The Effects of Perceived Credibility and Similarity of the Messenger on the Cervical Cancer Screening Intention.

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Abstract

Over half a million women are affected by cervical cancer every year, despite research suggesting that it can be prevented through cervical screening. Despite many efforts, the screening rates are suboptimal. It has been suggested that the intention to screen for cervical cancer can be increased by presenting the information by a suitable messenger. The messenger effect suggests that a message is evaluated through the perspective of a messenger. Furthermore the source credibility theory proposes that each messenger can be evaluated on three dimensions: trustworthiness, expertise and similarity. This study was conducted as an online survey experiment. The data was gathered from 370 participants that were biological women between the ages of 18 and 29. Each person was exposed to one, randomly allocated messenger: a healthcare professional (doctor), a governmental health organization (RIVM) or a peer (another woman). Furthermore, each participant was asked what was their intention to participate in cervical cancer screening before and after they saw the messenger. An increase in intention was observed across messenger conditions, however no significant effect was found of the messenger type on the change in intention. Principal Component Analysis suggested that proposed questions reflected two dimensions: credibility and similarity. It has been found that both factors can serve as a predictor of intention change. For the peer messenger, credibility was also found to act as a mediator. The findings provided evidence contradicting the messenger effect and evidence supporting the role of credibility and similarity. The study contributes to the literature gap and makes suggestions for the future research and policy.

Keywords: Messenger Effect, Source Credibility Model, Cervical Cancer, Cervical Cancer Screening

The Effects of Perceived Trustworthiness Expertise and Similarity of the Messenger on the Intention to Engage in Cervical Cancer Screening

Cervical cancer is highly prevalent among women worldwide. According to the World Health Organization (2024), cervical cancer is the fourth leading cancer type in the world. Every year, 900 women are diagnosed with cervical cancer and 200 pass away as a result in the Netherlands (Integraal Kankercentrum Nederland [IKNL], 2024). The prevalence of cervical cancer is especially concerning as the World Health Organization suggests that 100% of the cervical cancer cases are preventable (2019). Women are advised to vaccinate against HPV as well as take part in cervical cancer screenings, which can lower the risk or completely prevent cervical cancer. Despite offering a free screening programme, the screening rates are decreasing leading to an increased prevalence of cervical cancer (IKNL, 2024). In 2023, out of the women invited to participate in cervical cancer screening, only 49.7% decided to participate (RIVM, 2023).

A study by Cartmell et al. (2018) has shown that women pay great attention to factors surrounding the message about health, including the messenger. This research aims to look into the effect of a messenger on the intention to participate in cervical cancer screening, in biological women ages 18 to 29. This paper aims to answer the question " Does the type of the messenger and the perceived dimensions of the messenger impact the intention to engage in cervical cancer screening?". Understanding whether messengers and/or their perception impact the intention to undergo cervical cancer screening can help shape future attempts at decreasing the incidence of cervical cancer in the Netherlands.

Messenger Effect and Source Credibility

The messenger effect describes how the message perception changes depending on the person that communicates the message (Hafner et al., 2017). The research on the messenger effect in healthcare and health behaviours is limited and often produces mixed results. A study by Fishman et al. (2018) found that patients choose to read health-related news articles more frequently if they were written by doctors or other patients compared to articles written by celebrity or religious figures. On the other hand, when looking at a message about health risks associated with smoke exposure, Aminpour et al. (2022) did not find a statistically significant effect between the message from a governmental source and an academic source. Furthermore, interviews performed by Cartmell et al. (2018) revealed that when receiving information about HPV vaccination, women paid attention to both the message and the messenger. It has been suggested that both the message and the messenger may play an equally important role. When receiving a message about HPV vaccination, women have shown a preference for messengers from the following categories: a health professional or organization, community leaders and organizations and peers (Cartmell et al., 2018). The preference for these categories was often associated with the messengers being perceived as trustworthy, well informed or approachable.

Source Credibility Theory is well established in communication and marketing research (Pornpitakpan, 2004; Ismagilova et al., 2020). It suggests that each source can be evaluated on three dimensions: trustworthiness, expertise and attractiveness (Hovland & Weiss, 1951; McCroskey, 1969; Ohanian, 1990). The impact of the three dimensions on cancer preventative behaviours have previously been investigated. A study by Issaka et al. (2025) has found that overall source credibility is positively correlated with behavioural change in the context of cancer. Furthermore, a weak positive correlation was found between the enhanced cancer

preventative behavior and source expertise as well as a moderate positive correlation with source attractiveness. There was no correlation found between the enhanced cancer preventative behavior and source trustworthiness.

The Trustworthiness dimension measures to what extent the messenger is perceived as honest (Desarbo & Harshman, 1985). A synthetic review by Taylor et al. (2023) provides an overview of trust literature in a healthcare setting. The majority of research focused on the patient's trust in clinicians. Furthermore, the review suggests that while the trust in clinician increases behavioural outcomes, it also has no impact on actual health outcomes. A study by Yang et al. (2011) found that increased distrust in a provider has predicted a decrease in cervical cancer screening participation.

Expertise refers to how likely the person is to have extensive knowledge on a specific topic (Desarbo & Harshman, 1985). While trustworthiness and expertise are proposed as separate dimensions, Thon & Jucks (2017) provides evidence of a connection between the two dimensions. The study found that expert messengers were perceived as more trustworthy than the non-expert messengers when presenting online health information. Additionally, messengers with medical credentials were rated as higher in expertise than messengers with non-medical credentials. In line with these findings, a study by Crisci & Kassinove (1973) found that when advice was given by an expert, the participants were more likely to comply with the given advice. Ronzani et al. (2022) found an increased intention to vaccinate when the endorsement came from an expert. Furthermore, the study performed a second analysis with controlling for trust towards the expert, which again found the relationship to be statistically significant.

Attractiveness is described as the appeal of the person to the audience, both in terms of physical appearance and personality (Desarbo & Harshman, 1985). It can be divided into several

factors - liking, similarity and familiarity (Issaka et al., 2025). This study will focus on the attractiveness in the context of similarity.

Research suggests that a similarity in status may play a role in the acceptance of a message. Women identify that peer-to-peer communication can be as important as advice from doctors when it comes to HPV vaccination (Cartmell et al., 2018).

Woman-to-woman communication can be especially important in areas where health literacy is low. It has been found that women from rural areas show an increased intention to participate in cervical screening after hearing about a screening experience from another community member (relatives, neighbours, friends). Furthermore, woman-to-woman communication, not only increased the intention to participate, but also the screening behaviour (Zhang et al., 2023).

On the other hand, college women indicate that they rarely communicate about HPV vaccination (Hopfer & Clippard, 2010). However, it has also been reported that women who were vaccinated against HPV were often associated with HPV-vaccinated peers. Furthermore, it has been stated that, in vaccinated peer-groups, the vaccine has been more normalised than in non-vaccinated peer-groups. These findings provide evidence that similarity may play a crucial role in increasing cervical cancer preventative behaviours.

