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Which values relate to vaccine hesitancy and vaccination willingness, receipt, and word-of-mouth? And why? An application of Schwartz's value theory

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ABSTRACT

Objective: Vaccine hesitancy is a major public health concern, and identifying novel antecedents of vaccine hesitancy, such as values, can provide significant contributions to research and practice.

Methods and Measures: We report a three-wave survey study utilizing a sample of older adults (age ≥ 55) from the United States to investigate the mediating role of Howard's vaccine hesitancy dimensions between the relations of Schwartz's values with vaccination willingness, receipt, and word-of-mouth.

Results: Conformity, Universalism, and Self-Direction were the three values with the most consistent relations with these outcomes. Perceptions that vaccines can cause health problems (Health Risks) and/or are ineffective for healthy individuals (Healthy) mediated the effects of Universalism and Self-Direction, but Conformity produced significant relations independent of vaccine hesitancy. Similarly, perceptions that vaccines can cause negative reactions specific to the respondent (Personal Reactions) produced significant relations with outcomes that were independent of values.

Conclusion: These results support the relevance and importance of values to vaccination willingness, receipt, and word-of-mouth. We recommend directions for future research to further explore the relation of values with vaccination willingness and behaviors, and we detail possible interventions focused on values to promote vaccination.

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Values; Schwartz's value theory; vaccination; vaccine hesitancy; preventive behaviours; older adults

Although COIVD-19 vaccines became widely available during the pandemic in the context of the current study, the United States, many U.S. citizens elected not to receive these vaccines (Brehm et al., 2022; Diesel et al., 2021; Sun & Monnat, 2022). This refusal caused scholars and practitioners to recognise that the largest barrier to vaccine receipt in the United States is not accessibility, but it is instead vaccine hesitancy (Dror et al., 2020; Mewhirter et al., 2022; Troiano & Nardi, 2021). Vaccine hesitancy is the reluctance or refusal to vaccinate despite the availability of vaccines (Bussink-Voorend et al., 2022; MacDonald, 2015), and research before and during the

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COVID-19 pandemic has supported that it is among the strongest predictors of vaccination willingness and receipt (Germann et al., 2022; Howard, 2022a; Hu et al., 2022). Perhaps for this reason, vaccine hesitancy has remained at the forefront of scholarly and popular discourse on vaccines as the COVID-19 pandemic transitions to an endemic in the United States (Adepoju, 2022; Baker et al., 2020; Katzourakis, 2022).

A multitude of authors have studied antecedents to vaccine hesitancy to understand how these perceptions emerge and may be modified, but also to determine whether vaccine hesitancy mediates the relations of more distal antecedents and vaccination willingness and behaviours (Argyris et al., 2021; Evans et al., 2021; Howard & Davis, 2023). Authors have investigated an array of deeply held beliefs (e.g. political orientation, conspiracy beliefs) and individual differences (e.g. age, gender, personality) as antecedents to vaccine hesitancy and behaviours (Hornsey et al., 2020; Moore et al., 2021; Pertwee et al., 2022; Robertson et al., 2021). Within the scope of both categories is values. Indeed, 'values are beliefs' that 'transcend specific actions and situations', and they 'refer to desirable goals that motivate action' (Schwartz, 2012, pp. 3–4). A person with a strong Benevolence value, for instance, is motivated to pursue goals associated with aiding others (Schwartz, 1992; Schwartz et al., 2012). Due to the proximity of values to commonly studied antecedents to vaccine hesitancy and behaviours, the current article empirically investigates the links between values, vaccine hesitancy, and vaccination behaviours.

To achieve this goal, we apply Schwartz's (1992) value theory and Howard's (2022a) conceptualisation of vaccine hesitancy (Table 1). Schwartz proposed ten values observed across cultures, which are categorised into four quadrants in a circumplex model. Schwartz's ten values are among the most studied values, with a multitude of studies supporting their validity (Bardi & Schwartz, 2003; Fischer et al., 2010; Knafo

Table 1. Descriptions of Schwartz's values and Howard's vaccine hesitancy dimensions.

Values	Central motivational goal
Schwartz's values	
(1) Conformity	Restraint of actions likely to upset or harm others and/or violate social norms.
(2) Tradition	Commitment to customs and ideas of culture and/or religion
(3) Benevolence	Preservation and enhancement of people around oneself
(4) Universalism	Understanding, appreciation, and protection for all people and nature
(5) Self-Direction	Independent thought and action
(6) Stimulation	Novelty, excitement, and challenge
(7) Hedonism	Pleasure and gratification for oneself
(8) Achievement	Success *via* demonstrating competence defined by social standards.
(9) Power	Social status and dominance over people and resources.
(10) Security	Safety and stability of society, relationships, and oneself.
Dimension	**Definition—Each begins with 'The belief that vaccines…'**
Howard's vaccine hesitancy dimensions	
(1) Health Risks	Can be damaging to well-being.
(2) Cost	Are expensive.
(3) Physical Pain	Are painful to receive.
(4) Inconvenience	Are bothersome to receive.
(5) Personal Reactions	Cause side effects specific to the participant (e.g. allergic reactions).
(6) Access	Are difficult to obtain due to scarcity.
(7) Healthy	Are not needed due to the participant's good physical condition.
(8) Forget	Are easy to accidentally ignore.

Notes: Central motivational goals adapted from Schwartz and Bardi (2001). Vaccine hesitancy dimension definitions adapted from Howard (2022a).

et al., 2011). Further, Howard proposed that eight dimensions underlie vaccine hesitancy, each representing negative perceptions of vaccines. Many studies have supported the validity of the conceptualisation and associated operationalisation, the Multidimensional Vaccine Hesitancy Scale (MVHS) (Howard, 2022a, 2022b, 2024; Howard & Davis, 2023), with Balgiu et al. (2022) stating, 'the MVHS is suitable for medical practice and for research on the analysis of vaccination behaviours and intentions'. In the current article, we hypothesise that specific values and vaccine hesitancy dimensions relate to vaccination willingness and behaviours, with vaccine hesitancy ultimately mediating the relations of the values and vaccination willingness and behaviours; however, we also study both perspectives in their entirety, monitoring whether unexpected values and vaccine hesitancy dimensions produce significant relations with vaccination willingness and behaviours.

By studying values and vaccine hesitancy together, the current article provides many implications for research and practice. First, identifying the determinants of vaccine hesitancy is a critical health priority (Brehm et al., 2022; Diesel et al., 2021; Sun & Monnat, 2022). Due to the proximal nature of values to known antecedents, the current article may uncover powerful influences on vaccine hesitancy, leading to both more comprehensive models and more effective interventions. Second, our results can identify novel theories and frameworks useful for the study of vaccine hesitancy. For instance, many values are associated with moral beliefs about the treatment of others (Caprara et al., 2009; Sinn, 2019). If these values relate to vaccine hesitancy or vaccination willingness and behaviours, then theories and frameworks associated with moral beliefs may be applicable for the study of vaccination. Third, research has repeatedly linked political orientations with vaccination willingness and behaviours (Hao & Shao, 2022; Howard, 2024; Kannan & Veazie, 2018). Given the known importance of values in predicting political orientations, our results may produce inferences regarding why and how these linkages develop. Fourth, we study the vaccination willingness, receipt, and word-of-mouth. The first two outcomes relate to personal health, but the latter can influence whether others decide to receive vaccines—enabling the current article to identify relations with broad impacts. Thus, the current article provides valuable theoretical implications and needed methodological insights.

