Master's Thesis of Public Health

Association between general trust in government and COVID-19 vaccine hesitancy: A comparative study for Southeast Asian Countries (Indonesia, Philippines, Vietnam, and Thailand)

동남아시아 4 개국 (인도네시아, 필리핀, 베트남, 태국)의 정부 신뢰 수준과 코로나 19 백신 망설임의 연관성

February 2023

Graduate School of Public Health
Seoul National University
Health Care Management and Policy Major

Dayoung Song

Association between general trust in government and COVID-19 vaccine hesitancy: A comparative study for Southeast Asian Countries (Indonesia, Philippines, Vietnam, and Thailand)

Examiner Sun-Young Kim

Submitting a master's thesis of Public Health

February 2023

Graduate School of Public Health
Seoul National University
Health Care Management and Policy Major

Dayoung Song

Confirming the master's thesis written by
Dayoung Song
February 2023

Chair	김창엽	(Seal)
Vice Chair	조원광	(Seal)
Examiner	김선영	(Seal)

Abstract

Association between general trust in government and COVID-19 vaccine hesitancy: A comparative study for Indonesia, Philippines, Vietnam, and Thailand

Dayoung Song
Department of Health Care Management and Policy
Graduate School of Public Health
Seoul National University

Background: Vaccines are the most cost-effective public health measures for preventing infectious diseases, but the increasing trend of vaccine hesitancy serves as barriers to increasing vaccination uptake (Hoy et al., 2022). Vaccine hesitancy is becoming one of global health concern and the World Health Organization has recently declared vaccine hesitancy as 'Top Ten Threats to Global Health'. Vaccine hesitancy is also prevalent in Southeast Asian countries and there is a growing trend of distrust of vaccines and vaccine hesitancy in Southeast Asian countries.

During the COVID-19 pandemic, many countries implemented various health prevention campaigns and vaccination policies. However, according to recent studies, the COVID-19 vaccines uptake in Southeast Asian region is decreasing compared to other regions (Wong et al., 2021). This trend could be result of various factors including vaccine distribution, challenges in administration, procurement, and lack of resources. However, after the initial challenge of vaccine procurement at the beginning of the pandemic, there are safe and effective vaccines readily available with minimal cost. Still, some countries in Southeast Asian countries such as Philippines and Malaysia face challenges in increasing the vaccine uptake. Therefore, it is important to identify the attributing factors to vaccine

hesitancy to increase vaccination coverage and identify the factors in vaccine hesitancy.

Trust in government and health authorities plays a critical role in vaccine rollout as well as perception of COVID-19 vaccination campaigns in the general population. Government plays a significant role in vaccination campaigns from setting regulations to procurement of vaccines, and ensuring accurate information related to vaccines are available to the population. Governments are regulators of vaccination campaigns and provider of vaccines and related information to citizens. Therefore, the citizens' perception of the government and trust on government may play a role in vaccine hesitancy by influencing vaccination motivation.

Previous research also suggest that citizens may have less desire to get immunized if they perceive that government is lacking competence and are incapable of administering safe and effective vaccines (Van Oost et al., 2022). General trust in government, particularly in Southeast Asian countries, varies from country to another by different political settings and government structures. The different political context and level of trust in government can potentially affect the vaccination motivation and vaccine hesitancy. This study aims to investigate the association between government trust and COVID-19 vaccine hesitancy using the dataset of four Southeast Asian countries: Indonesia, Philippines, Vietnam, and Thailand from YouGov Covid19 Behavior Tracker'.

Methods: From the individual-level behavioral survey 'YouGov Covid19 Behavior Tracker', a total of 41,430 respondents from Indonesia, Thailand, Philippines, and Vietnam were included in the analysis. The survey was conducted by Imperial College London's Institute of Global Health Innovation (IGHI) in 30 countries by telephone interviews. This survey provides behavioral analysis on how different populations are responding

and coping with the COVID-19 pandemic and the survey questionnaire was constructed to collect information on how the transmission of COVID-19 and the impact of government's restriction impacted life satisfaction, trust in government, and confidence in health authorities as well as socioeconomic and demographic information.

Using this dataset, the association of vaccine hesitancy and level of government trust was analyzed by country-level and in subgroup based on the level of government trust. The 4 countries were divided into two groups: 1) high government trust countries and 2) low government trust countries. The groups are divided based on government trust. The median government trust score among 113 countries from 'Wellcome Global Monitor 2020'was used as reference to separate the four countries into two groups.

Three models of multivariate logistic regression model were used to calculate the relative risk ratio (RRR). The multivariate logistic regression models were adjusted for sociodemographic variables, health-related variable, and Health Belief Model (HBM) variables. Model 1 shows crude RRR, Model 2 is adjusted for sociodemographic, health-related, and HBM variables, and Model 3 excluded HBM variables. The dependent variable was two dichotomous response of the question " If a Covid-19 vaccine is safe and available to you, will you receive it?" and the independent variable of government trust is based on level of government trust: completely trustworthy, somewhat trustworthy, trustworthy, Not trustworthy, and Not at all trustworthy.

Results: In Indonesia, 'Perceived Barriers of health intervention' and 'Perceived Severity of disease' was observed to have statistically significant association in Model 2 with adjusted RRR 2.39 (95% CI 1.33-4.32) and 1.40 (95% CI 1.01-1.96). For Thailand, negative association was observed in 'Perceived benefits of health intervention' in Model 2 and Model 3. In

Philippines, 'Perceived Barriers of health intervention' and 'Perceived Susceptibility of disease' was observed to have statistically significant association in Model 2 with adjusted RRR 1.88 (95% CI 1.06-3.33) and 1.57 (95% CI 1.11-2.21).