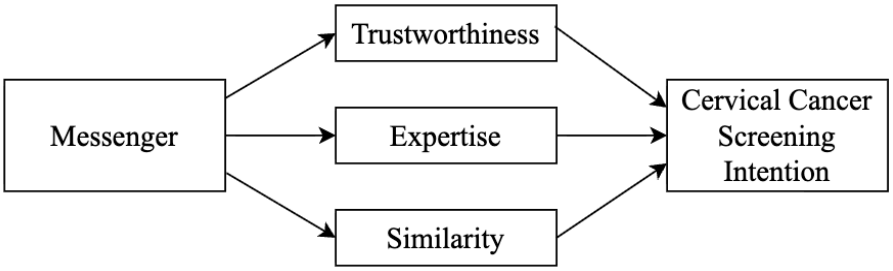
This study connects two conceptual frames: the messenger effect and the source credibility model (Figure 1). A following hypothesis about the messenger effect will be investigated:

H1: The intention to participate in a future cervical screening differs depending on the messenger that presents the information about cervical cancer screening

Furthermore, an exploratory analysis will investigate trustworthiness, expertise and similarity as separate components as well as an overall model. It can be expected that the three components fit well into the suggested model. Additionally, we predict that each messenger will score the highest on one of the components: doctor will score highly on trustworthiness, governmental health organization will score highly on expertise and woman will score highly on similarity. Lastly, it is expected that the dimensions may play a mediating role.

Figure 1

The Source Credibility Model, Adapted from Orhanian (1990)



Methods

Participants

The data collection took place from 27th October 2025 until 13th November 2025. A total of 435 participants took part in the experiment. Only biological women between the ages of 18 and 29 were included in the study. The data has been cleaned, resulting in a removal of 65 participants due to one of the following reasons: not meeting the inclusion criteria (n = 3), not consenting to take part in the study (n = 4), providing no answers on the survey (n = 40) or participating multiple times (n = 18). In a case of multiple attempts, only the first attempt was kept. Data from both attempts was excluded for 1 participant as both attempts were non valid (answering 1 to all questions).

A total of 370 participants were included in the analysis, out of which 292 were first year students of the University of Groningen. The remaining 78 participants were recruited via a university paid participant recruitment platform. The participants could choose between completing the questionnaire in Dutch (n = 209) or English (n = 161).

The participants were asked about their previous screening experience. Out of 370 participants, 10 (2.7%) stated they have previously screened for cervical cancer, 342 (92.4%) have not previously screened and 18 (4.9%) were unsure if they have been screened.

Study Design and Procedure

While the study covered a variety of themes, this paper will focus on the impact of messengers on the intention to engage in cervical cancer screening in the future, as well as on the role the messenger dimensions may play in this relationship. The study followed a 2 × 3 between-subjects design, in which each participant was exposed to a loss or gain framed message as well as one messenger type. The manipulations have undergone independent randomization. The aim of the study was to measure the intention of participants to recommend an HPV vaccination and the intention to participate in cervical cancer screening in a population of biological women between the ages of 18 to 29. This study was approved by the Ethics Committee of the Faculty of Behavioural and Social Sciences of the University of Groningen (PSY-2526-S-0018).

The participants were shown an informed consent page that included a description of the study and its purpose, as well as the consent question. After providing consent, the participants were requested to answer demographic questions (sex and age). Firstly, a pre measure of intention was obtained. The participants were asked to indicate their intention to recommend an HPV vaccination and the intention to engage in cervical cancer screening in the future.

Afterwards the messages were displayed in the following order: loss or gain frame message and messenger message, followed by manipulation check questions. Afterwards, a message with additional information about HPV and cervical cancer was displayed. The intention questions were displayed again, acting as a post manipulation measure of intention. Lastly, the participants were presented with a matrix including questions relating to the Message Dimensions. The relevant survey questions can be found in Appendix B. As this paper is a part of a larger study, only the relevant measures will be discussed.

Measures

Manipulation Description - Messenger

This study aims to look into the effects of different messengers on the intention to engage in cervical cancer screening. Based on the previous research and the specificity of the sample, three messengers were chosen: a healthcare provider (doctor), a governmental health organization (RIVM) and a peer (a woman similar in age). Each participant was randomly assigned to one messenger condition. Each messenger was displayed to approximately the same number of participants: 129 participants saw a message from the Doctor, 124 participants saw a message from RIVM and 117 participants saw a message from another woman. Table 1 presents the content of the messages shown to the participants.

Table 1

The Manipulation - Messages Presented to the Participants

Messenger	Message Content
Doctor	Family doctors encourage all women to get the HPV vaccine and participate in cervical cancer screening when invited.
RIVM	The RIVM (Dutch National Institute for Public Health and the Environment) encourages all women to get the HPV vaccine and participate in cervical cancer screening when invited.
Woman	Sarah, a 20-year old woman who is vaccinated against HPV and intends to participate in cervical cancer screening, encourages all women to get the HPV vaccine and participate in cervical cancer screening when invited.

Intention to Participate in Cervical Cancer Screening

To measure the intention to participate in cervical cancer screening, participants were asked to indicate to what extent they agreed with the statement "If I receive an invitation for cervical cancer screening in the future, I will definitely participate." on a 5-point Likert Scale (1 = *strongly disagree*, 5 = *strongly agree*). This item was presented twice. The intention measure displayed at the start of the survey acted as a baseline measure of intention of the participants (further referred to as pre intention). The second measure was displayed after the manipulation messages were presented, to measure the changes in screening intention (further referred to as post intention).

Manipulation Check

To assess the effectiveness of the messenger manipulation, a manipulation check was included in the survey: "Who gave the recommendation you just saw?" (1 = *Doctor*, 2 = *RIVM,* 3 = *Another woman*, 4 = *I don't know*). The manipulation check was evaluated as a 'pass' or 'fail'. An answer was evaluated as a 'pass' when participants correctly identified which messenger they saw.

A pilot phase, consisting of 67 participants, has shown that many participants were unable to identify which messenger was presented to them. Therefore, the manipulation question was moved. The change resulted in the question being displayed immediately after the messenger manipulation. This resulted in improved ability to correctly identify the messenger.

Messenger Dimensions

The study included 5 questions representing the dimensions of trustworthiness, expertise and similarity (Table 2). The items were presented in a matrix including a 5-point-Likert Scale (1 = *Strongly Disagree,* 5 = *Strongly Agree*). Participants were instructed to base their answers based on the messenger message they had received.

To ensure that the participants were able to adequately score the messengers on the presented dimensions, a message was displayed above the question matrix. The displayed message was the same as the manipulation message that the participant had seen previously.