Before continuing, however, the merits of our sample selection should be emphasised. Prior research has almost solely studied the MVHS with samples of general participants (Balgiu et al., 2022; Howard, 2022a, 2022b, 2024; Howard & Davis, 2023). The current article utilises a sample of older adults due to their heightened ramifications for vaccination, as older adults are more susceptible to illness and suffer more extreme outcomes from illness. Understanding vaccination behaviours in this population can produce a disproportionate impact, as increasing vaccination rates in older adults is more likely to save lives. In doing so, we provide psychometric and validity evidence for the applicability of the MVHS to this population, enabling researchers to more soundly study this at-risk population. Further, we also study participants solely from the United States, where vaccination has become particularly politicised (Hornsey et al., 2020; Moore et al., 2021; Pertwee et al., 2022). While those from some countries may view vaccination as relatively independent from values or politics, vaccination has certainly become intertwined with values and politics in the United States. Values may produce a stronger relation with vaccine hesitancy and behaviours in the United States, given the association

of vaccines with values and politics. If these relations are supported, future studies could then investigate whether these results hold in other contexts, providing many avenues for future research directions. If not supported, then there would likely be little reason to study these results in alternative contexts, as it would be less likely for these relations to be even stronger in alternative contexts. Therefore, focusing on the United States provides direct insights into this important context, but it also provides significant considerations for alternative contexts.

Background

General relevance of values

While many conceptualizations of values exist, Schwartz's (1992) value theory is among the most supported and widely researched (Bardi & Schwartz, 2003; Fischer et al., 2010; Knafo et al., 2011). Schwartz's theory proposes that values are beliefs that motivate action towards desirable goals and transcend specific actions and situations (Schwartz, 2012). Values are thereby differentiated by their associated goal(s), and Schwartz's theory identifies ten values that can be organised into four quadrants within a circumplex. These quadrants (and respective values) are Self-Transcendence (Universalism and Benevolence), Conservation (security, Conformity, and Tradition), Openness to Change (Self-Direction, Stimulation, and Hedonism), and Self-Enhancement (Achievement, Power, and Hedonism) (Hedonism falls within two quadrants) (Schwartz, 2012). When proposing relations of the values, researchers often theorise effects of specific values, but they also frequently theorise effects of all values within a quadrant together (Lindeman & Verkasalo, 2005; Schmitt et al., 1993; Schwartz, 2007).

Schwartz's structure of value is replicable across cultures, and differences in these values can be seen across cultures; however, the values of people in a culture also significantly differ, and researchers perhaps more frequently study the relations of values at the individual-level than the cultural-level (Fischer et al., 2010; Hemsey & Dahling, 2023). These individual-level studies have repeatedly shown that values relate to important personal outcomes, such as behavioural descension making and well-being (Grosz et al., 2021; Roets et al., 2012; Sortheix & Schwartz, 2017). In the current article, we follow both of these trends. We propose the relations of both a specific value and an entire quadrant, and we study values at the individual-level to determine whether and which personal values relate to vaccination willingness and behaviours.

Further, many models elucidate the manner that values impact cognitions and behaviours, and we apply the moral decision-making framework of Garrigan et al. (2018). This framework proposes that people undergo six steps when making a moral decision: (1) Encoding of Cues, (2) Interpretation of Cues, (3) Clarification of Goals, (4) Response Access or Construction, (5) Moral Response Decision, and (6) Behaviour Enactment. This framework also suggests that various individual differences may impact each of these steps, with values included in the scope of 'Database' features. Values are most often considered in Steps 4 and 5 of this process, as researchers often only consider how these values impact the construction of responses to events; however, values also paint the encoding an interpretation of cues, which is seen as early as Steps 1 and 2 of this process. For instance, a person who scores high on

Universalism and Benevolence may view opportunities to benefit others, such as vaccination, as a more positive cue than others, resulting in their increased likelihood of performing this behaviour. Therefore, their powerful effect to paint both the interpretation of and responses to cues causes values to be an influential motivator of all human behaviour—but especially moral behaviour.

Relevance of specific values

We first suggest that the two values within the Self-Transcendence quadrant relate to positive vaccination willingness and behaviours, which are Universalism and Benevolence. Universalism refers to the understanding, appreciation, and protection for all people and nature, whereas Benevolence refers to preservation and enhancement of people around oneself (Cieciuch & Schwartz, 2012; Saroglou et al., 2004; Schwartz, 2007, 2012). Both values reflect a general prosocial orientation, but the former focuses this motivation on all people, whereas the latter focuses this motivation on immediate others. Vaccines protect oneself from illness, but they also protect those around the recipient from receiving illnesses by transmission (Dhama et al., 2021; Milman et al., 2021). The community protection of vaccines became abundantly apparent during the COVID-19 pandemic, wherein the concept of herd immunity was a significant discussion point of popular press and academic articles alike (Britton et al., 2020; Omer et al., 2020). Due to the beneficial community impacts of vaccines, we suggest that those with greater values associated with protecting others are more likely to become vaccinated, resulting in a positive relation of Universalism and Benevolence with positive vaccination willingness and behaviours.

Alternatively, we also propose that Self-Direction relates to negative vaccination willingness and behaviours. Self-Direction refers to the preference for independent thought and action (Cieciuch & Schwartz, 2012; Saroglou et al., 2004; Schwartz, 2007, 2012). During the COVID-19 pandemic in the United States, popular press and academic articles alike recognised that many people expressed extreme displeasure regarding the perceived infringement of vaccination on their personal rights (Savulescu et al., 2021; Smith et al., 2021). These people felt that their bodily autonomy was violated by vaccination, suggesting that they particularly valued their independence and autonomy. In some cases, this desire for independence resulted in a distrust of others, including the government, scientists, and healthcare professionals (Kroke & Ruthig, 2022; Tomljenovic et al., 2020; Wirawan et al., 2021). This demand for independence was reflected in popular discourse surrounding other preventative behaviours during the COVID-19 pandemic, such as face mask wearing (Howard, 2020; Pascual-Ferrá et al., 2021). Because those who particularly value independence are believed to perceive vaccines as invasive, we predict that Self-Direction negatively relates to positive vaccination willingness and behaviours.

Oher values may relate to vaccination willingness and behaviours, but we do not hypothesise relations of any other dimensions due to modest theoretical rationale. A benefit of applying Schwartz' value theory is to investigate a wide array of values and potential emergent relations. Therefore, significant relations that were not hypothesised do not refute our arguments or hypotheses, but they instead demonstrate a benefit of the current investigation.

Hypothesis 1: (a) Universalism and (b) Benevolence negatively relate to vaccination negative word-of-mouth and positively relate to willingness, receipt, and positive word-of-mouth. (c) Self-Direction positively relates to vaccination negative word-of-mouth and negatively relates to willingness, receipt, and positive word-of-mouth.

Mediating role of vaccine hesitancy

Vaccine hesitancy is the reluctance or refusal to vaccinate despite the availability of vaccines, and many conceptualizations and operationalizations of vaccine hesitancy exist (Bussink-Voorend et al., 2022; MacDonald, 2015). While each of these conceptualizations and operationalizations reflect negative perceptions regarding vaccines, they differ regarding the number and nature of representative dimensions. In the current article, we apply Howard's (2022a) eight-dimension conceptualisation due to prior psychometric and validity support and ability to explain more variance in vaccination willingness and behaviours than other conceptualizations (Balgiu et al., 2022; Howard, 2022a, 2022b, 2024; Howard & Davis, 2023). While a benefit of Howard's (2022a) conceptualisation is the wide range of negative perceptions about vaccines included within its scope, two dimensions have emerged as most dominant in prior research (Howard, 2022a, 2022b, 2024; Howard & Davis, 2023).