In Thailand, one of the countries in 'high government trust countries' group, positive association was observed in 'Not trustworthy' and 'Vaccine Hesitancy' in Model 1 and Model 3, but the association was not observed after adjusting for controlled variables in Model 2. In Indonesia, significant positive association was observed in 'Not trustworthy' and 'Vaccine Hesitancy' in all three models (Model 1: Adjusted RRR 2.60 (95% CI 1.26-2.99), Model 2: 2.14 (95% CI 1.62-3.59), Model 3: 2.92 (95% CI 1.61-3.39)). Similar results were observed in Vietnam which is one of the 'low government trust countries' group. In Vietnam, significant association was observed in 'Not trustworthy' and 'Vaccine Hesitancy' in all three models (Model 1: Adjusted RRR 1.18 (95% CI 1.05-1.75), Model 2: 1.15 (95% CI 1.03-1.91), Model 3: 1.17 (95% CI 1.06-1.89)). In Indonesia, a significant association was observed in 'Not at all trustworthy' and 'Vaccine Hesitancy' with adjusted RRR in in Model 3, but the association was not observed after adjusting for controlled variables in Model 2. There were no significant association observed in 'Trustworthy' for all four countries.

In 'low trust government countries' group, there were no statistically significant associations observed in all three models. In 'High trust in government countries group', positive association was observed in crude RRR for 'Not at all trustworthy' in Model 1, 1.21 (95% CI 1.08 – 1.88), and in Model 2, 1.20 (95% CI 1.04 - 1.59), but the association was not observed after adjusting for controlled variables in Model 2.

Conclusion: This study shows the association of the level of trust in the government and COVID-19 vaccine hesitancy in Thailand, the Philippines,

Vietnam, and Indonesia, considering the effect of HBM and health-related variables. Our results show statistically significant association between low government trust to high vaccine hesitancy in Philippines and Vietnam. On the other hand, there were no significant association between level of government trust and vaccine hesitancy in Indonesia and the Philippines. The reasons for insignificant association could be attributed to various factors. Previous studies have suggested that low trust in government was associated with vaccination motivation. The attributing factors to vaccine hesitancy could be from various factors that are revealed to have statistically significant association from previous studies including perceived safety of vaccines, personal beliefs, misinformation, religious beliefs and influence of media that are unique to each country.

The observed association suggests that the level of government trust among the population may contribute to vaccine hesitancy in certain populations in Southeast Asia and requires public health attention in increasing vaccine coverage. This study might provide improved understanding the impact of the perception of people on their government and the value of trust on vaccine hesitancy. Previous studies have suggested that due to government's role as regulators of health policies and vaccination campaigns, the perception of government can impact the vaccination motivation. However, the underlying mechanism is still in need of further investigation. Furthermore. though the association of HBM model variables and vaccine hesitancy was observed in this study, the interaction effect of HBM on the association of vaccine hesitancy and level of government trust was not explored. Additional study on the association of HBM variables and vaccine hesitancy along with levels of government trust will contribute to understanding the increasing vaccine hesitancy trend worldwide and within Southeast Asia.

Keywords: Government trust, vaccine hesitancy, COVID-19, Health Belief Model
Student Number: 2019-27887

Table of Contents

List of Tables

List of Figures

Chapter 1. Introduction

1.1 Study Background

The COVID-19 pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARSCoV-2) is an ongoing public health challenge worldwide, significantly affecting health and public health services in developing countries (Ciotti et al., 2020). COVID-19 has affected almost 626 million people, causing the death of more than 6 million people worldwide as of October 2022 (World Health Organization, 2022). The spread of COVID-19 disease in countries around the world lead to World Health Organization (WHO) declaring COVID-19 as a global pandemic in 2020(World Health Organization, 2022). Implementation and delivery of COVID-19 vaccines during the time of worldwide pandemic is a major public health threat especially in many low-and middle-income countries (LMICs)(Shretta et al., 2021). Countries face challenges in the development, procurement, shipment, and delivery of COVID-19 vaccines with limited resources and increasing health threats of the pandemic within the population (Weintraub et al., 2021).

Vaccination is one of the most cost-effective ways to prevent COVID-19 disease and deaths(Gupta & Topol, 2021). Despite the challenges faced in developing vaccines in a short time, global efforts in research and development of vaccines were made to produce mRNA, DNA, and peptide-based COVID-19 vaccines(Marian, 2021). There were different COVID-19 vaccine candidates in clinical trials that accelerated due to the urgency and the need for rapid vaccine development. The unprecedented pandemic led to immediate clinical trials as immunologists searched for the SARS-CoV-2 associated immunogenic molecules to develop an immediate safe and effective COVID-19 vaccines (Chaudhary et al., 2021).

There was an urgent need for effective and safe COVID-19 vaccines to be delivered in a short span of time to prevent further health implications of COVID-19 and an increasing number of cases (Shahzamani et al., 2021). Though there were global efforts to efficiently develop and conduct clinical trials to test the safety of vaccines rapidly, there were several challenges in the delivery and deployment of COVID-19 vaccines due to restrictions on and disruption in travel, commerce, and social distancing(Nelson, 2020). The rapid development of COVID-19 was necessary, however there were heightened public concern in efficacy, safety, and availability as well as social challenges such as vaccine conspiracy beliefs, false information, and vaccine hesitancy (Rosenthal & Cummings, 2021).