Table 2

The Messenger Qualities Scale

Theorised Dimension	Question	Source
Similarity	Q1: This speaker is similar to me.	Adapted from Perey, I., & Koenigstorfer, J. (2023)
Expertise	Q2: I would consider this speaker to be an expert on the topic.	McCroskey, J. C. (1966).
	Q3: This speaker has enough knowledge to inform me properly	New item based on: Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995)
Trustworthiness	Q4: This speaker has good intentions in sharing information about the HPV vaccine and cervical cancer screening	New item based on: Mayer, R. C., Davis, J. H., & Schoorman, F. D. (1995)
	Q5: I believe this speaker is trustworthy	Adapted from McCroskey, J. C. (1966)

Analysis Plan

The main analysis will focus on the relationship between intention and the messenger types. Firstly, assumptions of parametric tests will be investigated, followed by a t-test investigating whether the mean intention scores differed between participants that have passed and failed the manipulation check. To test the main hypothesis a Mixed Method ANOVA will be performed. This type of ANOVA consists of two main components: within-subject test and between-subjects tests. The within-subject test investigates whether there are significant differences between the pre intention and the post intention in the sample. The between-subject test investigates whether

the intention change differs between the messenger groups. Additionally, the analysis will investigate whether there is an interaction between the messenger and post intention to determine whether the changes in intention can be attributed to the presence of a messenger.

The exploratory analysis will investigate the messenger dimensions. As the proposed items do not come from an existing scale, a reliability analysis as well as factor analysis (namely Principal Factor Analysis) will be performed to determine whether the items correspond to the Source Credibility Model. Based on the outcomes, new factors will be formed for the use in further analyses.

Furthermore, a mediation analysis will be performed using PROCESS macro version 4.2 by Hayes (2022) for SPSS. The mediation analysis will follow model 4 with the messenger (X), the post intention (Y) as well as the determined factors (M) as mediators. Furthermore, pre intention will be included in the model as a possible covariate.

Results

This research utilized a Mixed Method ANOVA for the analysis.The assumptions for this tests are as follows: continuous dependent variable, between-subjects factor and within-subjects factor has two or more groups, no significant outliers, normal distribution, homogeneity of variances and sphericity (Appendix C). All assumptions were met except the normality assumption, the data is extremely left-skewed (Appendix C, Figure C1 and C2). ANOVA is relatively robust against non-normality, especially considering a large sample size (n = 370). However, non-parametric tests were used where feasible.

Manipulation Check

The participants were presented with a question to determine whether it was clear who was the messenger. Out of 370 participants, 256 (69.2%) passed the messenger manipulation

check. Mann-Whitney Test indicated no significant differences in post intention, between the group that failed and the group that passed the manipulation check ($Z = -0.74$, $p = .458$).

Main Analysis

Mixed method ANOVA with the intention as a within-subject factor and messengers as the between-subject factor was performed to understand the relationship between the intention change and each of the messenger types. The within-subject test found that the post intention increased significantly compared to the pre intention [$F(1,367) = 69.56$, $p < .001$, $\eta^2 = .159$]. The mean cervical cancer screening pre intention 4.07 (SD = 1.16) compared to a mean cervical cancer screening post intention 4.47 (SD = 0.85) in the post intention measure.

However, no significant difference between the messenger conditions was found [$F(2,367) = 0.39$, $p = .677$,$\eta^2 = .002$], suggesting that none of the messengers showed a significantly different change in intention. The interaction effect between the intention change over time and messenger condition was not significant [$F(2,367) = 0.31$, $p = .736$, $\eta^2 = .002$], indicating that a messenger does not influence the change in the screening intention.

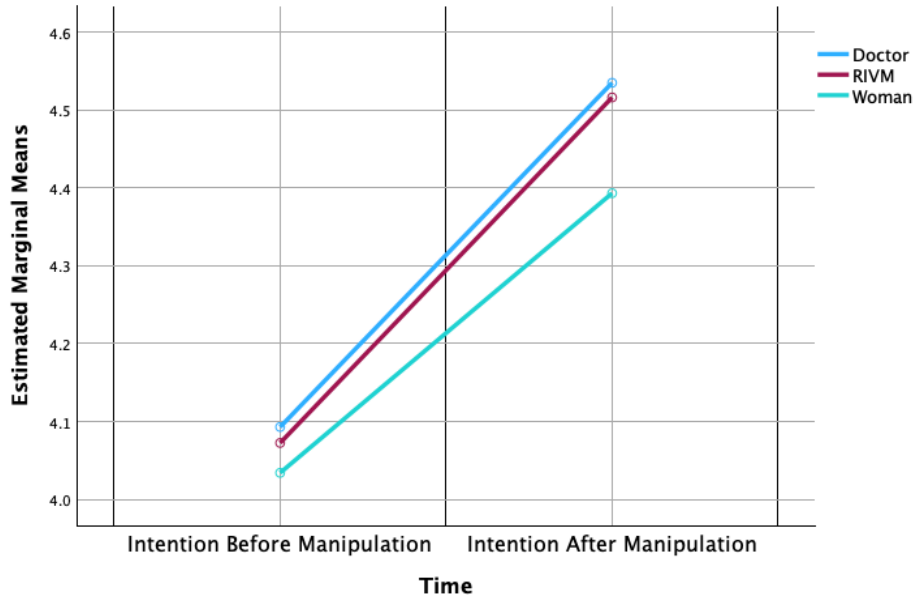
As the normality assumption is violated, two additional non parametric tests were performed to compare the within subject (pre vs. post intention) and between-subject (messenger condition) output of mixed methods ANOVA. The Friedman test showed a significant difference between the pre intention and post intention, $\chi 2$ (1, N = 370) = 87.72, $p < .001$. Additionally, Kruskal-Willis test showed a non-significant difference between the messenger groups, H (2) = 1.66, $p = .435$. The findings from non parametric tests are in line with the findings from mixed methods ANOVA.

The results of Mixed Method ANOVA clearly indicate that each messenger condition was associated with a similar change in intention, therefore leading to rejection of H1. Figure 2

illustrates the intention change per messenger condition. It can be observed that the doctor and RIVM condition have observed almost an identical increase in intention as well as almost identical means at the pre and post conditions. While the increase of intention in the women condition is smaller, the difference is not statistically significant. The insignificant interaction effect suggests that there is not enough evidence to determine whether the messenger conditions had an effect on the intention increase. Furthermore it cannot be determined whether the increase in intention was an effect of another variable.

Figure 2

The Graph of Intention Change Over Time Split by Messenger Type



Note. The y-axis does not start at 0

Messenger Dimensions

The 5 items, aimed at measuring the messenger dimensions, were answered by 366 participants. The Crononbah's alpha of the items was $\alpha = .66$, which is on the cusp of

acceptability. Principal Component Analysis (PCA) was performed to investigate the items. The data was found to be fit for PCA (Appendix C, Table C2)

The PCA factor extraction was performed based on Eigenvalues > 1 (Appendix C, Figure C3). A two-factor structure has been found accounting for a total of 77.43% of the variation, out of which factor 1 accounted for 52.84% and factor 2 accounted for 24.59%. A factor rotation was performed using the Varimax method (Table 3).

