A Study of Personality and Persuasive Messaging Based on Factors Influencing HPV Vaccination Intention

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Abstract

HPV vaccination is an effective approach for the prevention and treatment of cervical cancer; however, the vaccination situation in our country is not optimistic, as many young people exhibit hesitancy toward HPV vaccination. Research indicates that informational persuasion constitutes an effective means to improve vaccination rates. This study focuses on the content of persuasive messages to investigate the relationship between influencing factors and individual personality traits. To this end, we recruited 284 participants online for a questionnaire survey and employed analysis of variance (ANOVA) for data analysis. The results demonstrate that significant differences exist in the persuasive effects of messages containing various influencing factors, that selecting more effective influencing factors is essential for producing persuasive effects that promote vaccination, and that individuals' Big Five personality traits exert a significant influence on the persuasive effects of information. This study can provide scientific basis and guidance for vaccination promotion and holds important theoretical and practical value for advancing public health.

Full Text

A Study of Personality and Information Persuasion Based on Factors Influencing HPV Vaccination Intention

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Abstract: HPV vaccination is an effective way to prevent and treat cervical cancer, but the vaccination situation in our country is not optimistic, and many

young people hesitate to vaccinate. Research has shown that information persuasion is an effective means to increase vaccination rates. This study will focus on the content of persuasion information and explore the relationship between influencing factors and individual personality characteristics. To this end, we recruited 284 subjects online to conduct a questionnaire survey and analyzed the data using ANOVA. The results show that there are significant differences in the persuasive effect of information containing different influencing factors. It is necessary to select more effective influencing factors to produce the persuasive effect of promoting vaccination, and the Big Five personality characteristics of individuals will have a significant impact on the persuasive effect of information. This study can provide scientific basis and guidance for the promotion of vaccination and has important theoretical and practical value for promoting public health.

Keywords: HPV vaccine, vaccination intention, influencing factors, information persuasion, personality

1. Introduction

Cervical cancer ranks second among all cancers in women globally and represents a common malignant tumor that threatens women's health. Vaccination against human papillomavirus (HPV) constitutes one of the most important preventive measures against cervical cancer (陈亚梅, 2020; 孙秀 et al., 2021). Although numerous clinical trials have unequivocally demonstrated that HPV vaccination is an effective pathway for preventing and treating cervical cancer, and its safety has been widely recognized and promoted by authoritative organizations such as the World Health Organization, actual vaccination rates remain unsatisfactory across countries. In China, HPV vaccination rates are far lower than those in developed countries (孙秀 et al., 2021).

In the current social context, improving HPV vaccination rates and intentions among eligible female populations has become particularly urgent. Research indicates that individuals' specific vaccination behaviors are significantly associated with their vaccination intentions (Brewer et al., 2017). Despite substantial annual investments in vaccination promotion by various countries, studies show that these promotional efforts have minimal effect on enhancing vaccination intentions and behaviors (Thomsen, 2017). Moreover, mandatory vaccination policies tend to trigger public dissatisfaction and anger (Dube et al., 2015; Jarrett et al., 2015; Williams, 2014). Therefore, implementing appropriate interventions to reduce vaccine hesitancy and improve public vaccination intentions holds important practical significance and applied value.

Researchers have conducted numerous explorations to enhance individuals' vaccination intentions. Previous studies on other vaccines have demonstrated that information delivery can effectively improve vaccination compliance. The most common intervention approach emphasizes enhancing understanding of vaccination benefits while simultaneously dispelling misconceptions about vaccine risks.

Public health departments have employed various messaging strategies, such as highlighting personal benefits to oneself and family or emphasizing social responsibility for vaccination compliance, to increase people' s vaccination intentions (Duquette, 2020; Reich, 2016). However, this approach has shown limited effectiveness in alleviating public vaccine hesitancy (Brelsford et al., 2017; Eitze et al., 2021; Thomsen, 2017). Fadhel (2021) pointed out that leveraging factors influencing vaccination decision-making represents the best method for addressing vaccine hesitancy and improving vaccine acceptance. Hovland found that, from a longer-term perspective, the information content itself is key to persuasive effects. However, previous research on persuasive messages promoting vaccination has primarily focused on specific persuasion strategies, information framing, and message formulation styles (Ashworth et al., 2021; Ferguson & Gallagher, 2007; James et al., 2021; O' Keefe & Nan, 2012; Peng et al., 2021; Wang et al., 2023; Ye et al., 2021), while lacking systematic investigation into the persuasive effects of vaccination decision-making factors presented in message content.