By 2021, several pharmaceutical companies worldwide has conducted clinical trials and immune-response studies to determine the safety and efficacy of COVID-19 vaccines which were ready for deployment (Soleimanpour & Yaghoubi, 2021). By 2020, there were more than ten vaccines in the phase 3 of clinical trials and by 2021, the COVID-19 vaccines were available (Safar et al., 2020). Despite the rapid development process of COVID-19 vaccines, the demand of vaccines surpassed the vaccine production capacity and there were disparities in the distribution of the vaccines among the vulnerable populations(Sharma et al., 2020).

After the rapid COVID-19 development process and procurement of vaccines by governments, there were additional challenges in social mobilization and sensitization of vaccine delivery to the general population. Vaccine uptake and coverage is one of the main public health concerns to decrease the prevalence of COVID-19 and to reach heard immunity (Wong et al., 2021). There are several challenges in increasing vaccine coverage including vaccine hesitancy, allocation of vaccines within the population,

prioritizing vaccination groups, involvement of trusted sources for vaccine advocation, and evidence-based vaccination approaches to prevent missed target groups (Weintraub et al., 2021).

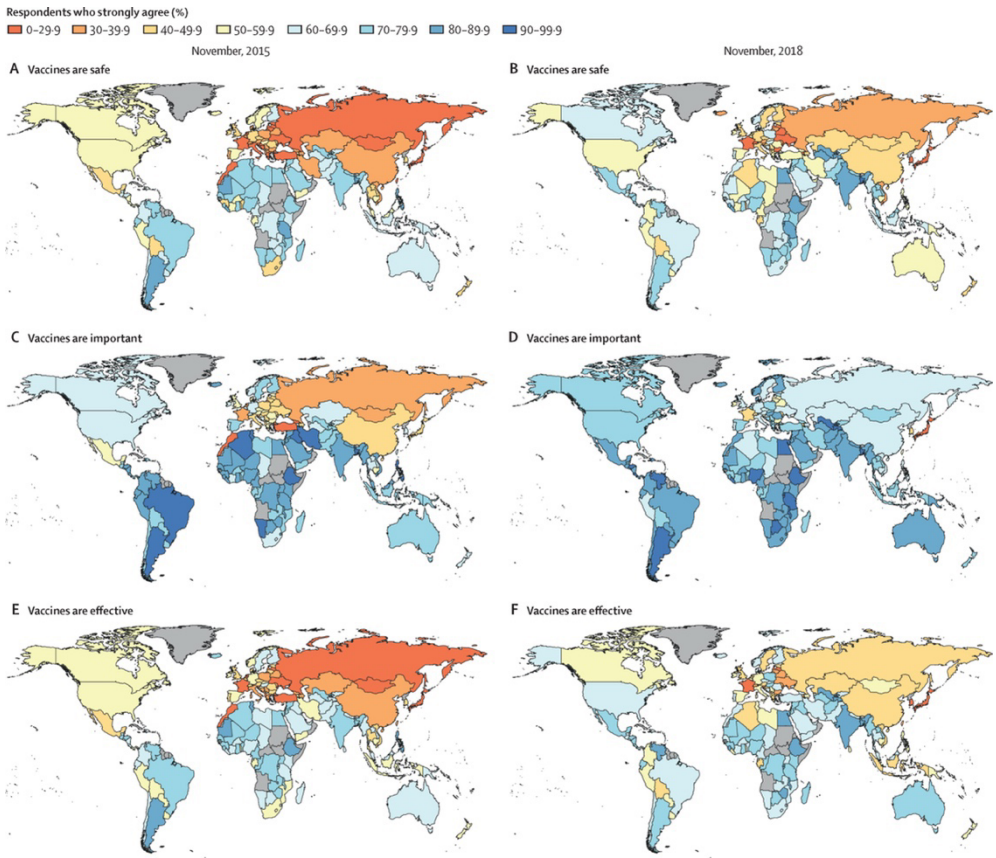

Figure 1. Global trends in perceptions towards the safety of vaccines in November 2015, and November 2018

As shown in Figure 1, the map shows the global trends in perception towards the safety of vaccines worldwide before the start of COVID-19 pandemic from 2015 to 2018 which shows significant improvement in trust of vaccines in majority of continents (De Figueiredo et al., 2020). This study has reported that there were strong association among confidence in the importance of vaccines with vaccine uptake compared to

other determinants such as vaccine safety or effectiveness. Also, there was an association found between vaccine uptake and individual's religious beliefs which was supported by low vaccine uptake in minority religious groups. Aside from six countries, most of the countries had significant increase in respondents strongly aggressing that the vaccines were safe from the year 2015 to 2018 (De Figueiredo et al., 2020). However, the global trends found in this large-scale retrospective temporal modelling study to show the increasing trust in vaccines worldwide does not support the recent attitudes of COVID-19 vaccine uptakes as it is outdated.

Compared to developed countries, the COVID-19 increasing vaccine uptake in developing countries face more challenges. Developing countries face limited resources in health service system, medical infrastructure, and health workers in addition to existing burden of widespread vaccine preventable diseases. One of the main differences among the developing and developed countries is the process of procurement and guaranteeing the designated number of vaccines by governments (Tagoe et al., 2021). In addition to barriers in vaccine procurement, developing countries may face different adversities in vaccine uptake due to cultural and social beliefs that are unique to each culture and experiences and attitude towards vaccine from extensive experience of the Expanded Programmed on Immunization (EPI) compared to developed countries (Tagoe et al., 2021).