Table 3

The Varimax Rotated Component Loadings on Two Factors Obtained From Principal Component Analysis

	Component	
	Expertise (Factor 1)	Similarity (Factor 2)
Q1: This speaker is similar to me.	-.26	.82
Q2: I would consider this speaker to be an expert on the topic.	.91	-.11
Q3: This speaker has enough knowledge to inform me properly	.93	-.02
Q4: This speaker has good intentions in sharing information about the HPV vaccine and cervical cancer screening	.41	.72
Q5: I believe this speaker is trustworthy.	.85	.19

The theoretical background has suggested three-factor structure: Similarity (Q1), Expertise (Q2, Q3) and Trustworthiness (Q4, Q5). The PCA results reveal that the Trustworthiness factor was not reflected. The questions corresponding to the Trustworthiness factor were evenly split among the two factors. The factors appear to reflect Expertise (Q2, Q3, Q5) and Similarity (Q1, Q4) as presented in Table 2 and Table 4.

The internal consistency of the factors was investigated. It has been found that the Cronbach's alpha for the Expertise was $\alpha = .88$ and $\alpha = .28$ for Smilarity. The low value of internal consistency of Similarity warranted additional investigation. Using reliability analysis in SPPS (scale if item deleted), it was found that Q1 has a low negative correlation to the scale ($r = -.131$). Additionally, it was found that if Q1 is excluded, the internal consistency of the scale increases from $\alpha = .66$ to $\alpha = .82$. Based on the findings, PCA (with Eigenvalues > 1) was performed again excluding Q1. It has been found that after removing Q1, all the remaining items formed a single factor, including all questions corresponding to the dimensions of Expertise and Trustworthiness. The merging of two dimensions can suggest that the items measure a larger concept. Issaka et al. (2025) suggest Credibility consists of the dimensions of Expertise and Trustworthiness. Therefore the factor will be referred to as ‘Credibility’. Based on these findings, 2 factors are computed by calculating the mean of all of the relevant items: Similarity (Q1) and Credibility (Q2, Q3, Q4, Q5). Table 5 presents the means of both factors in the sample and per messenger type.

Table 4

The Rounded Mean Scores and Standard Deviation of Credibility and Similarity by Messenger Type

Messenger	Credibility		Similarity	
	Mean	SD	Mean	SD
Doctor	4.46	0.59	3.08	1.07
RIVM	4.46	0.57	2.94	1.05
Woman	3.30	0.64	3.85	1.01
Total	4.09	0.65	3.28	1.24

Note: The values have been rounded for clarity.

It was expected that each of the messengers would correspond to a high score on one of the conditions. As predicted, the woman messengers scored highest on the similarity dimension. However the dimensions of trustworthiness and expertise were merged into one dimension (credibility). Therefore the prediction for the doctor and RIVM messengers could not be established. It was observed that both doctor and RIVM had the same average score of credibility. Therefore it can be assumed that both doctor and RIVM are perceived as equally credible.

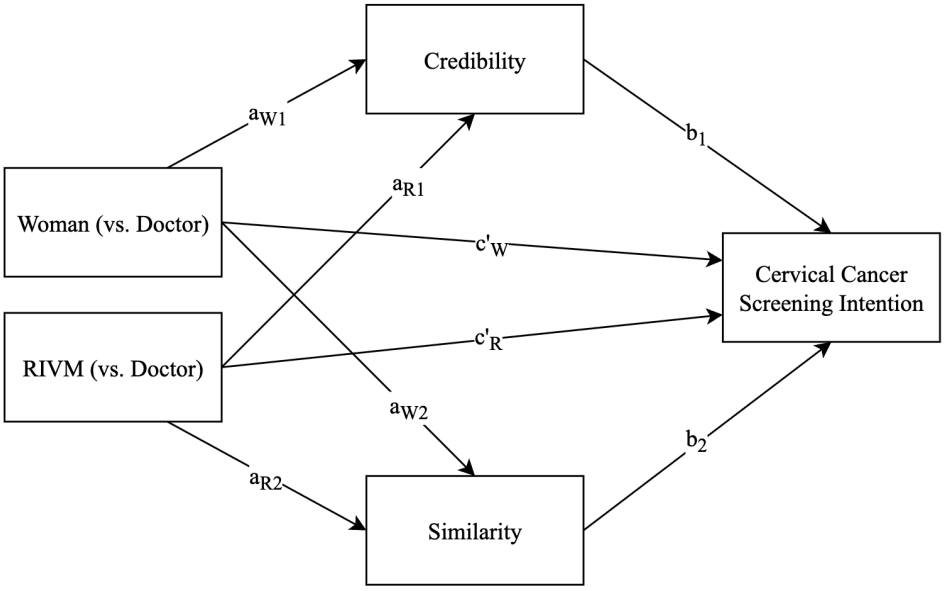
Mediation Analysis

To further investigate the factors and its role in predicting cervical cancer screening intention, a mediation analysis was performed using PROCESS (Hayes, 2022). The analysis was based on mediation model 4 with messenger (X), post intention (Y), similarity (M_1), credibility (M_2) as well as pre intention (covariate). Due to the categorical nature of the Messenger variable,

the 'Indicator' coding system was used. The doctor messenger was chosen as a comparison condition resulting in two dummy variables: Woman (compared to doctor) and RIVM (compared to doctor). The analysis was performed with 95% confidence intervals and 5000 bootstrap samples. The overall model, including 8 paths, is presented in Figure 3.

Figure 3

Mediation Model 4 Including the Paths with Multicategorical Messenger: Woman and RIVM as X, Credibility and Similarity as Mediators and Cervical Cancer Screening Intention as Y.



The model included several A, B and C' paths (Table 5). A-Paths describe the effect of messengers on the mediators. It has been found that only Woman, compared to a doctor, has a significant effect on the Credibility (a_{W1}) and Similarity (a_{W2}) dimensions. However, RIVM compared to a doctor had no effect on either of the mediators (a_{R1} and a_{R2}).

Paths B describe the effect of the mediators on the cervical cancer screening intention. Both Credibility (b_1) and Similarity (b_2) were shown to be significant predictors of cervical

cancer screening intention. However, it is worth noting that the moderators were significant at different levels: credibility at $p < .001$ and similarity at $p = .05$.

Table 5

The Paths (A, B and C') form PROCESS by Hayes for SPSS with Multicategorical Messenger (X), Post Intention (Y), Credibility (M_1), Similarity (M_2) and Pre Intention (Covariate)

	Estimate (B)	SE	*p*	95% CI	
				Lower	Upper
Effect on Credibility					
RIVM (vs Doctor) (path a_{R1})	0.006	0.08	.938	-0.14	0.15
Woman (vs Doctor) (path a_{W1})	-1.15	0.08	<.001	-1.30	-1.00
Effect on Similarity					
RIVM (vs Doctor) (path a_{R2})	-0.14	0.13	.281	-0.39	0.11
Woman (vs Doctor) (path a_{W2})	0.78	0.13	<.001	0.52	1.04
Effect on Intention					
Credibility (path b_1)	0.24	0.06	<.001	0.11	0.36
Similarity (path b_2)	0.07	0.04	.048	0.0007	0.15

The analysis has also found that there was no significant direct effect (path c'_W and c'_R) of either of the messengers on the cervical cancer intention (Table 6). The direct effect explains .14% of variance ($R^2 = .0014$; $F(2,361) = 0.406$, $p = .667$). These findings are in line with the mixed method ANOVA analysis.

