**KLASTER PENELITIAN DASAR INTERDISIPLINER**

# INVESTIGASI PERAN KEPERCAYAAN TERHADAP SAINS, SIKAP ANTAR KELOMPOK DAN PERSEPSI RELIGIUSITAS TERHADAP KESEDIAAN MELAKUKAN VAKSINASI DI INDONESIA

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# Examining the Impact of Trust in Science, Attitudes and Perceptions Between Groups, and Religiosity on Willingness to Vaccinate in Indonesia

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Abstract

The importance of willingness to be vaccinated as a predictor of a country's vaccination coverage cannot be overstated. This study aims to investigate the influence of trust in science, social dominance orientation (SDO), and perceived religiosity on an individual's willingness to be vaccinated. To achieve this, quantitative correlational methods were employed, utilizing single item measurements for willingness to be vaccinated and perceived religiosity, while the trust in science scale, which measures competence, benevolence, honesty, and openness, was used to assess trust in science. The SDO scale was utilized to measure social dominance orientation. The study was conducted on a sample of 987 Indonesian individuals, aged between <20 years and >60 years, using quota sampling based on age categories. The results indicate that trust in science was found to be a significant predictor of willingness to be vaccinated, exhibiting a positive correlation between the two variables. Conversely, the relationship between perceived religiosity and willingness to be vaccinated was found to be negative but not statistically significant, while social dominance orientation showed a similar tendency but also failed to reach statistical significance.

**Keywords:** pandemic, religious perception, social dominance orientation, trust in science, willingness to vaccinate

## Introduction

The advent of a global pandemic such as Covid-19 constitutes a significant threat to human survival. As a result, governments across the world must devise effective and efficient solutions to mitigate this threat. Thus far, vaccination has been regarded as a viable solution to combat both pandemics and endemics. Nonetheless, numerous individuals voice their opposition to vaccination as a mandatory policy for all members of society, perceiving it as an infringement on their freedom of opinion (Reich, 2021). This opposition is commonly

referred to as the anti-vaccine or anti-vaccine movement, which endeavors to cast doubt and even reject vaccines, thereby jeopardizing the efficacy of vaccination programs (K. Wang et al., 2021) and global health (WHO, 2020).

The emergence of the anti-vaccination movement and rejection of vaccines presents a serious challenge to the achievement of herd immunity, which is crucial for controlling a pandemic or endemic (Taylor et al., 2020). In order to reach herd immunity, Reich (2021) emphasizes that vaccine coverage must reach 85 to 95%. Given the urgent need for research that investigates factors that influence variables important for managing a pandemic, such as willingness to vaccinate, it is imperative that this matter be addressed (Bangerter et al., 2012).

Vaccine willingness, or the willingness to be vaccinated, is a crucial factor in achieving high vaccine coverage in a country (Baeyens et al., 2009). However, recent studies from various regions around the world indicate a disturbing trend of decreasing vaccine willingness (K. Wang et al., 2021; Biddle et al., 2021; Abedin et al., 2021; Hossain et al., 2021). For instance, research conducted in Hong Kong, China by K. Wang et al. (2021) revealed that vaccine willingness decreased from 44.2% to 34.8% between the beginning and middle of the pandemic. Similarly, in mainland China, the rejection rate for vaccines, including Covid-19 and influenza vaccines, reached 40% (Q. Wang et al., 2021). Furthermore, studies in Australia showed a significant increase in vaccine hesitancy and a decline in vaccine willingness from August 2020 to January 2021 (12.7% to 21.7%). Even at the individual level, 31.9% of Australians experienced a decline in willingness to be vaccinated (Biddle et al., 2021). Similar results were obtained from research conducted in Bangladesh (Hossain et al., 2021; Abedin et al., 2021). Notably, vaccine willingness in Bangladesh increased rapidly when the vaccine was offered free of charge (Abedin et al., 2021).

The reduced willingness to be vaccinated is influenced by several factors. Firstly, there is a lack of trust in health agencies, the national health system, the benefits of vaccination, and the pharmaceutical industry in general (Biddle et al., 2021; Taylor et al., 2020). Additionally, demographic factors such as language, age, place of residence, employment, education level, breastfeeding status, race, gender, and insurance ownership significantly influence willingness to vaccinate (Abedin et al., 2021; Biddle et al., 2021; Kelly et al., 2021; Daly & Robinson, 2021). Furthermore, pessimism about the benefits and side effects of vaccines, as well as increasing compliance with health protocols resulting in a perception of self-confidence to avoid the pandemic, also influence willingness to be vaccinated (Biddle et al., 2021; K. Wang et al., 2021). The vaccination development process, which appears to be

rushed, exacerbates this by increasing public distrust of vaccines and a sense of insecurity regarding vaccination (K. Wang et al., 2021).