Aside from challenges faced in vaccine coverage from limited resources in health service systems and availability of vaccines in developing countries, vaccine hesitancy, refusal of vaccines, is an increasing obstacle faced by governments in their efforts to increase vaccine uptake (Rosenthal & Cummings, 2021; Yasmin et al., 2021). Previous research has shown that the trust in government and government authorities contributes to vaccine uptake and intentions and motivations in receiving vaccines

(Jamison et al., 2019; Miyachi et al., 2020). However, the underlying mechanism of how government trust leads to vaccination or intention of vaccinations remains unclear.

1.2 Research Objectives

The study aims to investigate the association between government trust and COVID-19 vaccine hesitancy. More specifically, this study aims to investigate the association government trust and COVID-19 vaccine hesitancy in low-and middle-income Southeast Asian countries such as Indonesia, Philippines, Vietnam, and Thailand. This study aims to understand the potential barriers that prevent the vaccine uptake in low-and middle income Southeast Asian countries. This study will be a first study to analyze and compare the association of trust in government and vaccine hesitancy in Southeast Asian countries using individual survey data. Though there are various factor in vaccine hesitancy varying from trust in healthcare systems and concerns on side-effects of vaccines, it is important to investigate contributing factor in COVID-19 vaccine hesitancy.

Chapter 2. Background

2.1. Main Concepts

2.1.1 Vaccine Hesitancy

Vaccine hesitancy is defined as ‘an attitude or related actions of individuals who may refuse some vaccines (may not refuse all vaccines), delay uptake of vaccines, or deter from accepting vaccines according to recommended schedule and are unsure in making the decision to be vaccinated’ (Dubé et al., 2013b). It is difficult to clearly define or give direct definition of vaccine hesitancy at population level because vaccine hesitancy may not directly be associated with percentage of vaccine coverage or vaccine uptake. For example, people who show vaccine hesitancy may receive all the recommended vaccines by government’s recommended schedule, but they may have attitudes such as having significant doubts or worries in the process.

As a result, vaccination coverage and uptake cannot be interpreted as a result of vaccine hesitancy and there must be attitude and perception-related aspects in defining vaccine-hesitant individuals. Various studies have developed survey to determine population’s attitude towards vaccine hesitancy, including Opel et al.’s survey which measures four domains of vaccine hesitancy including 1) immunization behavior, 2) attitudes about vaccine mandates and exemptions vaccination behavior, 3) beliefs about vaccine safety, efficacy, and 4) trust (Opel et al., 2011).

The COVID-19 pandemic caused thousands of deaths worldwide and vaccine hesitancy has been recognized as one of the global health issues (Troiano & Nardi, 2021). Vaccine hesitancy of COVID-19 vaccines was observed from various countries from the onset of the pandemic to the distribution of vaccines to the general population (Jafar et al., 2022; Marzo

et al., 2022; Yasmin et al., 2021). There are several reasons for vaccine refusal and hesitancy. One of the most common reasons are concerns about the safety and effectiveness of vaccines(Rosenthal & Cummings, 2021). Also, concerns on side effects of vaccines and questions on the rapid pace of vaccine development were key issues in vaccine hesitancy(Wong et al., 2021). Additionally, trust in vaccines and the institutions that administer them, mostly the country's ministry of health or governments, disease surveillance and prevention institutions, were additional reasons for vaccine hesitancy.

The WHO SAGE Working Group on Vaccine Hesitancy developed 'Vaccine Hesitancy Determinants Matrix' which shows the determinants of vaccine hesitancy that fall under three categories including 1) contextual, 2) individual and group, 3) vaccine/vaccination-specific influences (MacDonald, 2015). The contextual influences can be defined as influences that are caused by historic, socio-cultural, environmental, health system, institutional, economic or political factors. The factors include politics, geographic barriers, perception of the pharmaceutical industry, and influential leaders. For individual and group influences, the influences from personal perception of vaccines or peer or social environments are included. Some of the examples include beliefs and attitudes about health and prevention, social norms, knowledge, awareness. Lastly, the vaccine specific factors are directly related to vaccines or vaccinations including vaccines, formulation of vaccines, mode of administration, mode of delivery and reliability of the supply of vaccines(MacDonald, 2015).

2.1.2 Government Trust

The concept of government trust can be interpreted in various ways and it is enclosed by conceptual vagueness as well as subjectivity(Bouckaert & Van de Walle, 2001). According to an in-depth analysis on the concept

and explanation of trust in government by Bouckaert et al, the perception towards government from the population can be divided into aspects such as government management, public administration, sociology and economy. The interpretation of government trust varies from research perspective from transparency, practice of democracy, corruption, to allocation of financial resources. In each category, the perception of government by population can evaluate the performance, government overload, capability, identity, participation, and cooperation as indicators of government trust (Bouckaert & Van de Walle, 2001).

The determination of 'trust' is also subjective, but through research on theoretical and practical concept of trust in government and organizations, 'trust' is defined by emotionality and rationality of public's susceptibility and belief in certain entities. The in-depth analysis by Bouckaert et al on the definition of 'government trust' suggests that there are diverse dimensions and criteria that are academically accepted and used in various research. One of the examples is Gamson's 4 objects of political trust introduces criteria for determining government trust such as incumbent authorities, political institutions, public philosophy, and political community (Levi & Stoker, 2000).