Indirect effects investigate whether the factors act as mediators for the relationship between the messenger and cervical cancer screening intention. It has been found that credibility

acts as a mediator only for the relationship between woman (vs. doctor) and the cervical cancer screening intention. Credibility did not have a mediating effect on the RIVM messenger (compared to a doctor). Additionally, similarity was not found to be a mediator for either of the messengers.

The total effect describes the relationship between the messenger and the cervical cancer screening intention without controlling for the mediators. No total effects have been found.

Table 6

The Total, Direct and Indirect Effects from PROCESS by Hayes for SPSS with Multicategorical Messenger (X), Post Intention (Y), Credibility (M_1), Similarity (M_2) and Pre Intention (Covariate)

	Estimate (B)	SE	*p*	95% CI	
				Lower	Upper
Total Effect on Intention					
RIVM (vs Doctor)	-0.005	0.09	.957	-0.19	0.18
Woman (vs Doctor)	-0.11	0.09	.249	-0.30	0.08
Direct Effect					
RIVM (vs Doctor)	0.004	0.09	.966	-0.18	0.18
Woman (vs Doctor)	0.11	0.12	.390	-0.14	0.35
Indirect Effect of Credibility					
RIVM (vs Doctor)	0.001	0.02		-0.04	0.03
Woman (vs Doctor)	-0.27	0.08		-0.45	-0.12
Indirect Effect of Similarity					
RIVM (vs Doctor)	-0.01	0.01		-0.04	0.01
Woman (vs Doctor)	0.06	0.03		-0.007	0.13

Discussion

The aim of this study was to investigate whether the use of messenger can influence the intention to participate in cervical cancer screening. Furthermore, a mediating role of the messenger dimensions was investigated. The H1 suggested that "The intention to participate in a future cervical screening differs depending on the messenger that presents the information about cervical cancer screening.", however the study results have led to the rejection of the hypothesis.

A study by Cartmell et al. (2018) has suggested that women prefer to receive messages about HPV vaccinations from governmental organizations, healthcare providers or a peer. The messengers in this study have corresponded to these categories. The main analysis used mixed methods ANOVA to determine the relationship between the messenger and the cervical cancer screening intention. An increase in intention was observed. However there is no evidence that the increase in intention can be attributed to the use of a messenger. The results show that the intention changes were similar for all of the messengers. Therefore, Hypothesis 1 is rejected. The results are in line with the findings of Amnipur et al. (2022) , as no significant differences were found between the different messenger types.

Furthermore, the questionnaire aimed at measuring the messenger dimensions was investigated through reliability analysis as well as Principal Component Analysis. It has been found that only two dimensions were represented, instead of the expected three. The dimensions of expertise and trustworthiness were merged forming a dimension of credibility. The dimension of similarity was reproduced, however, it was found to not be a reliable measure.

Furthermore, a mediation analysis was performed using PROCESS by Hayes (2022). It has been found that credibility dimension acts as a mediator between woman (vs. doctor) and the

cervical cancer screening intervention. While no other mediating effects were found, the results suggest that both credibility and similarity can serve as independent predictors of cervical cancer screening intention.

The existing research focused mostly on the source credibility dimensions as predictors of cancer preventative behaviours. The results of this study further corroborated the findings of existing literature. Multiple studies have found the source credibility and its separate dimensions are relevant predictors of cervical cancer preventative behaviour as well as the intention to participate in those behaviours (Thon & Jucks, 2017; Ronzani et al., 2022; Issaka et al., 2025).

Theoretical and Practical Implications

This study has contributed to the existing body of literature and to filling the current gap in research. This study took an extensive approach by combining the messenger effect and the source credibility theory. While the messenger effect and the source credibility theory are well established in marketing and communication research (Pornpitakpan, 2004; Ismagilova et al., 2020), they are significantly less utilized in healthcare and psychological research. The approach of this study will hopefully inspire future research to investigate theories and models developed by different disciplines, as they may offer important input that has not been considered previously. The combination of different disciplines allows us to understand the theories and behaviours in a wider and more holistic context.

The study provided further evidence for the messenger effect and source credibility theory in the context of cervical cancer prevention. Many women mention that the messenger matters to them when receiving a message (Cartmell et al., 2018), however the existing research often provides mixed results (Aminpour et al., 2022; Fishman et al., 2017). This study supports

the notion that the messenger does not have a direct effect on the intention to participate in cervical cancer screening. However, more research into the messenger effect in the context of healthcare needs to be conducted in order to reach more reliable conclusions.

This study conducted a mediation analysis to determine whether the credibility and similarity may play a mediating role between a messenger and the cervical cancer screening intention. The literature review did not identify existing research investigating this mediation. The findings are limited, as the mediation was found only for one of the messenger types, however it may provide guidance for the future research. Investigating the mediating effects of the credibility and similarity dimensions may contribute to understanding why and when certain messengers can be effective.

This research can have powerful practical implications, allowing for increasing the participation in cervical cancer screening as well as decreasing cervical cancer rates. These findings should be investigated in more detail, as described in the future study suggestion section. More research in this area will allow to determine an agreed upon effect of the messenger and its perception. Furthermore, understanding the role of these factors may prove to be impactful for the policymakers in the future efforts to decrease the cervical cancer rates.

Study Limitations and Future Directions

This paper is a part of a larger study where the participants were presented two manipulations: message framing and a messenger. It can be argued that the design did not allow to draw independent conclusions about the effect of the messenger as there were other factors potentially impacting the intention of participants. Future studies should further investigate the independent effect of the messenger by only including one manipulation. Furthermore, a

messenger focused survey could be implemented allowing for a more reliable measure of the messenger perception.

Designing a study that includes only messenger manipulation could be beneficial to fully understand the role of a messenger. Furthermore, messenger focused study would allow administering a questionnaire focused on the messenger. The questionnaire should be previously validated as it would ensure that all dimensions would be reflected in the data. Additionally it would be beneficial to investigate whether messenger types can be grouped based on their source credibility dimension scores.

Additionally, the data distribution posed a significant challenge. The data was not distributed normally, a high left side skew could be observed. This assumption violation has significantly limited the available tests. Furthermore the left side skew suggests that the intention scores were high at both the pre and post measure. It can be argued that the high intention at the pre measure, indicating that many women had the intention to participate in cervical cancer screening, leaves little room for improvement.

The homogenous sample may have influenced the high pre intention. All of the participants were recruited via an university programme, were biologically a woman and were between the ages of 18 to 29. It can be concluded that the sample did not represent the general population of women, potentially overestimating the average intention compared to the means found in the population.