Beyond the information itself, personality, as an important psychological characteristic, can significantly influence the persuasive effect of information. During information transmission, individuals exhibit individual differences in their responses to persuasive messages. Different individuals with varying personality traits respond differently to identical persuasive information. Alkış and Taşkaya Temizel (2015) explored the relationship between Big Five personality traits and six persuasion strategies, finding significant correlations between personality traits and persuasion strategies. In the health domain, Thomas et al. (2017) investigated the relationship between Big Five personality and information persuasion strategies, revealing that personality traits significantly influence the persuasiveness of persuasion strategies. Furthermore, when persuasive messages are tailored to individuals' personality characteristics, the persuasive effects become more pronounced (Kreuter et al., 1999; Zarouali et al., 2020).

Previous vaccination persuasion studies have not systematically examined how influence factors contained in messages affect persuasion effectiveness, nor have they considered the impact of individual personality traits on information persuasion effects. Based on this gap, the present study focuses on persuasive message content to explore the relationship between influence factors and individual personality characteristics. This experiment constructs corresponding message instances based on factors influencing HPV vaccination intention to investigate the feasibility and effectiveness of persuasion through factor-based information construction, while simultaneously examining how personality influences the persuasive effects of messages reflecting different vaccination intention factors. To this end, we conducted a questionnaire survey measuring participants' Big Five personality traits and their evaluations of different HPV vaccination persuasive messages, and tested the interaction between personality and influence factors.

2. Methods

In this study, we recruited participants through social media platforms according to the following criteria: (1) females aged 18-45; (2) individuals who had concerns about HPV vaccination and had not yet been vaccinated; and (3) non-medical majors and non-cervical cancer patients. Interested participants voluntarily enrolled in the study. A total of 284 valid participants were recruited, with a mean age of 24 years, and 88.8% holding a bachelor' s degree or higher. We strictly adhered to ethical requirements, ensuring that each participant provided full informed consent before participation and received compensation upon completion. Participant demographics are presented in Table 1 .

The influence factors employed in this study were derived from a previous investigation on factors affecting HPV vaccination intention among young Chinese women (宋梦瑶 et al., 2024). That study used semi-structured interviews to ask participants about influential factors in their vaccination decision-making process and, based on reaching information saturation, extracted multiple vaccination intention factors including vaccine safety, vaccination restrictions and contraindications, adverse reactions, and vaccine effectiveness (see Table 2).

Based on the operational definitions of influence factors, we employed two methods to construct our persuasive message instances. First, we searched social media platforms (Weibo) for real message instances matching the factor definitions, finding one corresponding persuasive message instance for each factor. Second, we utilized large language models (LLM) to generate message instances designed to simulate authentic online information content and expression styles. Large language models have made substantial progress in language generation, having been trained on text data comprising trillions of words, demonstrating powerful generation capabilities and achieving remarkable success in content generation across various contexts (Karinshak et al., 2023). In this study, we used the GPT-4.0 model to generate persuasive messages. Through specific instructions and optimization, we ultimately generated two persuasive messages meeting the requirements for each influence factor.

We created a total of 51 messages instantiating these 17 influence factors, with three message instances corresponding to each factor. To ensure message representativeness, following Thomas et al.' s (2017) message validation method, we invited five psychology experts to evaluate the messages. Specifically, we provided evaluators with a manual introducing the 17 influence factors and their definitions. The 51 messages were then presented to evaluators in random order. For each message, evaluators used a 7-point scale (1 = slightly reflects; 7 = strongly reflects) to rate the extent to which the message reflected the corresponding influence factor, with higher scores indicating greater representativeness. Evaluators also assessed whether the message reflected other influence factors and used a 7-point scale to evaluate the extent and nature of these additional factors.