The first is Health Risks, which refers to the belief that vaccines can be detrimental to physical well-being (Howard, 2022a). The second dominant dimension is Healthy, which refers to the belief that vaccines are not needed due to the good physical well-being of the respondent (Howard, 2022a). The dominance of these two dimensions may be due to the common negative sentiments shared regarding vaccines during the COVID-19 pandemic. Researchers repeatedly observed widespread conspiracy beliefs regarding COVID-19 vaccines, and two of the most common sentiments were that vaccines are unsafe and ineffective because they were designed for ulterior purposes (Kroke & Ruthig, 2022; Tomljenovic et al., 2020; Wirawan et al., 2021). Health Risks and Healthy both show a clear relevance to the common misinformation shared during the COVID-19 pandemic. We do not argue that those who hold these perceptions necessarily engage in conspiratorial thinking, but we instead suggest that the widespread nature of these sentiments increased the prevalence of these two dimensions. That is, even those who do not hold vaccine conspiracy beliefs may have these negative perceptions of vaccines due to the frequent sharing of these sentiments. In turn, expression of these beliefs caused these two dimensions to be among the strongest predictors of vaccination willingness and behaviours.

Due to their dominance in research, we propose that these two dimensions significantly relate to vaccination willingness and behaviours. Like values, we do not argue that other dimensions do not relate to these outcomes, per se, but instead their relations are not firm enough given prior research to hypothesise. Therefore, the significant results of other dimensions would not refute our arguments or hypotheses, as these relations could be expected to some extent.

Hypothesis 2: (a) Health Risks and (b) Healthy positively relate to vaccination negative word-of-mouth and negatively relate to willingness, receipt, and positive word-of-mouth.

Vaccine hesitancy and its dimensions are an immediate antecedent to vaccination willingness and behaviours (Adepoju, 2022; Baker et al., 2020; Germann et al., 2022; Hu et al., 2022), and they are expected to mediate the relation of more distal antecedents with vaccination willingness and behaviours. Those with greater values associated with prosocial motivation (Universalism and Benevolence) are expected to have less negative perceptions regarding vaccines (Health Risks and Healthy), which in turn results in more positive vaccination willingness and behaviours and fewer negative vaccination willingness and behaviours. Those with greater values associated with independence (Self-Direction) are expected to have more negative perceptions regarding vaccines (Health Risks and Healthy), which in turn results in less positive vaccination willingness and behaviours and more negative vaccination willingness and behaviours.

Hypothesis 3: (a) Health Risks and (b) Healthy mediate the relations of Universalism, Benevolence, and Self-Direction with vaccination willingness, receipt, positive word-of-mouth, and negative word-of-mouth.

Our study also tests the interrelations of all other values, vaccine hesitancy dimensions, and outcomes in an exploratory manner, which was performed for two primary reasons. First, values are rarely studied *via* an individual or piecemeal approach. Variance is shared between values. Studying one or two values in isolation would not account for this shared variance, causing any one value to appear more related to our outcomes than would otherwise seem when studied alongside other values. For this reason alone, it is essential to study entire value frameworks together rather than one or two values in isolation. Second, even if a theoretical rationale exists for the relations of one or two values, it is most common in the study of values to include the others to test in an exploratory manner (Bardi & Schwartz, 2003; Fischer et al., 2010; Knafo et al., 2011; Sinn, 2019). By utilising this approach, researchers can provide theory-driven assessments of certain values, but they can also identify any unanticipated relations for alternative values. This approach hastens theorising on the study of values, as it provides a greater number of results to draw from. Therefore, simultaneously assessing the hypothesised relations and others in an exploratory manner is ideal for the study of values.

Methods

Participants

Participants ($M_{age} = 62.55$, $SD_{age} = 7.45$, 63% female, 91% white, 100% United States) were recruited from Prolific and provided a small amount of monetary compensation. Prolific is an online service that connects those needing surveys completed with those willing to complete surveys, and studies have supported the validity of results obtained *via* Prolific when certain precautions are taken (Palan & Schitter, 2018; Peer et al., 2022; Stanton et al., 2022). We took those precautions, including utilising a time-separated research design and removing participants that failed more than one of seven attention checks. Our reported sample sizes below reflect our study after

removing two participants who failed more than one attention checks. We restricted participation to only those 55 years of age or older and located in the United States.

Procedure

As discussed below, our most sample-size intensive analyses were our tests of indirect effects, which were performed by calculating bias-corrected bootstrapped estimates. We considered an indirect effect produced by two small-to-moderate direct effects to be meaningful, as an indirect effect otherwise produced by two small direct effects would ultimately have little impact on our studied outcomes. According to the statistical power tables of Fritz and MacKinnon (2007), the necessary sample size to detect this effect when utilising bias-corrected bootstrapped estimates is 148, which was the minimum intended sample size for our study. Because we utilised a three-wave research design, we recruited twice as many participants needed at Time 1 to ensure that our final sample met this minimum recommended sample size.

Participants enrolled in the study online *via* the Prolific platform, and they immediately completed the first survey of values alone ($n = 297$). One week after the first survey, participants completed a second survey of the vaccine hesitancy dimensions ($n = 269$). One week after the second survey, participants completed a survey with all outcome variables ($n = 237$).

We performed a series of *t*-tests to determine whether the demographic characteristics differed between those who did and did not participate in all three surveys. We found that participants did not differ regarding their age or race (both $p > .05$), but they did slightly differ regarding their gender ($p = .03$). Women were slightly more likely not to participate in all follow-up surveys than men. Given that our sample was already slightly over-representative of women, we believe that this observation is not concerning for the interpretation of our results.

Measures

Values

We utilised the 57-item version of the Schwartz Value Survey (Schwartz, 1992). This survey asks participants to indicate the extent that certain values are important to them, and we utilised a scale from 0 (Not Important) to 7 (Of Supreme Importance). Example items are 'A World at Peace (free of war and conflict)' (Universalism), 'Freedom (freedom of action and thought)' (Self-Direction), and 'Honest (genuine, sincere)' (Benevolence). In the current study, each dimension had a Cronbach's Alpha of .65 or above.

Vaccine hesitancy

We used the MVHS (Howard, 2022a), which contains four items for each of eight dimensions (32 items total). Example items are 'Vaccines can cause long-term health issues' (Health Risks) and 'People in my physical condition do not need vaccines' (Healthy). The Cronbach's alpha of each dimension was .84 or above. Because the use of the MVHS for older adults is a novel application, we performed a confirmatory

factor analysis (CFA) to ensure that it demonstrates appropriate psychometric properties. We modelled the eight covaried dimensions as described by Howard (2022a), and we applied the author's cut-offs for appropriate model fit (CFI > .92, RMSEA < .08, SRMR < .08, $\chi^2/df < 4$). Our CFA met these cut-offs (CFI = .93, RMSEA = .07, SRMR = .07, $\chi^2/df = 2.31$), and each item produced a strong factor loading (≥.57). These findings support the use of the MVHS with older adults.

Vaccination willingness

We measured flu vaccination willingness and COVID-19 vaccination willingness with two items each, which have been used in multiple studies (Howard, 2022a, 2022b, 2024; Howard & Davis, 2023). These items read, 'Please indicate how willing you would be to get a [flu vaccine/COVID-19 vaccine (or booster vaccine shot if already received vaccine] next year if it was [free/US$40.00]'. During the study period, flu vaccines were about US$40 when not covered by insurance. While COVID-19 vaccines were provided by the government, they were expected to be about US$40 when no longer provided. Thus, we felt that asking participants about their willingness to receive these vaccines for free and US$40 were appropriate frames-of-reference. For both types of willingness, we averaged the two representative items together, such as the two items that referred to receiving flu vaccines for free and US$40.00. The Cronbach's alphas for the two pairs were above .86. Because a US$40 fee never occurred for COVID-19 vaccines during the study period, we also analysed the two items for COVID-19 vaccine willingness as two separate outcomes. Supplemental Material A provides these results, and the inferences from these findings are consistent with those reported in the primary text. This finding indicates that our observations were not driven by the choice to study these two items together, providing significant support for the robustness of our findings. We report these items analysed together in the primary text due to the simplicity of reporting.