Furthermore, the study has no control group. Due to the limitations of the recruitment platform, the predicted sample size was uncertain. Adding a comparison group could have resulted in an insufficient participant number in each of the groups. The study opted for a pre

measure to provide a baseline comparison. While the pre measure did provide important insights, it does not allow for tracking of change over time in a case where no messenger was presented. Therefore, it cannot be predicted whether the absence of a messenger would have resulted in different findings compared to the messenger groups.

The high initial intention as well as the lack of control group can be addressed by conducting a larger study, with recruitment via multiple platforms. The larger sample size would allow the addition of a control group in future studies to ensure a reliable comparison. Furthermore, gathering data from women of different demographic backgrounds may result in a wider variation in intention scores. That could lead to a normally distributed sample as well as counteract the ceiling effect.

This line of research is valuable as it can be translated into real-life applications. Understanding how we can increase the intention to participate in cervical cancer screening, has a potential to save many lives through minimizing the incidence of cervical cancer. Despite the importance of the topic, a significant gap in the literature can be observed.

Conclusion

This study has investigated the messenger effect in the context of intention of cervical cancer screening participation. It appears that the simple presence of a messenger is not sufficient to increase the intention to participate in cervical cancer screening. However it has been found that the perception of the messenger may play a mediating role in that relationship. To fully understand these effects more research needs to be conducted, in the interdisciplinary framework. This line of research is of high importance as it has the potential to save many lives.

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Appendix A - Data Cleaning

PPP Sona: 78 participants remaining

- First remove ourselves (testing, problem solving etc.) - identified by date (prior to it going live) and email address - 3 removed
- Missing data - 10 removed:
    - Removed participants who had zero data: 1 participant
    - Removed participants who had not consented: 1 participant
    - Removed participants who were screened out: 1 participant
    - Removed participants who did not provide any answers, including primary outcomes: 7 participants (primarily duplicates)
- Duplicates by Sona Code (6 removed)
    - 4 participant took part twice - only first (by end date) was kept
        - One seemed to have clicked away right at the end (survey not completed) and participated again to enter email address for payment.
    - 1 participant took part three times - only first was kept

First year Sona: 292 participants remaining

- Removed ourselves - based on SONA ID and blank Sona ID columns - 5 participants
- Missing data: 37 removed
    - Zero data: 0 participants
    - Not consented: 3 participants
    - Screened out: 2 participants (too young)
    - Did not provide any answers: 32 participants (all but 1 were duplicates)
- Duplicates by SONA code: 12 removed

- 11 participants took part twice:
- For the majority of these, the first participation was coded as not completed. They likely participated twice to get assigned SONA points. However, their first case was taken, even if missing most answers, to avoid the impact of seeing different manipulations during their second participation.
- One participant (105079) gave nonsense answers (all 1) in the first attempt, and "normal" answers in the second attempt - in this case both were removed.

Appendix B - Survey

Consent and Study Information

"Cervical cancer screening and hpv vaccinations"

This online survey experiment tests the appropriateness and effectiveness of potential campaign messages to promote the uptake of cervical cancer screening and HPV vaccinations among women aged 18-29.

The survey includes questions about your awareness, intentions, recommendations, and previous behaviours related to cervical cancer screening and HPV vaccinations. It also includes questions about potential factors which may influence people's interest and intention.

By selecting 'yes' to the following questions, you consent to the following:

- I have read the information about the research.
- I understand what the research is about, what is being asked of me, which consequences participation can have, how my data will be handled, and what my rights as a participant are.
- I understand that participation in the research is voluntary. I myself choose to participate. I can stop participating at any moment. If I stop, I do not need to explain why. Stopping will have no negative consequences for me.

Below I indicate what I am consenting to.

Do you consent to participate in this study?

- Yes, I consent to participate. (1)
- No, I do not consent to participate. (2)

Do you consent to processing your personal data?

- Yes, I consent to the processing of my personal data as mentioned in the research information. I know that until 31-01-2026 I can ask to have my data withdrawn and erased. I can also ask for this if I decide to stop participating in the research. (1)
- No, I do not consent to the processing of my personal data. (2)

Relevant Survey Questions

What is your biological sex?

- Female (1)
- Male (2)
- Other (3)
- Prefer not to answer (4)

To which age group do you belong?

- Under 18 (1)
- Between 18-29 (inclusive) (2)
- 30 and older (3)

To what extent do you agree or disagree with the following statement: "If I get an invitation for cervical cancer screening in the future, I will certainly attend."

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree, nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Message Displayed (Messenger)

Who gave the recommendation you just saw?

- Doctor (1)
- RIVM (2)
- Another Woman (3)
- I don't know (4)

What was the message about?

- HPV (1)
- Cervical Cancer (2)
- Cervical Cancer AND HPV (3)
- I don't know (4)

Information Block:

CC and HPV Info Additional information: Cervical cancer is one of the most common cancers among women. In the Netherlands, around 900 people per year get cervical cancer. Cervical cancer is most common among women between 30 and 60 years old. The human papillomavirus (HPV) is the most common cause of cervical cancer. HPV is a sexually transmittable virus, infecting 80-90% of people at some point in their life. Most people do not develop symptoms. The HPV vaccine provides a 95% protection rate against the high-risk types that can lead to cervical cancer. Women who were not vaccinated before 18, can choose to get a catch up vaccine at their family doctors, but are required to cover the costs. Cervical cancer screening can detect if someone is at risk of cervical cancer. If you are between 30 and 60 years

old, you will receive regular invitations for the cervical cancer screening programme. It is important to take part even if you are vaccinated against HPV. You can take part by using a self-sampling test at home or by going to your family doctor for a smear test - both options are free.

To what extent do you agree or disagree with the following statement: "If I get an invitation for cervical cancer screening in the future, I will certainly attend."

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)

Have you previously participated in the cervical cancer screening program?

- Yes (1)
- No (2)
- Not Sure (3)

Messenger Qualities

One of the following messages was displayed matching the previously seen messenger.

- Doctor: Family doctors encourage all women to get the HPV vaccine and participate in cervical cancer screening when invited.
- Woman:Sarah, a 20-year old woman who is vaccinated against HPV and intends to participate in cervical cancer screening, encourages all women to get the HPV vaccine and participate in cervical cancer screening when invited.
- RIVM: The RIVM (Dutch National Institute for Public Health and the Environment) encourages all women to get the HPV vaccine and participate in cervical cancer screening when invited.

Messenger trust: Indicate to what extent you agree or disagree with the following statements.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
This speaker is similar to me. (1)	0	0	0	0	0
I would consider this speaker to be an expert on the topic. (2)	0	0	0	0	0
This speaker has enough knowledge to inform me properly. (3)	0	0	0	0	0
This speaker has good intentions in sharing information about the HPV vaccine and cervical cancer screening. (4)	0	0	0	0	0
I believe this speaker is trustworthy. (5)	0	0	0	0	0

Study Debrief

Thank you again for participating in this online survey experiment on the appropriateness and effectiveness of potential campaign messages to promote the uptake of cervical cancer screening and HPV vaccinations among young women.