Among all 51 messages, 45 received mean representativeness ratings above 6

points for their corresponding factors, while 6 messages received mean ratings above 5 points, indicating that the vast majority of our designed messages were representative. The five psychology experts' ratings demonstrated significant consistency (Kendall's $W = 0.809$, $p = 0.008$). Additionally, evaluators identified that 5 messages simultaneously contained other influence factors, belonging to the "Data" and "Scarcity" categories. Given the nature of the "Data" factor, its message instances inevitably involve other factors such as vaccine effectiveness, while "Scarcity" overlaps somewhat with vaccination convenience. We deemed this acceptable. Ultimately, using representativeness scores >6 and absence of other influence factors as criteria (except for Scarcity and Data), we employed three message instances per factor for subsequent research.

The questionnaire comprised three sections measuring participants'demographic characteristics, personality traits, and persuasive message evaluations: (1) Demographic information, including age, education level, and family cancer history; (2) Big Five personality, measured using the Big Five Inventory-10 (BFI-10), which includes 10 items assessing five personality dimensions: openness, conscientiousness, extraversion, agreeableness, and neuroticism. This widely used scale demonstrates good reliability and validity. Items were scored on a 5-point Likert scale ranging from "1 = strongly disagree" to "5 = strongly agree" ; (3) Persuasive message evaluation, which assessed participants' evaluations of each message instance. Participants evaluated each instance by responding to the following questions (7-point Likert scale, ranging from strongly disagree to strongly agree): "I believe this message is persuasive in promoting vaccination" and "After viewing this message, my vaccination intention has increased." Additionally, one vaccination-unrelated message (environmental protection) served as a control condition.

To examine the moderating effect of personality on message persuasiveness, this study primarily employed mixed-measures ANOVA to analyze personality' s influence on message persuasiveness. For each personality dimension, we classified the top 27% of participants as the high-score group and the bottom 27% as the low-score group. The distribution of our sample across groups is shown in Table 3 . For influence factors, we treated reading specific persuasive messages and providing evaluations as the manipulation condition and reading unrelated messages and providing evaluations as the control condition. We conducted 2$\times$$2 mixed ANOVA with personality as the between-subjects independent variable, persuasion factor as the within-subjects independent variable, and persuasiveness as the dependent variable. All statistical analyses were performed using SPSS 26.0.

3. Results

3.1 Persuasiveness of Influence Factors

We first analyzed the persuasiveness of messages for the 17 influence factors, using the average persuasiveness score of the three messages corresponding to

each factor as the factor' s persuasiveness rating. The results are presented in Figure 1 [Figure 1: see original paper]. The figure shows that the mean persuasiveness scores for most influence factors exceeded 5, indicating that messages reflecting these factors were generally persuasive to participants. However, the persuasiveness varied across messages containing different influence factors. Specifically, messages reflecting scientific principles, official stance, data, and unofficial stance demonstrated the highest persuasiveness.

3.2 Relationship Between Persuasiveness and Vaccination Intention Change

Correlation analysis was conducted to explore the relationship between individuals' evaluations of message persuasiveness containing various influence factors and changes in vaccination intention. The results significantly demonstrated a strong positive correlation between individuals' evaluations of message persuasiveness and changes in their vaccination intention. In other words, when individuals rated a message as more persuasive, their vaccination intention correspondingly increased.

Table 4 presents the correlation analysis results between persuasiveness and vaccination intention, showing significant positive correlations across all factors (ranging from 0.797** to 0.907**, all $p < 0.01$).

3.3 Demographic Characteristics and Message Persuasiveness

We used t-tests to examine differences in factor persuasiveness evaluations between individuals with and without family cancer history. The results showed that among the 17 factors, only four demonstrated significant differences: scientific principles ($t = 2.468$, $p = 0.014$), peer groups ($t = 2.226$, $p = 0.027$), providing choice space ($t = 2.083$, $p = 0.039$), and data ($t = 2.109$, $p = 0.036$). Individuals with family cancer history rated the persuasiveness of these four factors significantly higher than those without such history.

We used ANOVA to explore differences in factor persuasiveness evaluations across education levels. The results (Table 5) revealed that among the 17 factors, individuals with different education levels showed significant differences in evaluating six factors: adverse reactions ($F = 3.488$, $p = 0.032$), vaccination convenience ($F = 4.080$, $p = 0.018$), official stance ($F = 3.346$, $p = 0.037$), unofficial stance ($F = 4.939$, $p = 0.008$), conformity ($F = 7.344$, $p = 0.001$), and vicarious experience ($F = 4.090$, $p = 0.018$). Individuals with lower education levels rated the persuasiveness of these factors higher than those with higher education levels.