Moreover, mental illness has emerged as a significant predictor of vaccine willingness in Denmark, as revealed by Jefsen et al. (2021). Furthermore, the presence of comorbidities exacerbates resistance to vaccination (Kelly et al., 2021). It is not surprising, therefore, that this group is in a priority position for vaccination. Those who reject this tend to adhere more strongly to the doctrine of natural immunity, as indicated by Taylor et al. (2020).

Previous studies have demonstrated a strong correlation between trust in vaccines, both in terms of their efficacy and safety, and an individual's willingness to be vaccinated (Zagefka et al., 2022). Moreover, low levels of trust in government health experts have been found to exacerbate the prevalence of vaccine refusal (Baumgaertner et al., 2018). It is believed that these two forms of trust are closely linked to trust in science in general. This is supported by the findings of Hamilton and Safford (2021), who reported a significant decline in trust in science and researchers during the Covid-19 pandemic, which in turn affected the public's response to government recommendations for public health behavior, even when backed by empirical evidence. For instance, Plohl and Musil (2021) found that risk perception and trust in science influence an individual's compliance with Covid-19 health protocols. Additionally, trust in science has been shown to mediate the influence of political conservatism, religious orthodoxy, conspiracy ideation, and intellectual curiosity on compliance behavior.

According to Hamilton and Safford (2021), there are four factors that contribute to the rejection of science-based information by the public. Firstly, science often contradicts individuals' general views and ideology, as well as posing a potential threat to economic interests through science campaigns. Secondly, individuals process information differently, with some being more susceptible to conspiracy theories. Thirdly, peer and cultural influences frequently contradict scientific findings. Lastly, messages from a country's elite are often perceived as political and understood in a dichotomous manner. For instance, a message from a conservative leader in a liberal society may be difficult to accept. Consequently, researchers propose that a high level of trust in science correlates with a positive attitude towards vaccination. The greater a person's trust in scientific research and researchers, the more likely they are to willingly receive vaccination.

The Covid-19 pandemic has amplified unfavorable sentiments towards individuals beyond one's own group, particularly foreigners originating from regions where the virus is widely prevalent, such as Italy and China. Research conducted in the United Kingdom and

Poland indicates this trend. The pandemic intensifies prejudice and heightens the probability of increased social isolation in countries most severely impacted by the pandemic (Sorokowski et al., 2020). Moreover, elevated levels of negative intergroup attitudes may contribute to vaccine hesitancy. Vaccines that are perceived to emanate from groups that contradict political ideologies are likely to be shunned. For instance, Filipinos are more likely to trust vaccines produced in the United States over those from China due to the latter's political views aligning with their own (Zagefka et al., 2022).

The negative inter-group attitude of social dominance orientation (SDO) refers to a preference for hierarchical positions between groups, justification for the dominance of certain groups over others, and a lack of empathy for other groups (Peng, 2022). Research conducted by Zhai et al. (2022) revealed that this attitude significantly influenced community resistance to government policies aimed at anticipating the Covid-19 pandemic. Moreover, individuals with high SDO were found to exhibit greater resistance to vaccination, predicting higher levels of unwillingness to be vaccinated.

One of the factors that researchers assume will influence an individual's willingness to be vaccinated is their perceived religiosity. Studies have shown that perceived religiosity can have a significant impact on an individual's willingness to accept vaccination. For example, Lahav et al. (2022) found that perceived religiosity was negatively associated with willingness to vaccinate, although the relationship between these two variables was not linear. Similarly, Milligan et al. (2022) also found a negative relationship between religiosity and acceptance of vaccines, indicating that individuals who perceive themselves to be more religious may be more hesitant to accept vaccination.

The aforementioned description presents a comprehensive perspective on the issue of vaccination willingness, which poses a considerable threat to global health. The declining trend in vaccination willingness is believed to be influenced by a multitude of factors, thereby attracting the attention of researchers who wish to delve deeper into the impact of variables such as trust in science, inter-group attitudes, and perceived religiosity on vaccination acceptance. Researchers hypothesize that these three variables, in conjunction with demographic factors such as gender and education level, will exert a considerable influence on an individual's attitude towards vaccination.