The campaign messages and information were designed for the study, based on publicly available health information. To give a bit more background, the study included:
Two types of message frames: gain framed messages about the protection offered by screening and vaccination, and loss framed messages about the risks of not participating in screening and vaccination.
Three types of messengers: A young woman similar to our study population, a doctor, and the RIVM (Dutch Institute of Public Health and Environment).
We randomized which version each participant saw, so you will only have seen one message frame and one messenger. In our study we are hoping to discover which of these message frames and messengers are most effective in the promotion of cervical cancer screening and HPV vaccination.

If you would like further information about:
Cervical cancer screening:
https://www.rivm.nl/en/cervical-cancer-screening-programme/information-materials,
HPV vaccination: https://www.rivm.nl/en/hpv/hpv-vaccination.
If you have questions or concerns about the study, you can contact Veerle Snijders via v.snijders@rug.nl.

Appendix C - Assumptions

Mixed Method ANOVA Assumptions

The assumptions are as follow:

- A dependent variable is measured at a continuous level.
    - Assumption is met as Likert scale data is treated as approximately continuous.
- Within-subject factor has at least 2 groups
    - Assumption is met as Intention is measured 2 times (pre and post)
- Between-subject factor has at least 2 groups
    - Assumption is met as Messenger has 3 groups (Doctor, RIVM and Woman)
- No Outliers
    - Assumption is met as all Cook's distances are < 1(Min = 0.00; Max = 0.079)
- The dependent variable is normally distributed
    - Assumption is not met as indicated by Figure 1
- Homogeneity of Variances
    - Assumption is met as indicated by Table 1
- Sphericity
    - Assumption is met as sphericity is not applicable in this study design.

Figure C1

Histogram of Frequency of Intention Measure Before Seeing the Message (CC_intent_pre)

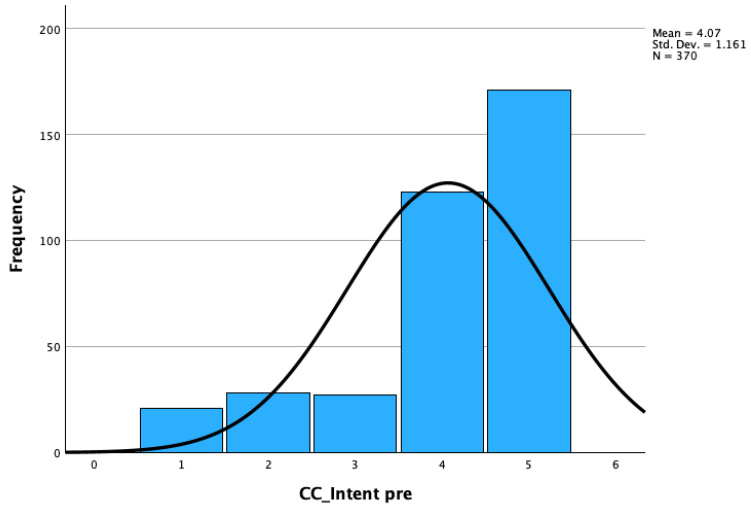

Figure C2

Histogram of Frequency of Intention Measure After Seeing the Message (CC_intent_post)

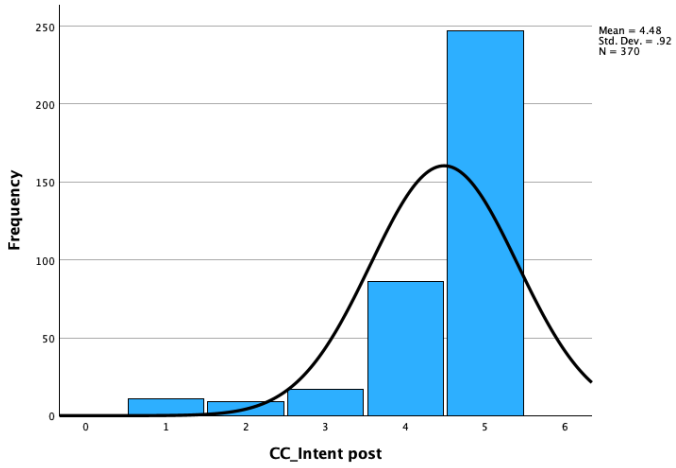

Table C1

Homogeneity of Variances: The Levene Test of Equality of Error Variances

		Levene Statistic	df1	df2	Sig.
PRE	Based on Mean	.052	2	367	.950
POST	Based on Mean	1.192	2	367	.305

Note. Tests the null hypothesis that the error variance of the dependent variable is equal across groups

Principal Component Analysis (PCA)

Table C2

KMO and Bartlett's Test Results

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.712	
Bartlett's Test of Sphericity	Approx. Chi-Square	803.353
	df	10
	Sig.	<.001

Figure C3

The Scree Plot

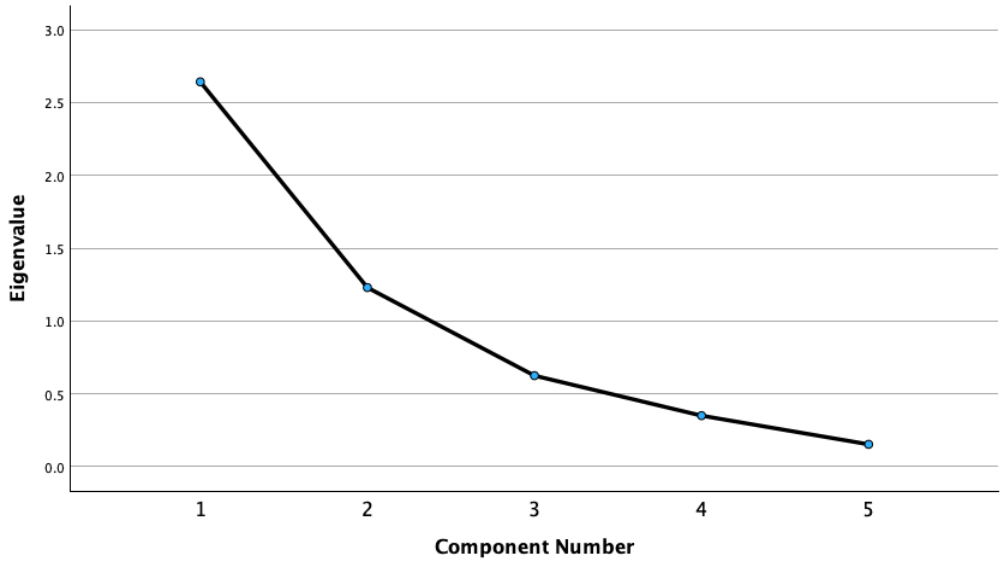

Table C3

Total Variance Explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	2.642	52.838	52.838
2	1.230	24.592	77.430
3	0.625	12.498	89.928
4	0.350	7.005	96.933
5	0.153	3.067	100.000