Studies show that the role of government and trust in government is critical in ensuring public confidence in the effectiveness and safety of vaccines as well as vaccination coverage (Ahn et al., 2021; Bronfman et al., 2022; Lim et al., 2021). COVID-19 pandemic has been characterized by misinformation and conspiracy theories, mistrust in government can prevent people from following government COVID-19 vaccine recommendations (Andronicean u, 2021). Thus, trust in government and health authorities plays a critical role in vaccine rollout as well as perception of COVID-19 vaccination campaigns in general population. The government in each country plays a significant role in vaccine distribution and delivery,

therefore the level of trust in government may have influence on public's attitude towards receiving COVID-19 vaccines (Gotanda et al., 2021). Especially in Southeast Asian countries, the general trust in government is different among the countries and further studies are required to analyze the implication of government trust on vaccine rollout, uptake, and vaccine hesitancy.

2.1.3 Health Belief Model (HBM)

The health belief model (HBM) is a model which aims to describe the behavioral actions and explain why individuals make or fail in making preventative health actions(Abraham & Sheeran, 2015). In 1956, the initial model was developed to explain why patients were not seeking diagnostic x-rays for tuberculosis when it was available and evident in preventative effects (Figure 2).

The initial model include critical parts in the HBM such as perceived susceptibility to diseases and perceived benefits of engaging in the preventative health actions (Janz & Becker, 1984). The initial structure of HBM is developed further by different researchers and it is one of the widely used models in describing health decisions in individual level and health psychology. The use of HBM is mostly used to predict and explain certain health behaviors and it has been implemented to design health interventions such as immunization campaigns and preventative diagnostics(Jones et al., 2014).

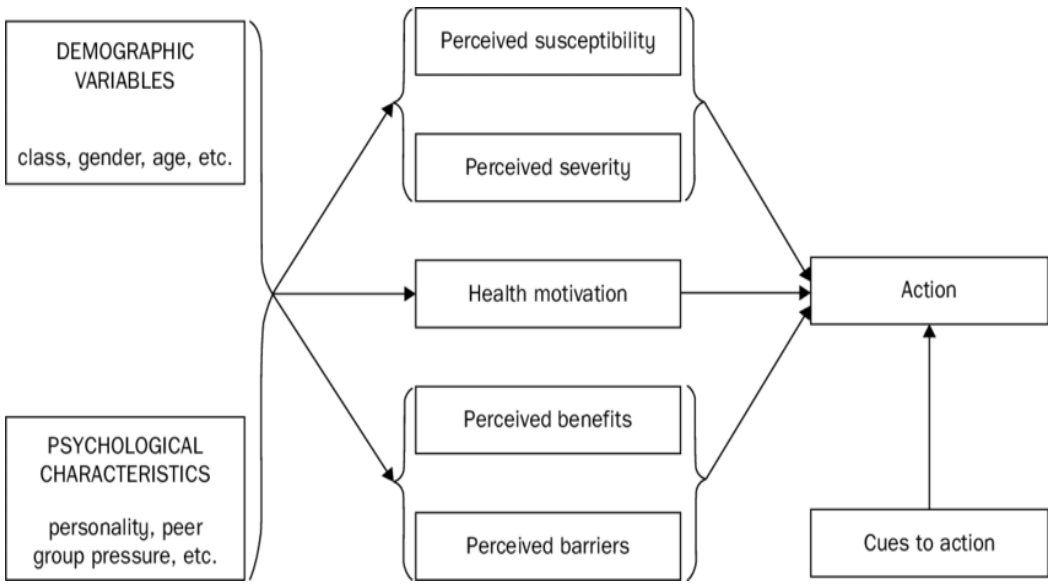

Figure 2. The Health Belief Model(Abraham & Sheeran, 2015)

There are five components of HBM which can be grouped into two main groups: 1) perception of threat of illness and 2) the effectiveness of health actions that are perceived by individuals. The perceptions of the threat of illness includes beliefs about perceived susceptibility of certain diseases and perceived severity of the effects or consequences of certain disease(Rosenstock et al., 1988).

The perceived susceptibility is belief of individual on their risk of contracting a disease or certain health conditions. The perceived severity of contracting an illness is related to individual's concerns on the side effects of disease including medical conditions as well as social effect such as impact on economics, family, occupation, and social status(Abraham & Sheeran, 2015). The perceived effectiveness of health action and health intervention can be evaluated by perceived benefits and perceived barriers(Barley & Lawson, 2016). The perceived benefits refer to health benefits that can be obtained by participating or engaging on health actions that reduce the susceptibility to an illness. Also, the perceive benefits are

individual's assessment in benefits in reduction of susceptibility to illness or reducing the severity of the disease. The perceived barrier are conditions that prevent individuals from making health actions or decisions such as cost, inconvenience, pain, or discomfort(Wu et al., 2020).

2.2 Vaccine Hesitancy in Southeast Asia, Government Trust, and Vaccination Motivation

2.2.1 Vaccine Hesitancy in Southeast Asia

There are 11 countries in Southeast Asia: Brunei, Burma (Myanmar), Cambodia, Timor-Leste, Indonesia, Laos, Malaysia, the Philippines, Singapore, Thailand and Vietnam. Recent studies have shown that there is a widespread of hesitancy towards receiving vaccines in Southeast Asian countries. According to the study conducted in 2022 on vaccine hesitancy and vaccine acceptance in some of the Southeast Asian countries including Indonesia, Malaysia, Myanmar, Philippines, Thailand, and Vietnam, half of the population from 5260 survey participants expressed hesitancy in getting vaccinated (Marzo et al., 2022).