3.4 Main Effects of Personality

ANOVA results indicated that extraversion showed significant main effects on six factors: vaccine safety, adverse reactions, unofficial stance, scientific principles, data, and vicarious experience. Individuals with high extraversion rated

the persuasiveness of messages containing these factors higher than those with low extraversion. Agreeableness, conscientiousness, neuroticism, and openness showed no significant main effects on any factors.

3.5 Interaction Effects Between Personality and Influence Factors

As shown in Table 6 , the interaction between extraversion and adverse reactions was significant, $F(1, 153) = 4.474$, $p = 0.036$, $p^2 = 0.028$, indicating that extraversion moderates the persuasive effect of messages reflecting adverse reactions. Simple effects analysis revealed (Figure 2-1) that for individuals with high extraversion, messages reflecting adverse reactions showed significantly enhanced persuasive effects, whereas no such enhancement was observed for individuals with low extraversion.

The interaction between extraversion and unofficial stance was significant, $F(1, 153) = 4.729$, $p = 0.031$, $p^2 = 0.010$, indicating that extraversion moderates the persuasive effect of messages reflecting unofficial stance. Simple effects analysis showed (Figure 2-2) that for individuals with high extraversion, messages reflecting unofficial stance demonstrated significantly enhanced persuasive effects.

The interaction between extraversion and data was significant, $F(1, 153) = 4.070$, $p = 0.045$, $p^2 = 0.030$, indicating that extraversion moderates the persuasive effect of messages reflecting data. Simple effects analysis revealed (Figure 2-3) that for individuals with high extraversion, messages reflecting data showed significantly enhanced persuasive effects.

The interaction between extraversion and vicarious experience was significant, $F(1, 153) = 5.739$, $p = 0.018$, $p^2 = 0.026$, indicating that extraversion moderates the persuasive effect of messages reflecting vicarious experience. Simple effects analysis showed (Figure 2-4) that for individuals with high extraversion, messages reflecting vicarious experience demonstrated significantly enhanced persuasive effects, whereas no such effect was observed for individuals with low extraversion.

Figure 2 [Figure 2: see original paper] illustrates these interaction effects between different personality traits and influence factors.

4. Discussion

In this study, we found that the mean persuasiveness scores for most persuasive messages exceeded 5, indicating that messages designed based on influence factors generally demonstrated strong persuasive effects on participants. Furthermore, we discovered a significant positive correlation between individuals' evaluations of message persuasiveness and their vaccination intentions. This finding not only reveals the important role of message persuasiveness in stimulating vaccination intentions but also provides empirical support for influence factor-based persuasive messages, further validating the feasibility and effectiveness of constructing persuasive messages based on influence factors. We also ob-

served that the persuasiveness of messages containing different influence factors varied. Specifically, messages reflecting scientific principles, official stance, data, and unofficial stance showed the highest persuasiveness. This may be because messages reflecting scientific principles use accurate and accessible language to convey information scientifically and objectively, demonstrating that conclusions are based on rigorous experiments and research, which renders them more persuasive. Data provides objective evidence supporting certain viewpoints or facts and can be regarded as indisputable, making messages containing data potentially more persuasive. Moreover, information supported by substantial data can better stimulate women' s relevant information needs, and such information needs can prompt people to adopt recommendations in the message (Kim & Nan, 2019). Official and unofficial stances provide authoritative or diverse perspectives, giving messages greater depth and breadth, thereby enhancing their persuasiveness.

Additionally, we found that individuals with family cancer history rated the persuasiveness of messages containing scientific principles, peer groups, providing choice space, and data significantly higher than those without such history. This may be related to their health risk perception and decision-making styles (Asmundson et al., 2010). Due to their health conditions, individuals with family cancer history are more sensitive to factors that may negatively impact their health and seek more information to avoid further health risks. Consequently, they are more easily persuaded by messages with scientific and data support while also placing greater emphasis on community influence. In this experiment, individuals with lower education levels rated the persuasiveness of factors such as adverse reactions, vaccination convenience, official stance, unofficial stance, conformity, and vicarious experience higher than those with higher education levels. This may suggest that individuals with lower education levels rely more on direct, easily understandable information (e.g., adverse reactions, vaccination convenience) and authoritative and social influences (e.g., official stance, conformity effects). Conversely, individuals with higher education levels may be more inclined toward independent and critical thinking (Mackert et al., 2016), thus rating the persuasiveness of these factors lower. These results reveal that family cancer history and education level influence individuals' information evaluations. Therefore, when developing promotional messages, these individual background factors should be fully considered to enhance message targeting and effectiveness.