Vaccine receipt

We measured three different forms of vaccine receipt as three entirely separate outcomes: flu vaccine receipt, COVID-19 vaccine receipt, and other vaccine receipt. To measure flu vaccine receipt, we asked participants, 'Have you received the flu vaccine within the past year?' To measure other vaccine receipt, we asked participants, 'Other than the flu and COVID-19 vaccine, are you up to date on your vaccines?' For these two outcomes, we coded responses as 1 (Yes) or 0 (No). To measure COVID-19 vaccine receipt, we asked participants two questions: 'Have you ever received the COVID-19 vaccine?' and 'Have you tried to receive the COVID-19 vaccine but were unable to receive it due to factors outside of your control?' Responses were coded as 1 if participants answered 'Yes' to either and coded as 0 if participants answered 'No' to both. This approach is common in current research (Howard, 2022a; Perez et al., 2016; Shapiro et al., 2016), but it should be recognised that receiving and trying but not receiving are two phenomenologically different outcomes. For readers interested in the analysis of these two responses separately, Supplemental Material A provides these corresponding results. Our inferences were consistent regardless of whether these items were analysed together or separately, indicating that our observations

were not driven by the choice to study these two options together and providing significant support for the robustness of our findings. We report these items analysed together in the primary text due to the simplicity of reporting.

Word-of-mouth

As done in prior research (Howard, 2022b; Howard & Davis, 2023), we measured negative and positive word-of-mouth with three items each on 1 (Strongly Disagree) to 7 (Strongly Agree) scales. These scales referenced negative and positive word-of-mouth in general, rather than regarding specific vaccines. Example items were 'I share negative information about vaccines on social media' (negative word-of-mouth) and 'I tell others about the benefits of vaccines' (positive word-of-mouth). Cronbach's alphas were .83 or above.

Analyses

In all analyses, we simultaneously assess the effect of each value while accounting for all other values, as well as the effect of each vaccine hesitancy dimension while accounting for all values and other vaccine hesitancy dimensions. By doing so, we observe the effects of each antecedent while accounting for all other antecedents as well as the effects of each mediator while accounting for all other antecedents and mediators. Also, we conducted many analyses, which poses concerns for significant results being spurious effects. For this reason, we assess the number of significant relations with outcomes for each predictor rather than focusing on specific effects, which can address concerns with over-extrapolating from specific findings that may be spurious effects. For instance, we determine whether our hypotheses are (un)supported by assessing the total number of significant relations produced by the values and vaccine hesitancy dimensions (e.g. six of seven significant relations with outcomes), rather than interpreting specific significant relations as supportive of hypotheses (e.g. relation of Healthy and COVID-19 vaccination). Our data is provided at the following OSF link: https://osf.io/4uqfe/overview?view_only=0efafcda9d4a4c319b734640a395e952.

To test our hypotheses, we performed linear regression analyses to assess the relations of any predictors with a continuous outcome. We performed binomial regression analyses to assess the relations of any predictors with a dichotomous outcome. To test our mediating effects, we used Hayes's (2017) PROCESS macro to assess specific and total indirect effects of the values on the outcomes *via* the vaccine hesitancy dimensions. This macro is among the most accurate approaches to testing mediation, as it provides bootstrapped estimates that are accurate for both non-dichotomous and dichotomous outcomes. These analyses provide accurate assessments of our studied relations given the characteristics of our data.

Results

Hypothesis tests

Supplemental Material A provides means, standard deviations, correlations, and Cronbach's alphas. We conducted eight linear regression analyses with all values

Table 2. Linear regression results of values predicting vaccine hesitancy dimensions.

	Health risks	Cost	Physical pain	Inconv.	Personal reactions	Access	Healthy	Forget
(1) Conformity	.16	−0.09	−0.03	−0.10	.00	−0.04	.16	.02
(2) Tradition	.04	**.20***	.19	**.22***	.11	.05	.00	.18
(3) Benevolence	.04	−0.14	−0.16	**−0.23***	.02	−0.05	−0.06	−0.18
(4) Universalism	**−0.35***	−0.09	.04	−0.06	−0.08	−0.02	**−0.22****	−0.05
(5) Self-direction	.13	.13	−0.05	.09	.14	−0.02	**.22****	.07
(6) Stimulation	.03	−0.03	−0.05	.01	−0.06	.13	.08	−0.07
(7) Hedonism	.02	.06	.05	.01	−0.04	−0.10	.01	.04
(8) Achievement	.11	.07	.01	.01	−0.01	**−0.21***	−0.00	−0.06
(9) Power	.04	**−0.18***	−0.01	−0.04	**.21***	.10	−0.03	−0.01
(10) Security	−0.16	.09	.10	.03	**−0.19***	.07	−0.10	.04
R^2	**.13****	.06	.04	.05	.06	.05	**.07***	.04

Incov.: inconvenience.
Note. Statistically significant results ($p < .05$) indicated in boldface.
*$p < .05$.
**$p < .01$.

predicting each vaccine hesitancy dimension (Table 2). While not used to test our hypotheses, this analysis provides insights into the first step of potential indirect effects (i.e. *a path* in standard mediation notation; Fritz & MacKinnon, 2007). No value was dominant in relation to the vaccine hesitancy dimensions. Tradition, Benevolence, Universalism, and Power each related to two dimensions (all $p < .05$), whereas Self-Direction related to one ($p < .01$). All other values did not relate to any vaccine hesitancy dimensions (all $p > .05$).

We conducted seven regression analyses with all values predicting each outcome (Table 3). These analyses provide insights into the overall relation between our predictors and our outcome (i.e. *c path*), and they are used to test Hypothesis 1. Universalism related to six of the seven outcomes (all $p < 05$); Conformity and Self-Direction both related to three outcomes (all $p < .05$), and Hedonism and Security each related to one outcome (all $p < .05$). All other values did not relate to any outcome (all $p > .05$). Hypothesis 1a and 1c were supported, as Universalism and Self-Direction were among the values most frequently related to the outcomes; however, Hypothesis 1b was not supported, as Benevolence was not significantly related to any outcome.

We conducted another set of seven linear and binomial regression analyses with all values and vaccine hesitancy dimensions predicting each outcome (Table 3). These analyses provide insights into the relation of the vaccine hesitancy dimensions and outcomes while accounting for the values (i.e. *b path*), and they are used to test Hypothesis 2. The vaccine hesitancy dimensions of Heath Risks, Personal Reactions, and Healthy related to both willingness outcomes (all $p < .05$). For the three receipt outcomes, Healthy related to all (all $p < .01$); Health Risks related to COVID-19 vaccine receipt ($p < .01$), and Personal Reactions related to flu vaccine receipt ($p < .05$). For the two word-of-mouth outcomes, Health Risks related to both (all $p < .05$), and Inconvenience and Healthy related to positive word-of-mouth (all $p < .05$). In all, Healthy significantly related to six outcomes; Health Risks related to five; Personal Reactions related to three outcomes; and Inconvenience related to one outcome. These results support Hypothesis 2a and 2b, as Health Risks and Healthy related to most outcomes.

Table 3. Regression results of values and vaccine hesitancy dimensions predicting outcomes.