Additional study suggested that low public trust in vaccines becomes obstacles in government's immunization campaigns in conducted in Southeast Asian countries and nearly half of the population said they would not receive COVID-19 vaccines due to concerns in safety of vaccines in Philippines (Corpuz, 2021). Furthermore, increasing concern of vaccine hesitancy was observed in Malaysia as they experience resurgence of vaccine preventable diseases (Wong et al., 2020). The studies above raise an alarming concern of vaccine hesitancy in Southeast Asian countries and further investigation of the reasons and causes is needed.

Contributing Factors of Vaccine Hesitancy in Southeast Asia

According to recent research, contributing factors with statistical significance in Southeast Asian countries are: demographic characteristics such as age, sex, residence, income, occupation, and marital status, vaccines-related knowledge, attitude towards COVID-19 vaccination, false information, conspiracy beliefs, religious beliefs, trust and confidence (Wong et al., 2021). Another study suggested that the most important factors in determining vaccine update in 6 of Southeast Asian countries are the perceived safety and side effects of the vaccines (Marzo et al., 2022).

Religious and Cultural Beliefs

Several studies had identified religious beliefs as one of the components of vaccine hesitancy(Corpuz, 2021; Kalok et al., 2020). Among 11 Southeast Asian countries, the religion of Islam is the official religion of Malaysia and Brunei as well as officially recognized religion of Indonesia, Thailand, and the Philippines. In previous study conducted in Malaysia, COVID-19 vaccine hesitancy was associated with Islam religion, showing statistically significant association of vaccine hesitancy in Muslim population (Jafar et al., 2022).

A study conducted in Indonesia observed that there were religious concerns regarding the production of vaccines and the vaccine's 'halal status', potentially influencing vaccine hesitancy in the population (Jusril et al., 2022). The ingredients used in the vaccine manufacturing process and its acceptance under Islamic law raised concerns on acceptance of COVID-19 vaccines in Muslim population. In the past, the government in Indonesia has required that the vaccines should be certified as halal and vaccine ingredients should follow the rulings under Islam law, not containing forbidden materials (Pronyk et al., 2019).

In one of the Southeast Asian countries, Malaysia, vaccine hesitancy was related to anti-vaccine propaganda, religious beliefs, adverse event following immunization (AEFI), and belief that traditional or alternative medication use is more effective and safer, pseudoscience practices, and anti-vaccine conspiracy theories lead to vaccine hesitancy actions. Though the fear or vaccine safety and effectiveness has contributed to vaccine hesitancy in Malaysia, the role of conspiracy theories, pseudoscience beliefs, religion, and experience of immunization campaigns played a critical role in vaccine hesitancy(Wong et al., 2020). Thus, the Southeast Asian countries' context and local cultural beliefs my influence the attitude of the population towards governments' immunization efforts.

Past Experiences of Vaccine Hesitancy in Southeast Asian Countries

The contributing factors in vaccine hesitancy in Southeast Asian countries may be unique to their experience in vaccine introduction and government's national immunization campaigns. One of the examples is Dengue vaccine refusal in Philippines where the parents refused to vaccinate their children with dengue vaccines (Yu et al., 2021).

There were various levels of contributing factors of dengue vaccine hesitancy in Philippines. First reason for Dengue vaccine hesitancy in Philippines was the media exchange of wrong information on the vaccines that contributed to mistrust of general public on the vaccination campaign(Yu et al., 2021). This lead to increasing public anxiety and mistrust in government, leading false information, rumors, and conspiracy theories on vaccines to spread in social media. This incident led to false information on the side effect of the vaccines and embedded false and negative narrative on immunization campaign conducted by the government (Yu et al., 2021).

The continuous mistrust in government and the government authorities lead to general public concluding that the dengue vaccines lead to death without proven scientific evidence. The distortion of truth and rumors circulating in communities lead to the mistrust in government officials. The lack of information and proper media coverage led to highly political controversies and public panic (Migriño et al., 2020). These political experiences that some of the Southeast Asian countries faced provided personal narratives and may have effect on trust in government and its public health policies regarding COVID-19 vaccination (Yu et al., 2021).

2.3 Government Trust and Vaccination Motivation

Currently, there few studies conducted on the correlates of COVID-19 vaccine hesitancy, but there is a lack of research on the association of general trust in government and vaccine hesitancy in low-and middle-income countries (LMICs). Though the underlying mechanism remains to be identified, are several suggestions provided by previous literature which contributes to how government trust influences individual's motivation and intention in vaccine uptake(Fall et al., 2018; Trent et al., 2022). Vaccine hesitancy, in other words, is demotivation of individuals to take vaccines, so exploring how government trust influences individual's motivation may provide insight of association between government trust and vaccine hesitancy.

Vaccination Motivation

The role of individual's motivation plays a critical role in vaccine uptake and previous research provides factors relating to individual's motivation to receive vaccines. There are two types of motivations: internal motivations and external motivations. The internal motivations of

individuals to seek and receive vaccines include fear of contracting disease, intention to protect themselves from the disease, fear of severity of disease, and protecting those around them from disease from vaccination(Van Oost et al., 2022).