## Method

### *Research design*

This study employs a correlational quantitative approach with the aim of examining the impact of trust in science, intergroup attitudes, religiousness, and demographic factors such as gender, age, highest level of education, annual household income, and place of residence on the willingness to receive a COVID-19 vaccine.

*Participants*

The present study will be conducted among the population of Indonesian citizens who have access to the Bilendi Respondi market research website. Bilendi Respondi is an online platform that facilitates data collection across the globe, including Indonesia. With this website, researchers can ensure that participants will be evenly distributed throughout Indonesia. The target sample size for this study is set at 500, which is in line with the requirements of the TISP Many Labs Study. Participants will be incentivized with compensation as determined by Bilendi Respondi.

*Research Procedures*

This research project is divided into two distinct phases: the adoption of a tool to measure trust in science and science-related populism, and the collection of data. The measuring tool used in this study is a questionnaire developed by Viktoria Cologna and her team. The validation and try-out process was conducted at Harvard University. To ensure cultural appropriateness, researcher Denisa Apriliawati and her team translated the measuring tools and adapted several items to suit Indonesian culture. After translation, the items were integrated into the Qualtrics platform (<https://www.qualtrics.com>). The link to complete the questionnaire on this platform will be sent to the market research platform Bilendi Respondi (<https://www.bilendi.co.uk>). Bilendi Respondi will also handle the process of searching for research subjects. Prior to data collection, researchers have ensured that the research procedures have been approved by the IRB at their home institution and meet the research code of ethics by providing an informed consent form. Participants will receive compensation for their participation in this research according to the standards set by Bilendi Respondi. The data will then be downloaded from Qualtrics in .csv format and analyzed according to the research objectives.

*Data collection techniques*

The dependent variable in this research is vaccine willingness. To assess this, a closed-ended question was employed: "If another pandemic as dangerous or more so than the

COVID-19 pandemic were to arise in the future, would you be willing to participate in the government-led vaccination program, provided the vaccine is free of charge?" Responses were recorded using a Likert scale consisting of three options: Willing, Undecided, and Not Willing. This measurement approach has been employed in several prior studies, such as those conducted by Abedin et al. (2021).

In this study, the predictors examined were demographic factors, including gender, age, highest level of education, annual household income, and place of residence, as well as belief in science, subjective religiosity, and intergroup attitudes. Gender was assessed using four categorical response options: Female, Male, Choose to describe yourself, and Choose not to answer. Age was determined through an open-ended question asking how old the participant was, while education level was grouped into four categories: Primary Education, Secondary Education (e.g. high school), Higher Education (e.g. bachelor's degree or higher), and No education. Household income was estimated through open-ended questions in which participants were asked to provide the average annual income in rupiah. Place of residence was categorized as Rural or Urban. Subjective religiosity was measured using ordinal scale questions ranging from Not At All Religious (1) to Very Religious (5).

The Trust in Science, Intergroup Attitudes, and Religiosity scales were adapted from measurement tools developed by the TISP Many Labs Study, which had not yet published articles related to the research theme at the time this proposal was written. The preregistration manuscript containing details on the measurement instruments is available on a limited basis via <https://osf.io/>. Researchers will provide the necessary information once the manuscript is available. To measure trust in science, a scale consisting of 12 items was utilized, such as "How honest are most scientists?" and "How open are scientists to feedback or suggestions?" Additionally, the subjects' trust in scientific methods and attitudes of scientists regarding the public interest were assessed. To measure intergroup attitudes, the Social Dominance Orientation (SDO) scale, consisting of five questions, was utilized. The SDO scale measures attitudes towards group dominance and whether someone supports equality or the oppression of one group against another (Ho et al., 2015). Perceived religiosity was directly measured using a single item question "Please indicate how religious/religious you are?" with five answer choices ranging from Not Religious At All (1) to Very Religious (5).

*Data analysis techniques*

The data collected from this research will be analyzed using Logistic regression, as described by Navarro and Foxcroft (2019). This technique involves examining how multiple

independent variables can predict discrete dependent variables. To employ this technique, it is essential that several assumptions are met, including normality of residuals, independence of observations, and linearity of the relationship between variables. Additionally, the data must be free of errors and multicollinearity, and the residuals of the dependent variables must adhere to the rules of normality. By ensuring these assumptions are met, the data can be analyzed using Logistic regression in JAMOVI Software (<https://www.jamovi.org/>). The data will first be tabulated using Microsoft Excel before being analyzed using JAMOVI.