	Flu vaccine willingness[a]		COVID-19 vaccine willingness[a]		Flu vaccine receipt[b]		COVID-19 vaccine receipt[b]		Other vaccine receipt[b]		Negative word-of-mouth[a]		Positive word-of-mouth[a]	
	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2
(1) Conformity	**−0.25***	**−0.17***	**−0.32****	**−0.20****	**.61***	.54	.75	.98	.67	.77	−0.01	−0.10	−0.12	−0.00
(2) Tradition	−0.01	.05	−0.01	.02	1.10	1.36	1.05	1.88	1.07	1.23	.13	.09	−0.06	−0.08
(3) Benevolence	−0.07	−0.07	−0.06	−0.04	1.17	1.06	.69	.39	1.52	1.10	.05	.04	−0.09	−0.06
(4) Universalism	**.32****	.09	**.44****	**.18****	**1.45***	1.07	**2.05****	1.28	1.01	.86	**−0.32****	−0.10	**.39****	**.20****
(5) Self-direction	**−0.27****	−0.10	**−0.28****	**−0.11***	.67	.92	**.52***	.74	.73	1.00	.12	.01	−0.11	.01
(6) Stimulation	.04	.07	.01	.06	1.09	1.13	1.03	.97	1.51	**1.82***	.10	.07	.06	.12
(7) Hedonism	−0.04	−0.02	−0.02	−0.01	.95	.94	1.17	**2.18***	**.52***	**.46****	−0.01	−0.02	−0.04	−0.03
(8) Achievement	.10	.13	.12	**.15***	1.21	1.22	1.23	**3.03***	1.16	1.19	−0.03	−0.08	.11	.09
(9) Power	−0.06	−0.08	−0.04	−0.04	.89	.99	.95	1.01	1.16	1.15	.06	.05	−0.01	−0.01
(10) Security	**.20***	.12	.07	−0.03	1.32	1.34	1.02	**.35***	1.37	1.22	−0.07	.03	.15	.09
(11) Health risks		**−0.16***		**−0.34****		.89		**.23****		1.23		**.47****		**−0.16***
(12) Cost		−0.06		−0.05		.89		1.28		1.23		−0.01		.07
(13) Physical pain		−0.05		.00		.84		1.15		.75		.01		−0.10
(14) Inconvenience		−0.02		.03		.99		.90		.78		.14		**.19***
(15) Personal reactions		**−0.17****		**−0.11***		**.56***		.60		.78		.04		−0.02
(16) Access		.13		.03		1.41		.57		1.66		−0.03		.00
(17) Healthy		**−0.54****		**−0.45****		**.37****		**.46****		**.50****		.14		**−0.52****
(18) Forget		.06		.07		.68		.81		.99		−0.12		−0.00
R^2	.12**	.60**	.20	.70**	.04	.37**	.08*	.62**	.08	.23**	.10**	.42**	.15**	.46**

Note. Statistically significant results ($p < .05$) indicated in boldface.
*$p < .05$.
**$p < .01$.
[a]Numbers in column are standardised beta coefficients and R^2 values from liner regression analysis.
[b]Numbers in column are odds ratios and McFadden R^2 values from binominal logistic regression analysis.

Table 4. Specific indirect effects of values on outcomes *via* health risks.

	Flu vaccine willingness	COVID-19 vaccine willingness	Flu vaccine receipt	COVID-19 vaccine receipt	Other vaccine receipt	Negative word-of-mouth	Positive word-of-mouth
(1) Conformity	−0.05	−0.12	−0.03	−0.37	.05	.09	−0.05
(2) Tradition	−0.01	−0.03	−0.00	−0.09	.01	.02	−0.01
(3) Benevolence	−0.03	−0.06	−0.02	−0.19	.00	.04	−0.02
(4) Universalism	**.14***	**.31***	.08	**.99***	−0.13	**−0.23***	**.12***
(5) Self-direction	−0.07	−0.15	−0.04	−0.49	.07	.11	−0.06
(6) Stimulation	−0.01	−0.02	−0.00	−0.05	.01	.01	−0.01
(7) Hedonism	−0.00	−0.01	−0.00	−0.03	−0.00	.01	−0.00
(8) Achievement	−0.04	−0.09	−0.02	−0.28	.07	.06	−0.03
(9) Power	−0.01	−0.03	−0.01	−0.09	.00	.02	−0.01
(10) Security	.06	.13	.03	.41	−0.06	−0.09	.05

Note. Statistically significant results ($p < .05$) indicated in boldface.
*$p < .05$.

Table 5. Specific indirect effects of values on outcomes *via* healthy.

	Flu vaccine willingness	COVID-19 vaccine willingness	Flu vaccine receipt	COVID-19 vaccine receipt	Other vaccine receipt	Negative word-of-mouth	Positive word-of-mouth
(1) Conformity	−0.12	−0.11	−0.15	−0.11	−0.12	.02	−0.11
(2) Tradition	−0.02	−0.02	.00	−0.02	−0.02	.00	−0.02
(3) Benevolence	.01	.01	−0.01	.01	.06	−0.00	.01
(4) Universalism	**.33***	**.29***	**.37***	**.29***	.21	−0.05	**.28***
(5) Self-direction	**−0.35***	**−0.31***	**−0.40***	**−0.31***	**−0.29***	.05	**−0.30***
(6) Stimulation	−0.08	−0.07	−0.07	−0.07	−0.03	.01	−0.07
(7) Hedonism	−0.01	−0.01	−0.01	−0.01	−0.02	.00	−0.01
(8) Achievement	.04	.04	.07	.04	−0.01	−0.01	.04
(9) Power	.05	.04	.02	.04	.02	−0.01	.04
(10) Security	.08	.07	.09	.07	.09	−0.01	.07

Note. Statistically significant results ($p < .05$) indicated in boldface.
*$p < .05$.

We calculated bootstrapped estimates of indirect effects to determine the relation of our predictors on our outcomes *via* our mediators (i.e. *a*b path*), which are used to test Hypothesis 3. All indirect effects are provided in Supplemental Material B, whereas those used to test our hypotheses are presented in Tables 4 and 5. Figure 1 provides a visual representation of our results. Only two values produced any significant total or specific indirect effects. Universalism produced significant total indirect effects on flu vaccine willingness, COVID-19 vaccine willingness, flu vaccine receipt, COVID-19 vaccine receipt, negative word-of-mouth, and positive word-of-mouth (all 95% C.I. exclude 0). The specific indirect effects *via* Health Risks and Healthy were significant for flu vaccine willingness, COVID-19 vaccine willingness, COVID-19 vaccine receipt, and positive word-of-mouth (all 95% C.I. exclude 0). The specific indirect effect was significant *via* Health Risks for positive word-of-mouth (95% C.I. exclude 0), and the specific indirect effect was significant *via* Healthy for flu vaccine receipt (95% C.I. exclude 0). Alternatively, Self-Direction produced significant total indirect effects on flu vaccine willingness, COVID-19 vaccine willingness, flu vaccine receipt, COVID-19 vaccine receipt, negative word-of-mouth, and positive word-of-mouth (all 95% C.I. exclude 0). Only the specific indirect effect *via* Healthy was significant for these outcomes (all 95% C.I. exclude 0). These results partially support Hypothesis 3a and 3b. Health Risks and Healthy did mediate the relations of Universalism, and Healthy