In this experiment, we found significant differences in extraverted individuals' evaluations of certain factors' persuasiveness. According to our results, extraversion showed significant main effects on vaccine safety, adverse reactions, unofficial stance, scientific principles, data, and vicarious experience. Individuals with high extraversion generally rated the persuasiveness of messages containing these factors higher than those with low extraversion. These influence factors are closely related to vaccine safety and reference information. Extraversion is significantly positively correlated with promotion focus, meaning individuals with high extraversion tend to actively adopt effective measures to achieve goals

(Higgins et al., 2001; Ouschan et al., 2007), which is closely related to the generation of individual health behaviors. Therefore, messages emphasizing these factors may help extraverted individuals make wiser, healthier decisions, making such messages more easily accepted by them.

Furthermore, we discovered the critical role of extraversion personality traits in moderating message persuasiveness. Extraversion significantly moderates the persuasive effects of adverse reactions and data. Individuals with high extraversion are more susceptible to messages reflecting adverse reactions and data than those with low extraversion. This may be because individuals with high extraversion pay greater attention to information accuracy and detail (DeYoung, 2015), while messages reflecting adverse reactions and data often provide detailed explanations of potential negative consequences of certain behaviors or decisions, satisfying high extraverts' need for more precise information. Consequently, these messages may receive higher persuasiveness ratings from high extraversion individuals. Additionally, extraversion moderates the persuasive effects of unofficial stance and vicarious experience, with high extraversion individuals being more susceptible to these factors than low extraversion individuals. High extraversion individuals typically pay more attention to social identity and acceptance (Tajfel & Turner, 2004) and may focus more on diverse voices in society. These results highlight the important role of personality traits, particularly extraversion, in influencing message persuasiveness evaluations and emphasize the need to consider target audience personality traits when designing and disseminating health information.

The findings of this study hold significant theoretical and practical implications. First, this study confirms the importance of persuasive message content itself for persuasive effects, filling a gap in previous persuasion research and providing important reference value for future related studies. Second, this study explores the relationship between personality traits and persuasion, yielding new conclusions that further enrich the knowledge system and theoretical framework of the research field. At the practical level, our conclusions can provide scientific basis and guidance for vaccination promotion and offer references for addressing other vaccine hesitancy issues. Previous research has shown that individuals' digital footprints can reflect their personality characteristics. Relevant institutions and public health workers can combine our findings to design and deliver targeted persuasive messages based on different personality traits to better promote vaccination.

In summary, this study holds important theoretical and practical value for promoting vaccination and public health. However, despite these achievements, several limitations remain. First, our sample primarily consisted of young, highly educated individuals, which limits the generalizability of our findings. Future research should consider more random sampling methods to obtain more comprehensive and representative samples. Second, cultural background may influence persuasion effects, and future studies should consider investigating more factors in multi-national contexts. Finally, this study employed a cross-sectional design

without examining long-term persuasion effects. Future research should adopt longitudinal designs to better understand the long-term effects and mechanisms of persuasion.

5. Conclusion

This study investigated the persuasive effects of messages reflecting different vaccination decision-making influence factors and the impact of individual personality on their persuasiveness. The results indicate that persuasive effects vary significantly across messages containing different influence factors, that selecting more effective influence factors is necessary to produce pro-vaccination persuasive effects, and that individual Big Five personality traits significantly influence message persuasiveness. These findings enhance our understanding of how personality affects persuasion processes and hold important practical significance. Specifically, by revealing the relationship between personality traits and persuasion effects, this study provides new insights for designing and delivering targeted persuasive messages for different populations, particularly offering scientific basis and reference for vaccination promotion and reducing vaccine hesitancy.

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Note: Figure translations are in progress. See original paper for figures.