**Result**

Table 1 presents the demographic characteristics of the participants in this study. The sample size consisted of 987 individuals, which was generally balanced between male and female participants, with 48.6% and 51.4% representation, respectively. The majority of the participants had a bachelor's/master's/doctoral education background, accounting for 787 participants, while the remaining 200 participants had a middle school or high school education background. The age distribution of the participants was relatively even, with most falling within the age ranges of 20-29 years (30.3%), 30-39 years (28.8%), and 40-49 years (29.8%). However, recruiting participants under the age of 20 proved to be challenging due to the limited age range specified in the study (18-19 years). Similarly, individuals over the age of 50 were underrepresented in the study as they tend to be rare and less likely to participate in market research.

Additionally, participants were asked to self-identify their political orientation on a scale from very conservative to very liberal. The majority of participants identified themselves as neutral or in the middle between conservative and liberal (34.8%), followed by conservative (21.5%), very conservative (13.8%), and a notable portion of participants (18.9%) who were unsure of their political orientation. When it came to political views, the majority of participants (39.3%) identified as neutral, not too left or not too right. A substantial portion of participants (24.8%) identified as having right or very right political views, while a considerable number (21.2%) chose not to indicate their political orientation.

Tabel 1. Tabel demografi partisipan (n = 987)

| **Variabel** | |
|---|---|
| **Gender, n (%)** | |
| Female | 507 (51.4) |
| Male | 480 (48.6) |
| **Educational Attainment, n (%)** | |
| Middle | 200 (20.3) |
| High | 787 (79.7) |
| **Age, n (%)** | |
| <20 | 14 (1.4) |
| 20 – 29 | 299 (30.3) |
| 30 – 39 | 284 (28.8) |
| 40 – 49 | 294 (29.8) |
| 50 – 59 | 75 (7.6) |
| >60 | 21 (2.1) |
| **Conservatism, n (%)** | |
| Ultra-Liberal | 40 (4.1) |
| Liberal | 69 (7.0) |
| Neutral | 343 (34.8) |
| Conservative | 212 (21.5) |
| Ultra Conservative | 136 (13.8) |
| Don't Know | 187 (18.9) |
| **Political Orientation, n (%)** | |
| Extreme Left | 13 (1.3) |
| Left | 24 (2.4) |
| Neutral | 388 (39.3) |
| Right | 245 (24.8) |
| Extreme Right | 108 (10.9) |
| Don't Know | 209 (21.2) |

As depicted in Table 2, the majority of participants expressed their readiness to receive the vaccine (89.6%), whereas a relatively small proportion indicated their reluctance (10.4%).

**Tabel 2. Kesediaan untuk divaksinasi**

| V_WILLING | Counts | % of Total | Cumulative % |
|---|---|---|---|
| Tidak bersedia | 102 | 10.4 % | 10.4 % |
| Bersedia | 883 | 89.6 % | 100.0 % |

The examination of outliers has revealed that the data has successfully passed the multicollinearity and autocorrelation tests, thus permitting the execution of hierarchical logistic regression analysis.

Tabel 3. Model Fit Measures

| | | | | Overall Model Test | | |
|---|---|---|---|---|---|---|
| **Model** | **Deviance** | **AIC** | **$R^2_{McF}$** | **$\chi^2$** | **df** | **p** |
| 1 | 628 | 632 | 0.0418 | 27.4 | 1 | < .001 |
| 2 | 628 | 634 | 0.0426 | 27.9 | 2 | < .001 |
| 3 | 627 | 635 | 0.0443 | 29.1 | 3 | < .001 |

Tabel 4. Model Comparisons

| Comparison | | | | | |
|---|---|---|---|---|---|
| **Model** | | **Model** | **$\chi^2$** | **df** | **p** |
| 1 | - | 2 | 0.520 | 1 | 0.471 |
| 2 | - | 3 | 1.124 | 1 | 0.289 |

Based on Tables 6 and 7, it can be concluded that there is a simultaneous influence of trust in science, religious perceptions, and social dominance orientation on an individual's willingness to be vaccinated ($\chi^2$ (3) = 29.1, p < .001). However, a hierarchical logistic regression revealed that only Model 1 (trust in science - vaccine willingness) was significant ($\chi^2$ (1) = 27.4, p < .001). Conversely, neither perceived religiosity ($\chi^2$ (1) = 0.52, p = .471) nor social dominance orientation ($\chi^2$ (1) = 1.12, p = .289) demonstrated a significant impact on vaccine willingness.