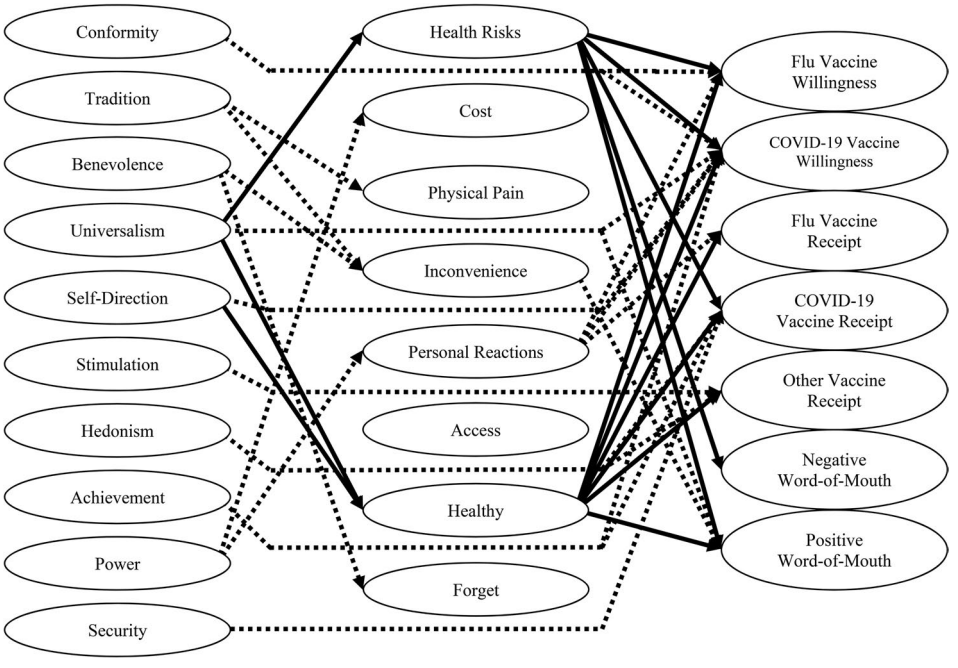

Figure 1. Visual representation of study results.

mediated the relations of Self-Direction; however, Benevolence did not produce significant effects on outcomes to be mediated.

Supplemental analyses

We performed many supplemental analyses to ensure the validity of our findings, which are reported in Supplemental Material A. We performed a complete replication of our results restricted to participants below and equal to the age of 61, and we performed another complete replication of our results restricted to participants above and equal to the age of 62. The intent of this analysis was to assess any differences in relations, given the heightened health risks of the older cohort. All inferences were consistent between our primary analyses and both sets of supplemental analyses, indicating that our insights do not significantly differ between the cohorts of older adults. Also, we performed two sets of analyses that inspected individual items within specific outcome measures. We replicated our findings when separating the COVID-19 willingness measure into its two respective items: willingness to receive for free and willingness to receive for US$40. We similarly replicated our findings when separating our COVID-19 receipt measure into its two respective items: received and tried but did not receive. In each analysis, our inferences were consistent with those reported in the primary text. Together, each supplemental analysis indicates that our results were not produced by our analytical decisions, and our results are both robust and represent substantive reflections of actual phenomenon.

Discussion

Several consistent pattens arose from our results. When the values alone were studied, three produced significant relations with more than one vaccine hesitancy outcome: Conformity, Universalism, and Self-Direction. When studied alongside the vaccine hesitancy dimensions, however, no value significantly related to more than two outcomes, and the vaccine hesitancy dimensions explained significantly more variance in the outcomes than the values. This result supports that vaccine hesitancy is more proximal to vaccination o willingness and behaviours than values, and the effect of values on vaccination willingness and behaviours may be *via* the vaccine hesitancy dimensions. Further, three vaccine hesitancy dimensions produced significant relations with more than one vaccine hesitancy outcome: Health Risks, Personal Reactions, and Healthy. When assessing the indirect effects, Universalism produced several significant indirect effects *via* both Health Risks and Healthy, whereas Self-Direction produced several significant indirect effects *via* Healthy. The value of Conformity and the vaccine hesitancy dimension of Personal Reactions did not produce any significant indirect effects, despite producing multiple significant direct effects. Lastly, the amount of variance explained in the outcomes was in the following order: willingness outcomes, word-of-mouth outcomes, and receipt outcomes (most to least). For all outcomes, the variance explained by the values and vaccine hesitancy dimensions was statistically significant. Thus, values produce important relations with vaccine hesitancy and vaccination willingness and behaviours, improving our understanding of the vaccination decision making process. These results provide many implications for research and practice.

Implications and future research directions

Values and vaccination

Our results supported that values relate to vaccination willingness and behaviours *via* various vaccine hesitancy dimensions. As expected, Universalism related to many vaccination willingness and behaviours *via* Health Risks and Healthy. People who have a general motivation for caring and protecting others are less likely to see vaccines are harmful, less likely to see vaccines as unnecessary, and more likely to be vaccinated. These people may also be more invested in the 'bigger picture' regarding their role in society, and prior research has supported that those who report greater Universalism values are more likely to support social programs (Caprara et al., 2009; Sinn, 2019). Due to this willingness, they may likewise be more willing to cooperate in public health efforts to protect both themselves and others, such as vaccination. Future research should apply theories associated with moral decision making, as those with high Universalism values may see vaccination as a moral issue to protect others. Notably, Garrigan et al. (2018) developed a comprehensive framework for moral decision making, mapping out the various individual- and situation-specific influences on moral decision making. Within the individual influences, the effects of values could be included in the scope of both social factors and emotion processes. By utilising this framework, researchers could determine how the general motivation for caring and protecting others, Universalism, not only

interacts with other aspects of the self (e.g. emotion processes and social factors) but also characteristics of the specific moral decision, which may be vaccination for those high in Universalism values.

Also, as expected, Self-Direction also related to many outcomes *via* Healthy. Those who particularly value independence are more likely to see vaccines as unnecessary and less likely to receive them. As those with greater Self-Direction values prefer to address issues on their own (Saroglou et al., 2004; Schwartz, 2007, 2012), they may likewise believe that their health is best managed on their own. Interventions may be particularly effective for this population, as counteracting beliefs that vaccines are ineffective may be easier than counteracting beliefs that vaccines are actively harmful. Future research should therefore assess whether counteracting Self-Direction values by emphasising the importance of vaccines and occasional need to receive assistance from medical health processionals is an effective approach to promote vaccination.

On the other hand, several results were surprising regarding values. While Universalism related to vaccination willingness and behaviours, Benevolence did not. These dimensions are clearly related, but they are also more different than similar; their correlation in the present article was .46, indicating that they only share 21% of their variance. Many of the items for Universalism (e.g. World at Peace, Unity with Nature) refer to broader prosocial feelings towards society, whereas many items for Benevolence (e.g. Honest, Helpful) refer to prosocial interactions. Universalism may have produced stronger effects because vaccination is seen as a behaviour that broadly benefits society, and the broader nature of Universalism produces stronger relations. While Benevolence may be relevant in isolation, the closer association of Universalism may cause it to more strongly relate to vaccination, including any shared variance. Therefore, valuing people in general (Universalism) appears to be more important than valuing close others (Benevolence) in relation to vaccination willingness and behaviours.

Little research has produced differential effects for these two values (Le, 2011; Ma & Lee, 2012; Roccas, 2003), and the current results are novel in this regard. This disparity may have arisen due to perceptions that vaccines are a type of public health initiative, as vaccines are most effective with broad uptake (e.g. herd immunity) (Britton et al., 2020; Omer et al., 2020). While both Universalism and Benevolence are associated with support for social programs, Universalism may be more strongly related to this support due to its greater focus on broader relations with others (Caprara et al., 2009; Sinn, 2019). This is only a post hoc suggestion, and research is needed to empirically support any causes for differential results of Universalism and Benevolence. Nevertheless, studying perceptions towards social programs and/or others in general appears to be a potentially fruitful starting point for studying these two values.

