in part 1, which have been frequently used in media coverage about COVID-19. Building on the above prognosis, respondents were exposed to six distinct COVID-19 articles, which had been identified due to their framings: (1) Consequence, (2) Uncertainty, (3) Action, (4) Reassurance, (5) Conflict, and (6) New Evidence (see Table 2). In total, 720 adults (male = 409, 56.80% and female = 311, 43.20%) were recruited from 12th December 2020 to 15th May 2021 through online announcements. Respondents' ages ranged between 18 and 63 years (Mean_age = 32.87 years). Concerning education level, 103 had higher school certificates (14.30%), 279 had two-year college degrees (38.8%) and 338 had university degrees (46.9%). Concerning employment status, 516 were employed (71.7%) and 204 were unemployed (28.3%). The respondents were then assigned to view a particular COVID-19 news framed message selected from Study 1. The 120 respondents

Table 1
Six Frames and their definitions.

Frames	Definition
Consequence	This emphasizes the consequences of the illness, including human life; social impact is the focal point of the story.
Uncertainty	Uncertainties may be portrayed regarding any aspect of the epidemic, including the cause, cure, and possible spread. Also included is the portrayal of the disease as something obscure that needs more exploration and assessment by the government or scientific bodies.
Action	The story focuses on any action against the disease, including anticipation, potential, solution and strategies.
Reassurance	The story communicates the possibility that people should not be stressed or worried about the effects of the disease. Additional stories cover the readiness and successes of authorities in fighting the infection.
Conflict	The story is about arguments, disagreements and different ideas among news sources. Alternately, it could be discussion and debate on how to combat the disease effectively.
New Evidence	This frame is related to new findings and results or explores new evidence that helps advance the understanding of the disease. It also discloses new strains of the infection, new approaches for spreading, new technologies to prevent, cure, treat the disease, and the development of new medicines.

Table 2
Comparison between the six News Media Frames.

Media	Frames						
	Consequence	Uncertainty	Action	Reassurance	Conflict	New Evidence	Total
Articles	205 (17.27%)	516 (43.47%)	113 9.52%)	65 (5.48%)	247 (20.81%)	41 (3.54%)	1187

in an experimental condition are far above the recommended minimum threshold of 30 respondents for statistical analyses**.**

3.1.1. Manipulation selection

To perform this research, six original news stories delineating six different frames were chosen as manipulation accessible. The frames were identified through the content analysis conducted for part 1. Expert opinion had re-confirmed the desired frame for Study 2 through the content validity rating (hereafter, CVR) procedure. In short, three news stories representing each frame were sent out to eight experts, along with operational definitions of all frames. Further, they were requested to rate each story on a 4-point scale, anchoring 1 = not suitable and 4 = most suitable without any neutral option. Consistent with the CVR guidelines, six manipulations were chosen based on the highest values in a particular condition. The research calculated the CVR values by using the CVR formula presented by Lynn in 1986 [29].

3.1.2. Measures

Media attention was measured through the "semantic differential scale." After viewing the particular news frame, respondents were provided with a statement: "I pay attention to news related to COVID-19 because I think it is _____." The statement was followed by three items to rate their assessments: (1) 5 = "extremely informative," 1 = "not at all informative"; (2) 1 = "reliable information," 5 = "not at all reliable information"; and (3) 1 = "extremely convincing," 5 = "not at all convincing." Risk perception (RP) was measured through four items to assess psychological and physical risk perceptions towards infectious disease [30]. These were averaged to create a composite index, with higher scores indicating higher risk perception (M = 4.65, SD = 1.15, Cronbach's α = 0.92). The benefit perception (BP) was measured through three items deducted from the literature [23]. The public acceptance of the vaccination campaign was measured through the three items adopted from the literature with modifications [31]. All scales were measured on a five-point scale (5= "strongly agree" to 1= "strongly disagree"). All participants provided written informed consent before taking part in the study.

4. Results

Our study analyzed 1187 news stories to answer the research question. Table 1 reports the counts of the primary frames published in the press. The Pakistani press gave more coverage to the uncertainty, conflict, consequences and action frames than to new evidence and reassurance frames.

4.1. Manipulation checks

The research used the post-hoc MANOVA test to verify the manipulations across the six conditions. The results of MANOVA exhibited substantial mean variances on media attention: MeanC1 = 4.18, SD = 0.79; MeanC2 = 4.53, SD = 1.13; MeanC3 = 4.31, SD = 1.04; MeanC4 = 3.41, SD = 0.91; MeanC5 = 3.26, SD = 0.76 and MeanC6 = 3.76, SD = 1.29. Hence, the results suggested the manipulation occurred due to the news framing (t = 7.53; p = 0.001). Moreover, Levene's variance test was conducted for validation of these stated variances among the different news frames the respondents viewed, which established assumed variances (F (2986) = 78.32, p = 0.001).