PROCESS by Hayes Assumptions

- Linear relationship Between the Variables
    - Assumption is met as there is no evidence of non linearity (Figure C4 - Figure C6)
- Normal Distribution of Dependent Variables
    - Assumption is not met as indicated by Figure C1
- Homoscadiscity
    - Assumption is met as indicated in Table C1
- No Autocorrelation
    - Assumption is met as indicated by Durbin-Watson test (Durbin-Watson value = 1.935)
- No Multicollinearity
    - Assumption is met as presented in Table C3
- No Outliers
    - Assumption is met as presented in Mixed Methods ANOVA section

Figure C4

Scatterplot of Post Intention vs. RIVM (a) and Woman (b)

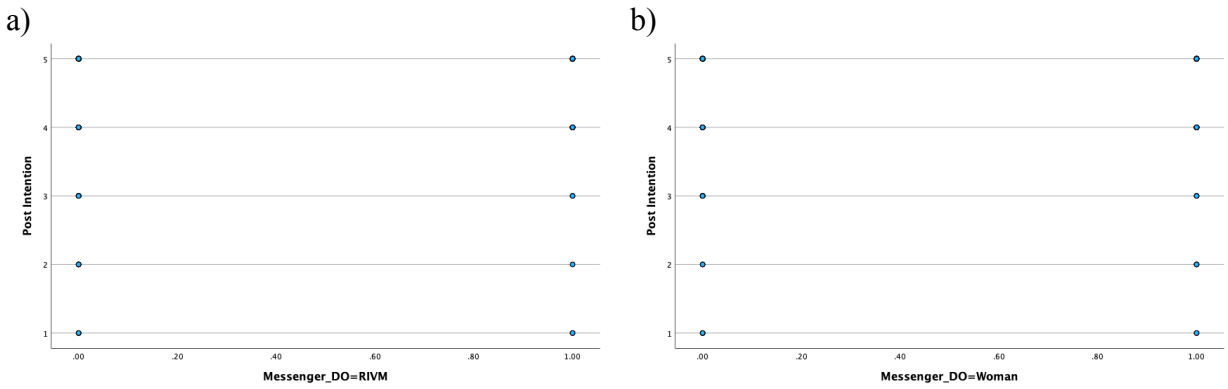

Figure C5

Scatterplot of Credibility vs. RIVM (a) and Woman (b)

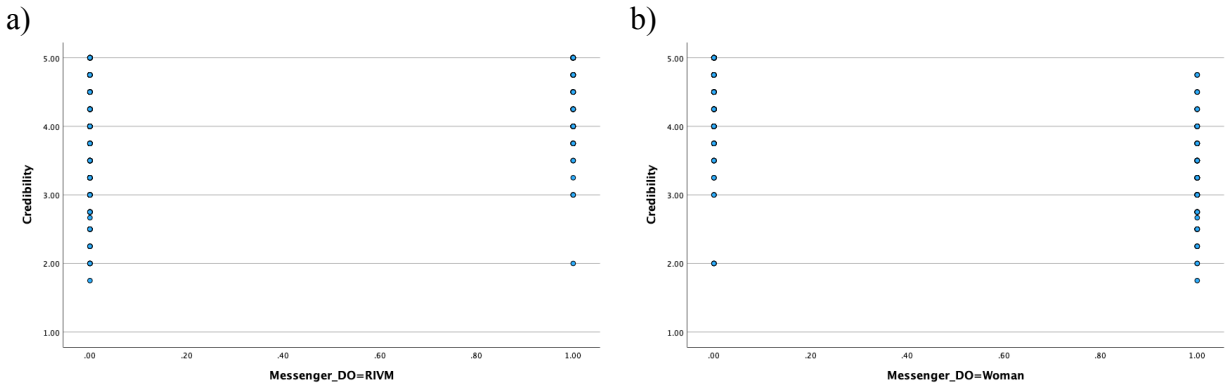

Figure C6

Scatterplot of Similarity vs. RIVM (a) and Woman (b)

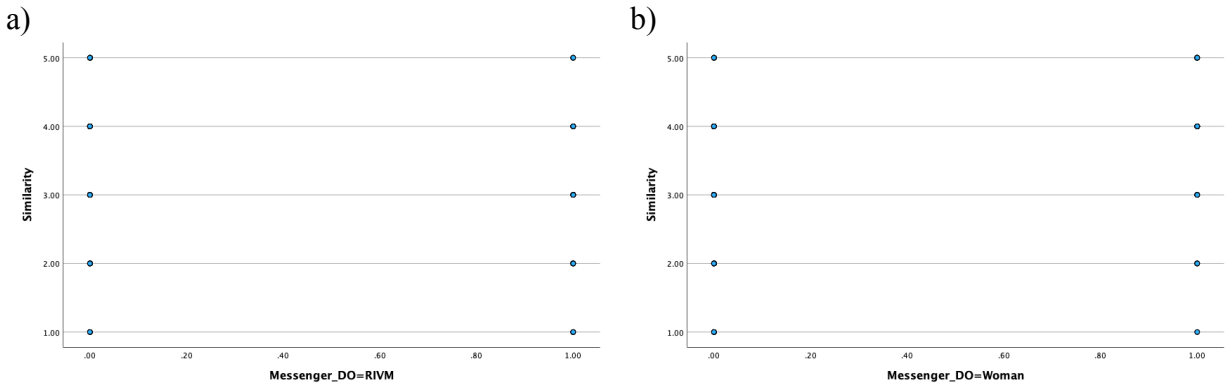

Table C4

Collinearity Statistics: VIF and Tolerance

	Collinearity Statistics	
	Tolerance	VIF
(constant)		
pre_intention	0.968	1.034

Messenger Dimension Score	0.689	1.452
RIVM dummy	0.765	1.307
Woman Dummy	0.576	1.735

Appendix : AI Use Summary

AI System: ChatGTP (https://chatgpt.com/)

- **Prompt 1: "Could you point out any inconsistencies in my text?"**
  - Use: I have used this prompt to see if my text is overall consistent. The output suggested a list of inconsistencies (e.g. conceptual, mismatches, logic and reporting). Based on the output I have read my thesis and corrected any that I did find to be relevant. The output did provide some exact wording, however it was not used in the thesis.
  - Modifications: The text was edited by me to omit the logical fallacies that were pointed out. No text that was suggested by the AI was included.
- **Prompt 2: "Can you suggest terms related to social attractiveness and social modeling?"**
  - Use: During literature review, I found it difficult to find relevant search words to find useful studies. Therefore this prompt was used to identify relevant theories and search terms for databases.
  - Modification: This prompt was used only for background search and was not a part of the text. Therefore no modifications were made, as it was not a part of the text.
- **Prompt 3: APA7 related prompts**
  - Example 1: I run a Principal Component Analysis with Varimax rotation. I included the varimax rotation table in my text. Should I round the values in that table or not according to APA 7 formatting?
  - Example 2: How to round to 2 decimals a value like this 0.0007?
  - Use: This prompt was added in cases when APA 7 rules were not clear to me. It has provided clear directions. Most APA prompts were used for the result section.
  - Modification: Based on the rules and suggestions the chat has provided I have made the edits to all relevant values, based on the given examples.