Likewise, Conformity unexpectedly related to lower vaccination willingness, and these effects may be explained by identity-protection theories (Ogbanufe & Ge, 2023; Sedikides, 2021). These theories suggest that people strive to protect their social identity and group memberships. Conformity reflects a general motivation to not violate social norms and upset others (Schwartz, 1992; Schwartz et al., 2012), indicating that those who score high on Conformity are even more sensitive to their social

identity and group memberships. Although vaccination was repeatedly encouraged by public messaging during the COVID-19 pandemic, many communities—especially rural and conservative communities—in the United States saw strong anti-vaccination norms, with many counties including more non-vaccinated than vaccinated citizens at the conclusion of the COVID-19 pandemic (Russell, 2023; Smith et al., 2023). Those scoring higher on Conformity may have observed these anti-vaccine sentiments, feeling that the norm in their community was to refrain from vaccination. To protect their social standing, those who scored high on Conformity may have then refrained even more strongly from vaccination, as they intended to align even their health behaviours with the perceived desires of their community. Future research should perform focused assessments of Conformity to determine both whether identity-protection theory may serve as a viable lens and whether anti-vaccination sentiments are perceived as the norm within many United States communities, which could result in theoretical advancements and the development of effective practical interventions.

Additionally, while the current article investigated between-person differences in values, values are regularly studied at the between-culture level (e.g. country) (Cieciuch & Schwartz, 2012; Schwartz, 1992). The current results cannot firmly provide insights regarding the differences between cultures regarding values or vaccination, but they may encourage future researchers to conduct these investigations. Notably, significant differences were observed in the vaccination rates between countries throughout the COVID-19 pandemic (Kassianos et al., 2021; Reza et al., 2022; Vaz et al., 2020). It is possible that countries with higher vaccination rates were those with stronger Universalism and weaker Self-Direction cultural values, which would systematically cause these countries' citizens to be less vaccine hesitant. Future research testing this possibility could provide important theoretical insights regarding the function of values in vaccination, but it could also suggest whether certain interventions have differential effectiveness across cultures. An intervention highlighting the importance of protecting others may be particularly beneficial in countries with heightened Universalism values, whereas it may be relatively ineffective in countries with lower Universalism values.

Vaccine hesitancy

Overall, the current results aligned with prior findings regarding vaccine hesitancy. Research has repeatedly supported that Health Risks and Healthy produce the strongest relations with relevant outcomes (Balgiu et al., 2022; Howard, 2022a, 2022b, 2024; Howard & Davis, 2023), and the current study replicated this finding. Future researchers should consider the dominant influence of these two dimensions when studying vaccine hesitancy. At the same time, the current article also supported that Personal Reactions produced several significant relations with our outcomes. This dimension has less consistently produced significant relations in prior research, suggesting that its current importance may be due to the studied sample. That is, while beliefs about personal reactions to vaccines may have little relation to behaviours for general samples, older adults' beliefs about their personal reactions may be a sizable influence on their subsequent vaccination willingness and behaviours. Future researchers should

attempt to replicate this finding in additional samples of older adults, but they should also test whether any other dimensions likewise produce influential relations for specific populations.

Further, Howard's (2022a) conceptualisation of vaccine hesitancy has been studied with general samples of all ages (Balgiu et al., 2022; Howard, 2022a, 2022b, 2024), and the present investigation is the first to specifically study older adults. We chose this population because older adults suffer greater health risks when unvaccinated, and public health organisations are often concerned with increasing vaccination rates in this population (Allen et al., 2020; Andrew et al., 2019). Our results supported the psychometric properties of the MVHS with this sample, and the dimensions' relations with the vaccination willingness and behaviours can be considered validity evidence. By providing both psychometric and validity support, the current article supports that future authors can utilise the MVHS to study vaccine hesitancy in older adults, and the measure may also be effective in developing adaptive interventions for these older adults.

The current results can also provide potential inferences regarding the relation of political orientation and vaccination willingness and behaviours. Those who identify as liberal are more likely to have positive vaccination willingness and behaviours, whereas those who identify as conservative are more likely to have negative vaccination willingness and behaviours (Hao & Shao, 2022; Howard, 2024; Kannan & Veazie, 2018). Universalism has been associated with liberalism in prior research, believed to be due to a common support for social programs; and Self-Direction has been associated with conservativism in prior research, believed to be due to a common support for personal responsibility (Barnea & Schwartz, 1998; Caprara et al., 2009; Piurko et al., 2011). In putting these linkages together, values affect political orientations; political orientations affect vaccination willingness and behaviours; and political orientations may mediate the relation of values and vaccination willingness and behaviours. Future research should test these linkages to determine whether studying both values and political orientation together is necessary to understand the complete impact of both on vaccination willingness and behaviours.

Practical implications

Our findings can be used to develop novel interventions focused on values and vaccine hesitancy to promote vaccination. Adaptive interventions provide intervention components based on people's characteristics, enabling these interventions to be shorter, less expensive, and more effective than omnibus interventions (Perski et al., 2022; Wang & Miller, 2020). Our results suggest that an adaptive intervention focused on the values of Conformity, Universalism, and Self-Direction or the vaccine hesitancy dimensions of Health Risks, Personal Reactions, and Healthy could be particularly effective for older adults in the United States. For instance, an adaptive intervention could begin by administering the MVHS, and participants could receive specific intervention components if they report elevated perceptions of Health Risks, Personal Reactions, and Healthy. Likewise, participants who score high in Self-Direction could be provided autonomy-supportive messaging, such that their natural propensity to

be self-motivated would be maximised. In turn, these participants may be more likely to receive vaccines due to effective intervention components. Equally important, participants would not be distracted by any relatively ineffective components, and the overall intervention would be shorter. To create these interventions, researchers should turn to the sequential multiple assignment randomised trial methodology, as it can determine which sequence of components may be most effective for specific participants (Chow & Hampton, 2022; Collins et al., 2014).

Limitations and future research directions

Methodology

The current article utilised a time-separated design to alleviate common-method bias (Podsakoff et al., 2012), but alternative designs are necessary to firmly support causality among our variables. The theoretical rationale underlying our relations strongly suggests a specific temporal ordering of our effects. For instance, it not believed that vaccine hesitancy produces values. Nevertheless, future research should apply more robust research designs to support the casual relations among our variables. Further, alternative research designs are also necessary to assess change. Participants' standings on the variables may have fluctuated during the study, which remained undetected due to each variable being measured only once. We call on future authors to apply more robust methodological designs, wherein each variable is measured at each measurement occasion. By doing so, researchers could assess change in each variable over time, assessing whether participants' standings indeed change over time. Perhaps more important, these methodologies could assess causality by testing whether variables predict change in other variables, but they could also assess also the potential of reverse-causality by testing whether variables relate to each other in the opposite direction than hypothesised.

We applied specific conceptualizations and operationalizations of values and vaccine hesitancy due to their popularity, support, and applicability (Balgiu et al., 2022; Howard, 2022a, 2022b, 2024; Lee et al., 2022; Schwartz et al., 2012), but other conceptualizations and operationalizations exist. Future research should investigate these alternative conceptualizations to identify both consistencies and disparities. For instance, alternative conceptualizations of vaccine hesitancy without dimensions representing Health Risks and Healthy may identify other mediators between the relations of values and vaccination willingness and behaviours, but they may also fail to find any mediators whatsoever without these two dimensions. Both findings would provide important insights in conjunction with the present results.

Similarly, our intent was to perform focused assessments of values, vaccine hesitancy, and vaccination behaviours. Our results achieved these goals, providing significant clarity to the current literature. At the same time, not all potential mediators were included in our study. As with any study, omitted variables (e.g. mediators) are guaranteed to exist. For instance, it is likely that political orientation mediates the relation of certain values with the vaccine hesitancy dimensions. Future researchers should capitalise upon this possibility in two manners. They should perform focused assessments into specific relations, such as the relations of Universalism with the

vaccine hesitancy dimensions, to identify novel mediators for certain values. Likewise, they should perform focused assessments into specific portions of the causal chain leading to vaccination behaviours, such as further mediators between the relations of the vaccine hesitancy dimensions and vaccination behaviours. By conducting these additional assessments, a more complete perspective can be obtained regarding the emotional, cognitive, and behavioural processes leading to vaccination behaviours, advancing both theory and practice.