Tabel 5. Model Coefficients - V_WILLING

| **Predictor** | **Estimate** | **SE** | **Z** | **p** |
|---|---|---|---|---|
| Intercept | 2.4283 | 0.2515 | 9.656 | < .001 |
| Z_TRUST | 0.5566 | 0.1031 | 5.401 | < .001 |
| SDO | -0.0114 | 0.0163 | -0.702 | 0.482 |
| Z_RELIGIO | -0.1163 | 0.1108 | -1.050 | 0.294 |

Note. Estimates represent the log odds of "V_WILLING = 1" vs. "V_WILLING = 0"

Table 7 demonstrates that only trust in science serves as a reliable predictor of willingness to receive vaccination. The regression formula V_Willing = 2.43 + 0.56 TRUST + e can be utilized to estimate willingness to be vaccinated. This equation indicates that an

increase in trust in science by one point would result in an increase in willingness to vaccinate by 0.56 points. Additionally, it is evident from the table that social dominance orientation and perceived religiosity exhibit a negative relationship with willingness to be vaccinated, although the impact of both variables is not statistically significant.

**Discussion**

The hierarchical logistic regression analysis revealed a significant positive influence of trust in science on willingness to be vaccinated. This finding supports the results of previous studies conducted by Zagefka et al. (2022) and Baumgaertner et al. (2018), which indicate that individuals with high levels of trust in science tend to comply with vaccination recommendations. Additionally, trust in science has been found to reduce the prevalence of resistance to vaccination and consequently enhance willingness to be vaccinated (Yuan et al., 2023).

However, social dominance orientation and willingness to vaccinate were not found to be related, which contradicts the findings of Bilewicz & Soral (2022), who reported that social dominance orientation was able to predict vaccine hesitancy. It is noteworthy that vaccine hesitancy has a strong association with willingness to be vaccinated (Q. Wang et al., 2021). Social dominance orientation is characterized by the tendency to view relationships between groups as competitive. People with high SDO tend to prioritize the perception that their group is dominant over others (Bilewicz & Soral, 2022). This characteristic is closely linked to Right Wing Authoritarianism.

The impact of SDO on an individual's willingness to receive the COVID-19 vaccine is relatively insignificant in Indonesian society, which is characterized by a lack of political polarization into Right or Left Wing ideologies. In contrast, Western countries such as the United States and those in Europe with democratic systems, political parties in Indonesia tend to share similar economic principles, with the main differences being in religious ideology, which is not necessarily linked to the right or left political categorization.

Regarding perceived religiosity, it does not have a significant influence on the willingness to receive the vaccine, which differs from previous research (Lahav et al., 2022). However, there is a slight indication that there may be a negative relationship between perceived religiosity and willingness to receive the vaccine, as indicated by the t-value. Although this effect is not statistically significant, it should be taken into consideration for future research. It should be noted that the measures used for perceived diversity and willingness to receive the vaccine were both assessed using single item measures. Although

single item measures have been proven to be valid and reliable in several previous studies (Mund et al., 2023; Song et al., 2023), they tend to have lower validity and reliability values compared to scales with multiple items (Jovanović & Lazić, 2020). Nonetheless, single item measures have demonstrated high predictive and criterion-related validity (Di et al., 2023; Song et al., 2023).

This study undoubtedly presents certain limitations. One of the primary limitations is the substantial number of items in the questionnaire (over 100), which contributes to an unfortunate high mortality rate among participants. Additionally, the research employs variables with single item measurement. This approach is justified for both practical and methodological reasons, as it is necessary to limit the number of questions and this type of scale has been found to be both valid and reliable. However, it is worth noting that single item measurements have a slightly lower level of validity and reliability compared to scales with numerous items.

## Conclusion

Based on the hierarchical logistic regression analysis, it is evident that trust in science significantly influences an individual's willingness to be vaccinated, with those possessing high levels of trust being more inclined to receive the vaccine in a pandemic scenario. However, this study also revealed that neither social dominance orientation nor perceived religiousness had any impact on willingness to be vaccinated. This finding differs from previous studies conducted predominantly in Western countries with a right-left political dichotomy. The researcher suggests that future investigations should employ a multi-item scale to measure willingness to be vaccinated and delve deeper into the domain of social dominance orientation to establish its distinct political characteristic.

## Declaration of Conflict of Interests

The researcher asserts the absence of any conflict of interest in the conduct of the research.

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