Aside from internal motivations, previous literatures have shown positive relation of various external motivation factors and vaccine uptake, including disapproval from the community and peers from not receiving vaccines, obligations by government authorities, disadvantages faced due to not being vaccinated such as entering public places, and obligations of vaccination for everyday activities such as going to workplaces and using public transportation(Khatiwada et al., 2021; Van Oost et al., 2022). These internal and external motivation factors have shown to have robust impact on vaccine uptake, but still some individuals lack motivation or refuse to receive vaccines(Cooper et al., 2021; Wong et al., 2020).

Role of Government Trust in Vaccination Motivation and Vaccine Uptake

Government plays a significant role in vaccination campaigns from setting regulations to procurement of vaccines, ensuring accurate information related to vaccines are available with efforts to contain the spread of the disease. Governments are regulators of vaccination campaigns and provider of vaccines and related information to citizens. Considering its critical role, the important question to consider is whether government trust play a role in vaccine hesitancy by influencing individual's motivation.

One component of trust is a person's willingness to voluntarily surrender to the actions or rules created by the trusted entity. There are different aspects of government trust which may influence a person's willingness to follow vaccination regulations including government's integrity, responsiveness, reliability, openness, fairness, and competence(Levi & Stoker, 2000). Previous research suggest that citizens

may have less desire to get immunized if they perceive that government is lacking competence and are incapable of administering safe and effective vaccines (Van Oost et al., 2022). Also, there might be more hesitation in vaccination if individuals perceive government lacking the components of trust including reliability and responsiveness. This leads them to believe that the government can be indifferent to the potential side effects of vaccines and prevent from receiving vaccines. Furthermore, citizens motivation to get vaccines may be influenced by perceiving government as having lack of integrity and openness by sharing misinformation. Thus, low trust in government, perceiving government lacking in integrity, responsiveness, reliability, and competence, may lead to vaccine hesitancy and low motivation of vaccine uptake.

Chapter 3. Methods

3.1 Data Source

The 'Imperial College London YouGov Covid19 Behaviour Tracker' data will be used for the analysis. This dataset is an individual survey which provides behavioral analysis on how different populations are responding to the pandemic provided by clinical experts at Imperial College London's Institute of Global Health Innovation (IGHI). The researchers at IGHI intended to identify the gap in populations' behaviors in responding to participating countries' governments COVID-19 guidelines. The individual-level survey was conducted to collect demographical information and participant's reason for either receiving or rejecting COVID-19 vaccination. The data is available online to the public audience and both developed and developing countries were included.

The survey was launched across total of 29 countries in 2020 after the onset of COVID-19 pandemic. The aim of the survey was to collect behavioral information on population's decision on receiving COVID vaccines as well as to understand changing behaviors and attitudes of people in relation to the pandemic. The survey questionnaire was constructed to collect information on how the transmission of COVID-19 and the impact of government's restriction impacted life satisfaction, trust in government, and confidence in health authorities. It also collected socioeconomic information, excluding personal identification information.

There are two sections in the survey questionnaire 1) preventative behaviors, focusing on populations' attitude towards preventative measures (i.e., washing hands, avoiding public places, wearing masks and receiving vaccines), and 2) life satisfaction and wellbeing influenced by COVID-19 (i.e., WHO's five wellbeing indexes, attitude towards contract-tracing, trust

in government, confidence in governments guidelines, etc.). The survey was conducted on weekly or bi-weekly basis since April 2020 with the aim to collect information to help public health officials in their efforts to limit the impact of the disease.

3.2 Study Design

3.2.1 Country Selection and Country Profile

The 'Imperial College London YouGov Covid19 Behaviour Tracker' survey was conducted in 30 countries. Among the 30 countries, 4 Southeast Asian countries were selected for this analysis: Indonesia, Philippines, Thailand, and Vietnam. Though there are a total of 11 Southeast Asian countries, the countries with available datasets from 'Imperial College London YouGov Covid19 Behaviour Tracker' were selected. The survey used same survey questionnaire in all 4 countries selected for this study with same data collection method. Thus, the survey questionnaire and variables are consolidated, and questionnaire is not tailored to be country specific. Table 1 shows the country profile including population, GDP, life expectancy, main religion, and government characteristics. Additionally, the characteristics of government including the governmental structure, regime type, and components of democracy index including scores of electoral process and pluralism, functioning of government, political participation. political culture, and civil liberties from EIU Democracy Index.

Table 1. Country Profile and Government Characteristics

Countries	Population	GDP	Life Expectancy	Main Religion	Government Structure Characteristics	Regime Type	Democracy Index Ranking	Democracy Index Overall Score	Electoral process and pluralism Score	Functioning of Government Score	Political Participation Score	Political Culture Score	Civil Liberties Score
Year	2021				2022	2020							
Source	World Bank				Wikipedia	EIU Democracy Index							
Indonesia	276.4 million	1.186 trillion USD	71.96 years	Muslim	Presidential representative democratic republic	Flawed democracy*	65	6.30	7.92	7.50	6.11	4.38	5.59
Thailand	69.95 million	506 billion USD	77.38 years	Theravada Buddhist	Constitutional monarchy with parliamentary system composed of three branches: executive, legislative, judiciary	Flawed democracy*	73	6.04	7.00	5.00	6.67	6.25	5.29
Philippines	111 million	394.1 billion USD	71.41 years	Roman Catholics	Presidential representative democratic republic	Flawed democracy*	55	6.56	73.00	7.00	5.00	6.67	6.25
Vietnam	98.17 million	362.6 billion USD	75.57 years	Buddhism	Socialist one-party rule, Authoritarian	Authoritarian**	137	2.94	0.00	2.86	3.89	5.63	2.35

* Nations have free and fair elections and basic civil liberties are respected. However, there are significant weaknesses in other aspects of democracy, including problems in governance, an underdeveloped political culture and low levels of political participation.
**Nations have substantial irregularities that often prevent them from being both free and fair. Government pressure on opposition parties and candidates may be common. Serious weaknesses are more prevalent than in flawed democracies- in political culture, functioning of government and political participation. Corruption tends to be widespread, and the rule of law is weak. Civil society is weak. Typically, there is harassment of and pressure on journalists, and the judiciary is not independent.