Prolific

While many authors have supported the validity of results obtained *via* Prolific (Palan & Schitter, 2018; Peer et al., 2022; Stanton et al., 2022), some have expressed concerns about the existence of bots as participants *via* this service. We took several steps to ensure that any potential bots and/or insufficiently motivated participants were identified. First, a time-separated research design was utilised, and only sufficiently motivated human participants are typically believed to enrol in multiple waves of a study. Second, we utilised attention checks in each survey, wherein an extremely small number of bots or insufficiently motivated participants would remain through random chance alone. Third, we inspected our data for participants that completed our surveys in an unreasonably short amount of time (e.g. speeders) (Smith et al., 2016), and we did not observe any concerns with any participants. These steps together suggest that any bots and/or insufficiently motivated participants would have likely been identified, but future researchers should nevertheless replicate our results utilising alternative sampling approaches. By doing so, these researchers can further support the robustness of our findings.

Further, those who participate in studies *via* Prolific may not be representative of the general population. Namely, these participants are often believed to be more highly educated and technologically savvy. They are also believed to be more likely to have a moderate level of income, as these participants possess the resources to participate *via* Prolific but still desire additional income through the service. These participants may be more likely to have positive perceptions of vaccination and be vaccinated, as education and income are positively related to vaccination rates (Forshaw et al., 2017; Lucyk et al., 2019). The characteristics of our sample further indicate that further researchers should replicate our results with alternative sampling sources. While these differences may not have been strong enough to significantly sway observations and interpretations, replication efforts could support the robustness of our findings.

Sample selection

The measures of central tendency and dispersion for the variables studied in the current article (Supplemental Material A) were typical for the United States (Doran & Littrell, 2013; Howard, 2022a, 2022b, 2024; Lee et al., 2011), supporting that our results may be generalisable to our intended context—older adults in the United States. Schwartz's values are often studied within a single cultural context, as values vary within a single culture enough to produce meaningful relations with outcomes (Fischer et al., 2010; Hemsey & Dahling, 2023); however, values also vary across cultures, and authors

regularly perform cross-cultural comparisons of values and their relations (Cieciuch & Schwartz, 2012; Schwartz, 1992). Our results should not be assumed to generalise across all cultures, and it should instead be recognised that our findings may only apply to the intended context—older adults in the United States. It is necessary to recognise two manners that differences across contexts may influence our results.

First, the expression of values differs across cultures. The central tendency and dispersion of values observed in the current article is typical for the United States (Doran & Littrell, 2013; Lee et al., 2011), which supports the generalisability of our results to the United States; however, people from alternative countries and cultures systematically express different values, and the salience of specific values to these people may produce differing relations with vaccination willingness, vaccination receipt, and vaccination word-of-mouth. For instance, the United States is an individualistic culture, whereas many Eastern countries are collectivistic cultures (Lee et al., 2011; Schwartz, 2007, 2012). People from Eastern countries often express greater standing on relationship-oriented values (Lee et al., 2011; Schwartz, 2007, 2012). Values such as Universalism and Benevolence to produce an stronger relation with our outcomes when studied in Eastern countries, as these people may be even more driven to protect others.

Second, each country has a unique political atmosphere. In the United States, vaccination has become particularly politicised (Hornsey et al., 2020; Moore et al., 2021; Pertwee et al., 2022), which is especially true for the time period during which the data was collected, December 2022. While those from some countries may view vaccination as relatively independent from values or politics, vaccination has certainly become intertwined with values and politics in the United States. For this reason, values may produce a stronger relation with our studied outcomes in the United States, as these are seen as more politicised perceptions and behaviours. Namely, the politicised nature of vaccination in the United States may cause those who score higher on self-direction to be more likely to adhere to their specific perspective on vaccines, whether positive or negative. This may cause more people to be absolutely supportive or against vaccines, with fewer people being unsure regarding how they feel about vaccines. If these possibilities are true, then the relation of values with vaccine hesitancy, vaccination perceptions, and vaccination behaviours may be weaker in alternative contexts.

Future research should replicate the current results in other contexts to determine the generalisability of our findings, potentially demonstrating that our theoretical insights can apply to other contexts; however, these studies could also demonstrate that novel theoretical lenses are needed to understand the relation of values with vaccine hesitancy and other vaccination-related outcomes, which would be an equally—if not more—important contribution to the current literature. Observing differences across samples could provide insights into example how and why values influence outcomes. For instance, observing consistent relations between individualistic and collectivistic countries would suggest that mean differences in these values may not ultimately impact health-related behaviours. Cross-cultural assessments of our studied relations may be an immediate next step in further resolving tensions within this literature.

Furthermore, researchers should also investigate the current results in contexts that were not considered in the current article. For instance, our participants are likely

composed of those living within both rural and urban areas. Those in more rural communities may have greater barriers to vaccination than those in urban neighbourhoods (Brandt et al., 2021; Sun & Monnat, 2022). Public transit and public programs enable those in urban environments to become vaccinated more easily, whereas these may not be available to those in rural communities. Those in urban areas are more likely to be vaccinated than those in rural communities. Likewise, rural and urban areas in the United States are more likely to be affiliated with specific political views, further shifting their likelihood to have certain perceptions of vaccines and likelihood of vaccination. Future research should perform comparisons of our studied relations between rural and urban areas, along with other similar comparisons. By doing so, the generalisability of our results can be determined, but novel theoretical insights could also be produced.

Lastly, we specifically chose to collect a sample of older adults, as this population is more likely to become ill and suffer greater consequences from illnesses. By understanding vaccination in this population, our results could produce a greater impact. At the same time, our results may not generalise to younger populations. For instance, older adults may not score as highly on Healthy, as they may be less likely to refrain from vaccination because they feel in good health. These systematic differences may cause older adults to produce different relations between the studied variables compared to younger adults. Because understanding vaccination is important for all populations, future researchers should test the currently studied relations in alternative populations, understanding that the current results may not speak to all people.

Conclusion

The primary aims of the current article were to identify the relations of values with vaccine hesitancy and vaccination willingness and behaviours and to determine which vaccine hesitancy dimensions mediate the relations of values with vaccination willingness and behaviours. Our results supported that the values of Conformity, Universalism, and Self-Direction and the vaccine hesitancy dimensions of Health Risks, Personal Reactions, and Healthy produced the strongest and most consistent relations with vaccination willingness and behaviours. Health Risks and/or Healthy mediated the relations of Universalism and Self-Direction, but the effects of Conformity and Personal Reactions were relatively independent of the other values and vaccine hesitancy dimensions. These results can now be used to justify further investigations into the relations of values and vaccination willingness and behaviours, and they may also aid in the development of novel interventions to promote vaccination. Therefore, the current article provides evidence that the integration of values into research on vaccination is a valuable direction for future research and practice.

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Ethical approval

All procedures of the current study were performed with the approval of the IRB of the primary author's institution (IRB #1663301).

Informed consent

Informed consent was not obtained from participants, who were instead given an information sheet. This was chosen because the only identifying information obtained from participants was their Prolific ID, which is difficult to trace back to individuals. Obtaining signatures *via* informed consent would otherwise be the only identifying information collected that could be easily traced back to individuals. For this reason, informed consent was not obtained to aid in ensuring anonymity, confidentiality, and participant safety.

Authors contributions

The sole author completed all aspects of this manuscript.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

The dataset can be found at the following OSF link: https://osf.io/4uqfe/overview?view_only=0efafcda9d4a4c319b734640a395e952.

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