4.2. Confirmatory factor analysis (CFA)

After confirming the manipulation, the study employed the partial structural equation modeling (henceforth PLS-SEM) and conducted confirmatory factor analyses (CFA) using smart PLS.3.0 to examine: (1) validity, (2) model goodness, and (3) hypotheses. For that reason, the study carried out a multi-group analysis on PLS.3.0. The multi-group analysis confirmed all six group-specific parameter estimations' measurement invariance (i.e., outer loadings). Furthermore, these findings of the multi-group analysis validated that the suggestive six groups have substantial dissimilarities (see Table 3). The goodness of fit of all six measurement and structural models also demonstrated satisfactory values of NFI > 90 and SRMR < 0.08 [32].

4.3. Reliability and Validity

The PLS-SEM algorithm estimations (see Table 3) specified that all constructs (e.g., BP, MA, PAV, and RP) demonstrated adequate reliability (>70). Furthermore, the findings of the PLS estimations such as Average Variance Extracted (AVE) demonstrated that values for all constructs (e.g., BP, MA, PAV, and RP) reported above 0.50 AVE values that are considered adequate estimations for convergent validity [32].

Furthermore, the discriminant validity was analyzed using the Fornell-Larcker criterion (FLC). The findings demonstrated that the pre-defined variables in the six groups confirmed the recommended satisfactory level of FLC (see Table 4).

4.4. Hypothesis testing

Once the reliability, validity, and model fitness were confirmed, the study tested the hypotheses. The study employed the PLS bootstrapping analysis for confirming the postulated mediation paths. The multi-group analysis facilitated the proposed mediation of the constructs (e.g., RP and PB) across the six conditions. The findings presented in Table 5 and Figs. A1-A6 in Appendix A revealed that the RP and BP mediate the relationship between the MA and PS across all conditions, however, with varying intensities. The direct effect of the MA on PS was in C1 (β = 0.104 and p = 0.000), C2 (β = 0.281 and p = 0.002), C3 (β = 0.302 and p = 0.003), C4 (β = 0.058* and p = 0.584), C5 (β = -0.03 and p = 0.73) and C6 (β = 0.145 and p = 0.137). Hence, H1 was not supported.

The mediating effect of the RP was found significant shown in all conditions except one condition of conflict: C1 (β = 0.147 and p = 0.00), C2 (β = 0.130 and p = 0.002), C3 (β = 0.116 and p = 0.004), C4 (β = 0.157 and p = 0.005), C5 (β = 0.134 and p = 0.057) and C6 (β = 0.161 and p = 0.006). Based on the past recommendations of scholars [33], it can be concluded that RP partially mediate the relationship between MA and PAV under the conditions of consequences, uncertainty and action. However, RP has fully mediated the relationship between MA and PAV under the conditions of reassurance and new evidence. Hence, H2 was

Table 3
Convergent Validity.

Items	C1: Consequence				C2: Uncertainty				C3: Action			
	α	CR	AVE	L	A	CR	AVE	L	α	CR	AVE	L
MA1	0.80	0.883	0.69	0.828	0.78	0.870	0.69	0.810	0.81	0.887	0.72	0.813
MA2				0.879				0.823				0.873
MA3				0.832				0.859				0.864
BP1	0.78	0.868	0.72	0.821	0.80	0.880	0.71	0.832	0.77	0.869	0.68	0.857
BP2				0.795				0.832				0.806
BP3				0.869				0.865				0.811
RP 1	0.71	0.837	0.63	0.827	0.73	0.841	0.64	0.821	0.74	0.803	0.58	0.803
RP 2				0.785				0.826				0.745
RP 3				0.773				0.746				0.728
PAV1	0.84	0.902	0.75	0.886	0.82	0.891	0.73	0.891	0.85	0.912	0.77	0.888
PAV2				0.896				0.871				0.911
PAV3				0.822				0.802				0.842
Items	**C4: Reassurance**				**C5: Conflict**				**C6: New Evidence**			
	α	CR	AVE	L	A	CR	AVE	L	α	CR	AVE	L
MA1	0.82	0.893	0.77	0.856	0.81	0.886	0.72	0.855	0.78	0.874	0.70	0.844
MA2				0.904				0.889				0.852
MA3				0.812				0.802				0.810
BP1	0.76	0.856	0.65	0.766	0.79	0.889	0.69	0.815	0.76	0.855	0.66	0.757
BP2				0.778				0.793				0.787
BP3				0.897				0.881				0.896
RP 1	0.72	0.840	0.67	0.798	0.76	0.859	0.671	0.862	0.72	0.829	0.619	0.806
RP 2				0.802				0.765				0.809
RP 3				0.793				0.827				0.743
PAV1	0.81	0.885	0.72	0.899	0.85	0.913	0.78	0.875	0.79	0.880	0.71	0.859
PAV2				0.899				0.901				0.895
PAV3				0.737				0.867				0.769

RP = Risk Perception, BP = Benefit Perception, MA = Media Attention, and PAV = Public acceptance of COVID-19 Vaccine, L = item loading, CR = Composite Reliability, and AVE = Average Variance Extracted.

Table 4
Discriminant validity: Fornell-Larcker Criterion.

Variables	C1: Consequence				C2: Uncertainty				C3: Action			
	BP	*MA*	*PAV*	**RP**	BP	*MA*	*PAV*	**RP**	BP	*MA*	*PAV*	**RP**
BP	0.82				0.84				0.82			
MA	0.29	0.84			0.46	0.83			0.41	0.85		
PAV	0.27	0.30	0.86		0.38	0.47	0.85		0.23	0.44	0.88	
RP	0.22	0.41	0.43	0.79	0.27	0.35	0.50	0.79	0.18	0.37	0.43	0.76
Variables	**C4: Reassurance**				**C5: Conflict**				**C6: New Evidence**			
	BP	*MA*	*PAV*	**RP**	BP	*MA*	*PAV*	**RP**	BP	*MA*	*PAV*	**RP**
BP	0.81				0.83				0.81			
MA	0.22	0.85			0.24	0.85			0.21	0.83		
PAV	0.15	0.23	0.84		0.31	0.15	0.88		0.29	0.34	0.84	
RP	0.17	0.45	0.38	0.79	0.27	0.47	0.32	0.81	0.20	0.35	0.53	0.78

* $p < 0.05$ ** $p < 0.001$.

Table 5
Meditation results.

Models	MA → PS		MA → RP → PAV		MA → BP → PAV		R^2
	β	p	β	p	β	P	
Consequence	0.104	0.00	0.147	0.00	0.049	0.00	0.228
Uncertainty	0.281	0.00	0.130	0.00	0.068*	0.19	0.379
Action	0.302	0.00	0.116	0.00	0.021*	0.5	0.278
Reassurance	0.058*	0.58	0.157	0.00	0.019*	0.43	0.160
Conflict	−0.03*	0.73	0.134	0.05	0.061*	0.08	0.161
New Evidence	0.145	0.13	0.161	0.00	0.037	0.12	0.340

β = Standardized Regression Weight and * $p \leq 0.05$.

partially supported. The mediating effect of the BP was found significant, with only one condition of consequences: C1 (β = 0.049 and p = 0.000), C2 (β = 0.068 and p = 0.190), C3 (β = 0.021 and p = 0.593), C4 (β = 0.019 and p = 0.435), C5 (β = 0.061 and p = 0.088) and C6 (β = 0.037 and p = 0.126).

5. Discussion

This study used a multi-method approach to investigate the effect of COVID-19 framing on the community acceptance for the COVID-19 vaccination. The study proposed one research question

and two hypotheses. First, the findings of media content analysis revealed that the press gave extensive coverage to uncertainty, conflict and consequence frames. This finding is consistent with the literature that posits that media framing of COVID-19 is uncertain, conflict-based and focused on the consequences of the COVID-19 [34]. As a result, these frames influence community support for COVID-19 vaccination. This corresponds with previous findings that public knowledge of pandemics is consistent with the aspects that are emphasized in the media [35]. Second, the findings of this study partially supported H2, whereas H1 was not supported. The findings suggest that risk perception partially mediates the relationship between MA and PAV under the conditions of consequences, uncertainty and action. Risk perception due to remedies suggested in media has fully mediated the relationship between media attention and public support for vaccines under reassurance and new evidence. Surprisingly, our findings revealed that benefit perception only mediates the relationship between MA and PAV when exposed to the consequences of Covid-19. These results are consistent with the previous psychological models, which identify people's search for appropriate actions to avoid the health risk in panic circumstances, such as a pandemic [23,24].

Studies support that the COVID-19 pandemic is a time of uncertainty and fear, and media framing of COVID-19 was fear-orientated, with the dominant frame being the alarming frame in the global media [31]. Recent studies posit that messages framed as fear are identified as the most viable communication strategy in combating vaccine hesitancy among the public [36,37]. Importantly, our findings of H2 suggest that community acceptance for the vaccine is influence by media framing, especially media framing of COVID-19 using uncertainty, action, and consequence frames. Hence, media can be effectively used to mobilize community support for the COVID-19 vaccine. This argument is consistent with the findings of a recent study [37]. The results of this study illuminate that fear frames (messages) can be effectively used to mobilize community support for massive COVID-19 vaccination campaigns.

5.1. Contribution

The findings have implications for policymakers to muster community support for COVID-vaccination. The effective framing of media messages can correspond to a greater public acceptance of vaccines. In this regard, this research provides timely evidence about the strategic utilization of communication resources. The policymakers can select the fear appraisal public service messages through the traditional media to instill greater public acceptance for COVID vaccines. For this purpose, strategically designed public service messages about the COVID-19 vaccine may be disseminated through traditional media more frequently to encourage public acceptance of the COVID vaccines.

5.2. Limitations and Future research

Although this is a multi-method study and has made a timely contribution to the body of knowledge addressing the role of media frames in mobilizing public support for the COVID-19 vaccine, this study has limitations, as well. First, the study utilized a cross-sectional research design. Future studies can use longitudinal research design(s) to better understanding the role of media in health communication, especially during the COVID-19 pandemic. Second, it was conducted in only one country—albeit a large and multi-lingual country. It would be interesting to see whether these findings hold in other settings. Third, the participants were recruited using online announcements, therefore, this method may affect the generalizability of the results. Though the research used a randomization procedure to ensure internal validity, online selection of the participants may induce generalizability-related limitations. Thus future studies may replicate the results of this research using cross-sectional survey method. Future research might also examine social media to get a more holistic picture of media's framing effects on the public.

6. Conclusion

In general, in COVID-19 hazard circumstances, the public is anxious about their susceptibility to getting the disease and likely to adopt the available actions (e.g., vaccination). Notably, our results also reported that public acceptance for vaccination varies with the clarity of the message and risk awareness. In sum, media framing messages instilling fear and vulnerability promote a greater acceptance of COVID-19 vaccination.

Author contributions

All authors attest they meet the ICMJE criteria for authorship and made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data, took part in drafting the article or revising it critically for important intellectual content, gave final approval to the submission.

Funding

This work did not receive any grants from any funding agency in the public, commercial or not-for-profit sectors.

Data Sharing Statement

The data supporting the findings are available from the corresponding author on reasonable request.

Ethics Approval

The study was approved by the Departmental Research Review Committee of the *[hidden for peer-review]*. The study was performed as per Helsinki Declaration principles.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

See Figs. A1-A6.

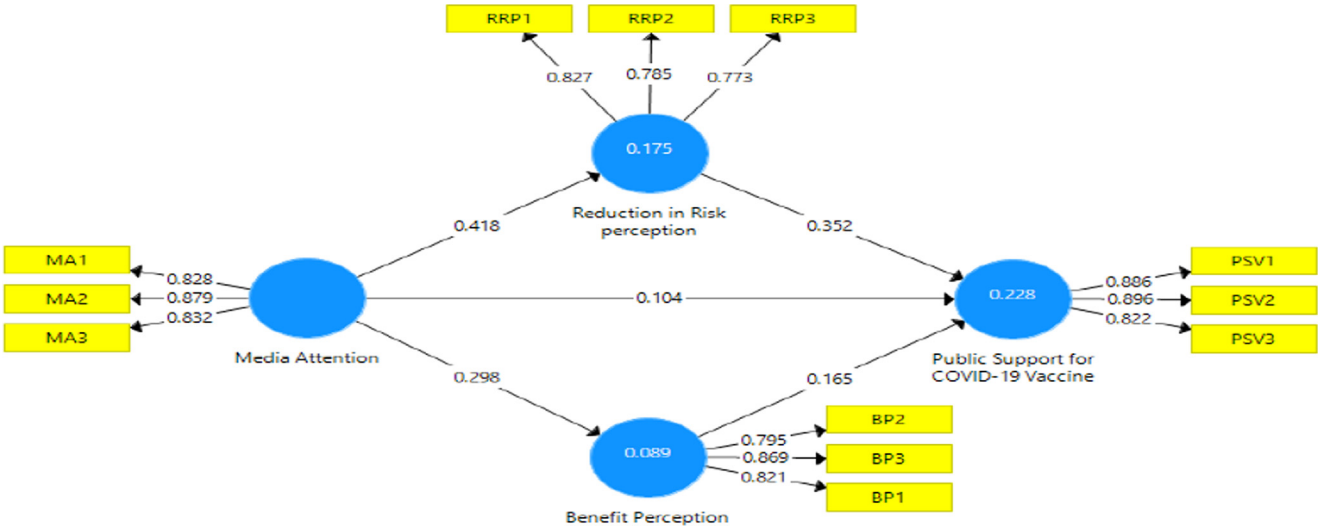

Fig. A1. Consequence.

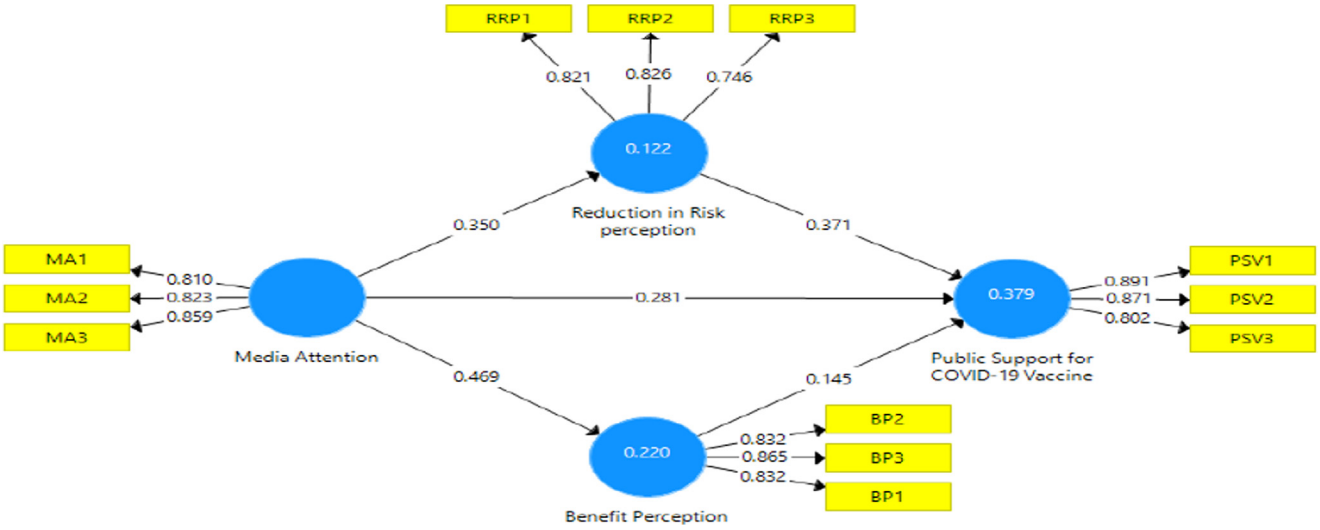

Fig. A2. Uncertainty.

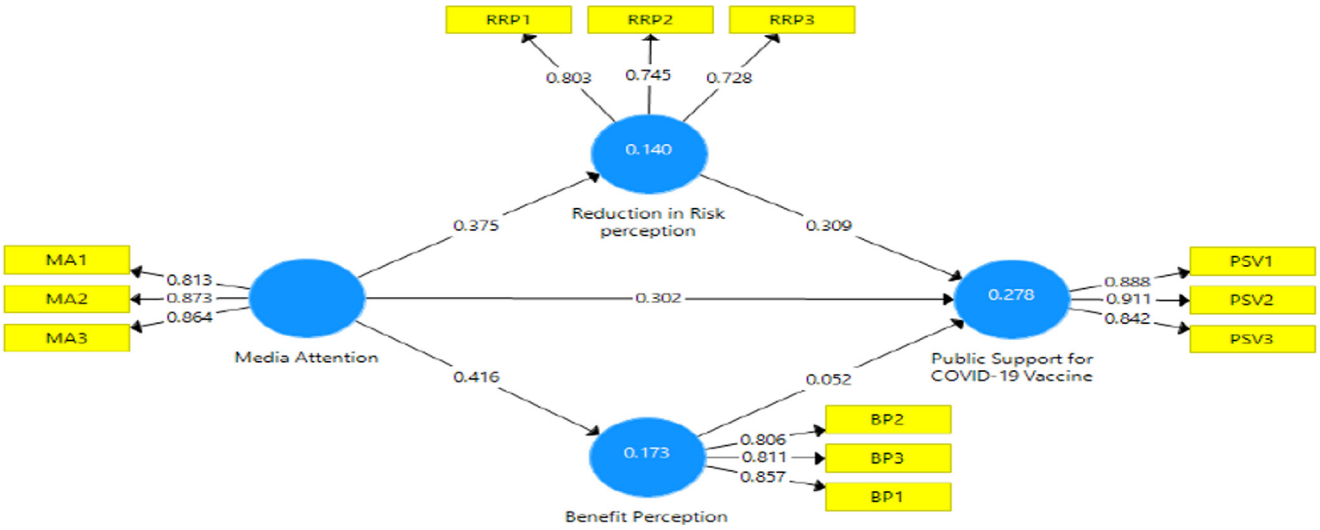

Fig. A3. Action.

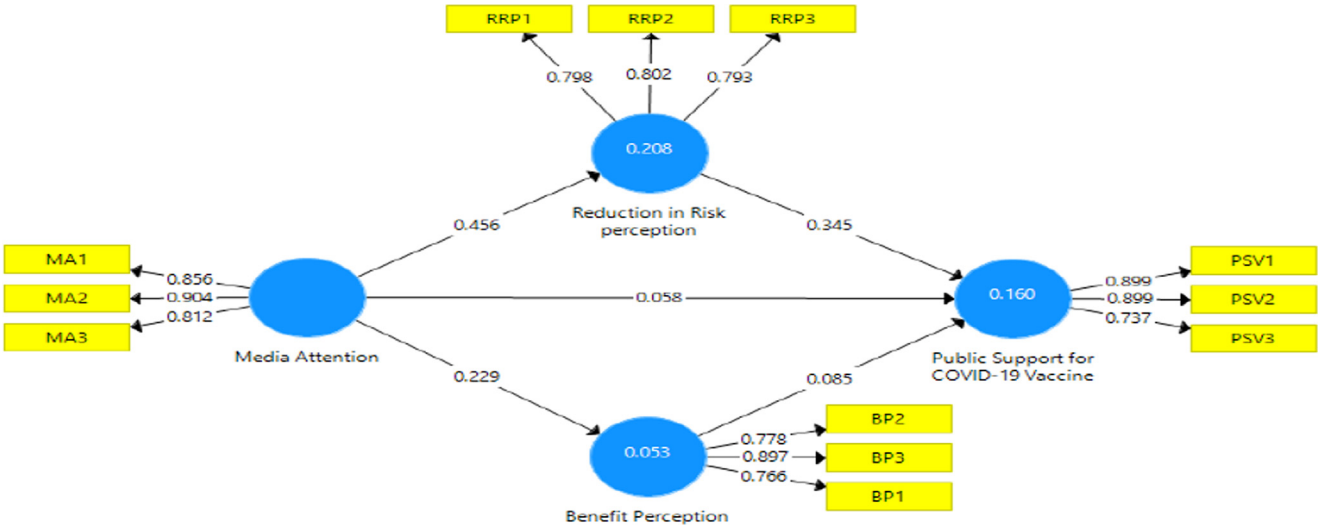

Fig. A4. Reassurance.

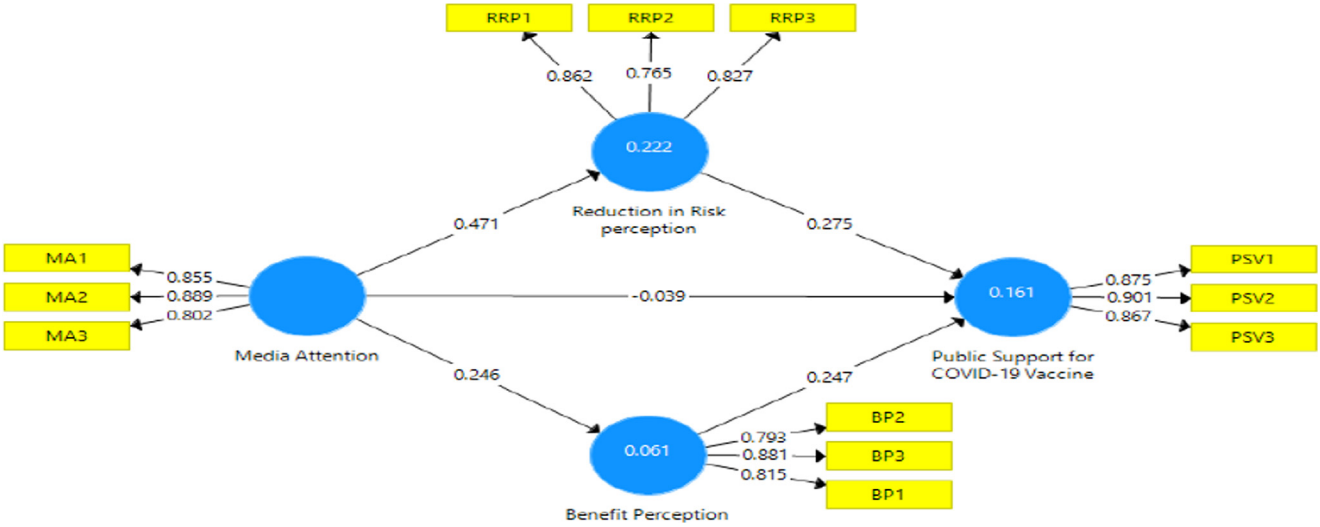

Fig. A5. Conflict.

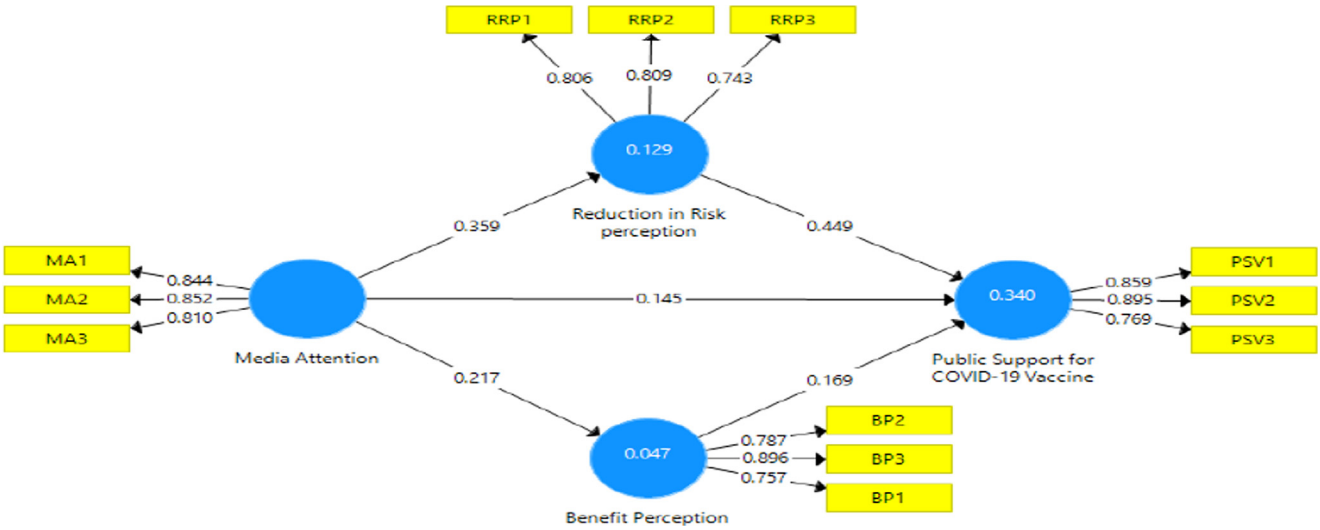

Fig. A6. New Evidence.

References

[1] WHO. WHO Coronavirus (COVID-19) Dashboard. Geneva: World Health Organization 2021. Retried from https://covid19.who.int/

[2] Fox, M. Unvaccinated people are 'variant factories'. CNN 2021, July 4. Retrieved from https://edition.cnn.com/2021/07/03/health/unvaccinated-variant-factories/index.html

[3] Poudel S, Ishak A, Perez-Fernandez J, Garcia E, León-Figueroa DA, Romaní L, et al. Highly mutated SARS-CoV-2 Omicron variant sparks significant concern among global experts–What is known so far? Travel Med Infect Dis 2022;45:102234. https://doi.org/10.1016/j.tmaid.2021.102234.

[4] Scannell D, Desens L, Guadagno M, Tra Y, Acker E, Sheridan K, et al. COVID-19 Vaccine Discourse on Twitter: A Content Analysis of Persuasion Techniques, Sentiment and Mis/Disinformation. J Health Commun 2021;26(7):443–59. https://doi.org/10.1080/10810730.2021.1955050.

[5] Khan ML, Malik A, Ruhi U, Al-Busaidi A. Conflicting attitudes: Analyzing social media data to understand the early discourse on COVID-19 passports. Technol Soc 2022;68:101830. https://doi.org/10.1016/j.techsoc.2021.101830.

[6] Closser S. Chasing polio in Pakistan: why the world's largest public health initiative may fail. Nashville, Tennessee: Vanderbilt University Press; 2010.

[7] Perveen S, Akram M, Nasar A, Arshad-Ayaz A, Naseem A. Vaccination-hesitancy and vaccination-inequality as challenges in Pakistan's COVID-19 response. J Community Psychol 2021;1–18. https://doi.org/10.1002/jcop.22652.

[8] Bullock OM, Shulman HC. Utilizing Framing Theory to Design More Effective Health Messages about Tanning Behavior among College Women. Commun Studies 2021;72(3):319–32. https://doi.org/10.1080/10510974.2021.1899007.

[9] Gollust SE, Fowler EF, Niederdeppe J. Television news coverage of public health issues and implications for public health policy and practice. Annu Rev Public Health 2019;40(1):167–85.

[10] Raza SH, Iftikhar M, Mohamad B, Pembecioğlu N, Altaf M. Precautionary behavior toward dengue virus through public service advertisement: mediation of the individual's attention, information surveillance, and elaboration. Sage Open 2020;10(2). 2158244020929301.

[11] Malik A, Khan ML, Quan-Haase A. Public Health Agencies Outreach through Instagram during COVID-19 Pandemic: Crisis and Emergency Risk Communication Perspective. Int J Disaster Risk Reduct 2021;102346.

[12] Guenther L, Gaertner M, Zeitz J. Framing as a Concept for Health Communication: A Systematic Review. Health Commun 2021;36(7):891–9. https://doi.org/10.1080/10410236.2020.1723048.

[13] Shih T-J, Wijaya R, Brossard D. Media Coverage of Public Health Epidemics: Linking Framing and Issue Attention Cycle Toward an Integrated Theory of Print News Coverage of Epidemics. Mass Commun Soc 2008;11(2):141–60. https://doi.org/10.1080/15205430701668121.

[14] Cacciatore MA, Scheufele DA, Iyengar S. The End of Framing as we Know it . . . and the Future of Media Effects. Mass Commun Soc 2016;19(1):7–23. https://doi.org/10.1080/15205436.2015.1068811.

[15] Coleman R, Thorson E, Wilkins L. Testing the Effect of Framing and Sourcing in Health News Stories. J Health Commun 2011;16(9):941–54. https://doi.org/10.1080/10810730.2011.561918.

[16] Entman RM. Framing: Toward clarification of a fractured paradigm. Journal of Communication 1993;43(4):51–8. https://doi.org/10.1111/j.1460-2466.1993.tb01304.x.

[17] Ahmad Kamboh S, Ittefaq M, Sahi AA. Journalistic routines as factors promoting COVID-19 vaccine hesitancy in Pakistan. Third World Quart 2021;1–10. https://doi.org/10.1080/01436597.2021.1995713.

[18] Morissan JAW, Siang TG, Cahyowati TD. Media Framing on Covid-19 Pandemic in Malaysian and Indonesian Newspapers. Int J Academic Res Bus Social Sci 2020;10(10):800–12.

[19] Ogbodo JN, Onwe EC, Chukwu J, Nwasum CJ, Nwakpu ES, Nwankwo SU, et al. Communicating health crisis: a content analysis of global media framing of COVID-19. Health Promotion Perspect 2020;10(3):257–69.

[20] Chong D, Druckman JN. Framing theory. Annu Rev Political Sci 2007;10(1):103–26. https://doi.org/10.1146/annurev.polisci.10.072805.103054.

[21] Valkenburg PM, Semetko HA, De Vreese CHJCr. The effects of news frames on readers' thoughts and recall. J Commun 1999;26(5):550–69. https://doi.org/10.1177/009365099026005002.

[22] Anspach NM, Draguljić G. Effective advocacy: the psychological mechanisms of environmental issue framing. Environ Politics 2019;28(4):615–38. https://doi.org/10.1080/09644016.2019.1565468.

[23] Shafer A, Kaufhold K, Luo Y. Applying the Health Belief Model and an Integrated Behavioral Model to Promote Breast Tissue Donation Among Asian Americans. Health Commun 2018;33(7):833–41. https://doi.org/10.1080/10410236.2017.1315678.

[24] Head KJ, Kasting ML, Sturm LA, Hartsock JA, Zimet GD. A National Survey Assessing SARS-CoV-2 Vaccination Intentions: Implications for Future Public Health Communication Efforts. Sci Commun 2020;42(5):698–723. https://doi.org/10.1177/1075547020960463.

[25] Dang HP, Rahimah A, Lin J-C, Truong-Dinh BQ, Glebanov PD, Raza SH, et al. What makes consumers willing to pay for carbon taxes–A View of Terror Management Theory. Sustainable Production Consumption 2021;28:1192–203. https://doi.org/10.1016/j.spc.2021.07.033.

[26] Yousaf M. News Media Roles in Bridging Gaps of Our Society: Consensus Function of Agenda Setting [Unpublished doctoral dissertation]. Beijing: The Communication University of China; 2018.

[27] Cappella JN, Jamieson KH. News Frames, Political Cynicism, and Media Cynicism. Ann Am Acad Political Social Sci 1996;546(1):71–84. https://doi.org/10.1177/0002716296546001007.

[28] Nisbet MC, Huge M. Attention Cycles and Frames in the Plant Biotechnology Debate: Managing Power and Participation through the Press/Policy Connection. Harvard Int J Press/Politics 2006;11(2):3–40. https://doi.org/10.1177/1081180X06286701.

[29] Lynn MR. Determination and quantification of content validity. Nurs Res 1986;35(6):382???386. https://doi.org/10.1097/00006199-198611000-00017.

[30] Jones CL, Jensen JD, Scherr CL, Brown NR, Christy K, Weaver J. The health belief model as an explanatory framework in communication research: exploring parallel, serial, and moderated mediation. Health Commun 2015;30(6):566–76.

[31] Wang J, Jing R, Lai X, Zhang H, Lyu Y, Knoll MD, et al. Acceptance of COVID-19 Vaccination during the COVID-19 Pandemic in China. Vaccines 2020;8(3):482. https://doi.org/10.3390/vaccines8030482.

[32] Hair J, Hollingsworth CL, Randolph AB, Chong AYL. An updated and expanded assessment of PLS-SEM in information systems research. Ind Manage Data Syst 2017;117(3):442–58.

[33] Hayes AF. Partial, conditional, and moderated moderated mediation: Quantification, inference, and interpretation. Commun Monographs 2018;85(1):4–40.

[34] Bavel JJV, Baicker K, Boggio PS, Capraro V, Cichocka A, Cikara M, et al. Using social and behavioural science to support COVID-19 pandemic response. Nat Hum Behav 2020;4(5):460–71. https://doi.org/10.1038/s41562-020-0884-z.

[35] Ophir Y, Jamieson KH. The Effects of Zika Virus Risk Coverage on Familiarity, Knowledge and Behavior in the U.S. – A Time Series Analysis Combining Content Analysis and a Nationally Representative Survey. Health Commun 2020;35(1):35–45. https://doi.org/10.1080/10410236.2018.1536958.

[36] Jin Q, Raza SH, Yousaf M, Zaman U, Siang JMLD. Can Communication Strategies Combat COVID-19 Vaccine Hesitancy with Trade-Off between Public Service Messages and Public Skepticism? Experimental Evidence from Pakistan. Vaccines 2021;9(7):757. https://doi.org/10.3390/vaccines9070757.

[37] Motta M, Sylvester S, Callaghan T, Lunz-Trujillo K. Encouraging COVID-19 vaccine uptake through effective health communication. Front Political Sci 2021;3(1). https://doi.org/10.3389/fpos.2021.630133.