3.2.2 Country Profile and Government Characteristics

Country group based on trust of national government

The four countries selected are divided into two groups by 1) higher trust in government countries and 2) lower trust in government countries using the trust in the national government by country index from 'Wellcome Global Monitor 2020'. This survey is conducted in 113 countries to explore the country's perceptions of science, healthcare systems and governments. The survey provides the percentage of the survey population's trust in the national government by country. The data provided percentage score of trust in national government of Indonesia, Philippines, Thailand, and Vietnam, 47.4%, 79.8%, 69.4%. 47.6%, respectively. The four countries are divided into two groups by percentage score using the median percentage score of 113 countries in the survey 54.8 as reference. The two country groups are divided by: 1) high trust in national government countries (Philippines and Thailand) and 2) low trust in national government with relatively lower percentage score (Indonesia and Vietnam).

Table 2. Countries Grouped by Level of Government Trust using 'Wellcome Global Monitor 2020' Index

Government Trust Level	Country	Year	Trust in National Government (%)
Low Trust	Vietnam	2020	**47.6**
	Indonesia	2020	**47.4**
High Trust	Philippines	2020	**79.8**
	Thailand	2020	**69.4**
Median score of 'Trust in National Government' among 113 countries			54.8

3.2.1 Theoretical Model Used: HBM

The health belief model is a social psychological health behavior change model developed to explain and predict health-related behaviors, particularly regarding the uptake of health services. There are four dimensions to the HBM which are 1) perceived susceptibility, 2) perceived severity, 3) perceived benefits and 4) perceived barriers, and 5) health motivation. The HBM factors are used in the study as the components of HBM are suggested to be statistically significant factors of vaccine hesitancy in previous studies (Al-Metwali et al., 2021; Chen et al., 2021; Hossain et al., 2021; Huynh et al., 2022; Limbu et al., 2022; Shmueli, 2021). The HBM components were included in this analysis as controlled variable in observing the association of government trust and vaccine hesitancy.

3.3 Dependent and Independent variables

The explanatory variable, controlled variable, and dependent variables were all obtained from 'Imperial College London YouGov Covid19 Behaviour Tracker' country-level data sets for Indonesia, Thailand, Vietnam, and Philippines. The country-level datasets adopted same survey questionnaire and variables, thus allowing compatibility and comparison among the countries.

3.3.1 Outcome Measures

For vaccine hesitancy, the respondents were asked the question "If a Covid-19 vaccine is available to you, will you get it?" and the answer choices were 1) yes, 2) no, and 3) not sure. From the responses to the question above, the respondents were grouped into two categories: Group 1- No vaccine hesitancy (responding to answer choice 1) yes) and Group 2- Vaccine hesitancy (responding to answer choice 2) no and 3) not sure).

Those who responded to answer choice 3) not sure were also included in Group 2 – Vaccine hesitancy group as indecision and unsure in making the decision to be vaccinated is in the scope of vaccine hesitancy.

3.3.2 Independent Variables

The level of trust in government is measured based on the questions "The government of your country is.." and the answer choices are: 1) not at all trustworthy, 2) not trustworthy, 3) somewhat trustworthy, 4) trustworthy, and 5) completely trustworthy. The level of trust was compared using "not at all trustworthy" as reference and comparing other levels of trust in government mentioned above.

3.3.3 Controlled Variables/ Covariates

The estimated controlled variables are shown in Figure 6, including sociodemographic variables such as gender, age, education, and occupation, as well as health-related variables and HBM variables. *Sociodemographic variables* gender, age, and education were included as controlled variables from literature review (Lazarus et al., 2020; Troiano & Nardi, 2021).

Health-related variables are included in the analysis as previous literature review have shown that having underlying health conditions are positively associated with vaccine hesitancy (Batty et al., 2022; Ehde et al., 2021; King et al., 2021; Tsai et al., 2022). The health conditions of respondents were measured by survey question "Which, if any, of the following have you been diagnosed with?.." with answer choices 1) yes and 2) no to diseases (arthritis, asthma, cancer, cystic fibrosis, chronic obstructive pulmonary disease (COPD), diabetes, epilepsy, heart disease, high blood pressure, high cholesterol, HIV/ Aids, mental health condition, and multiple sclerosis (MS)).

Health Belief Model related variables are included in this study as covariates since previous literature have shown significant associations with HBM components and vaccine hesitancy(Chen et al., 2021; Limbu et al., 2022). Previous study has observed the association of high level of perceived barriers and perceived benefits with higher vaccine hesitancy(Chen et al., 2021). Therefore, the HBM components were selected in this study as controlled variables. 1) *Perceived Susceptibility*- perceived susceptibility is measured on participants' perceived level of COVID-19 infection from survey questions "Getting infected with COVID-19 is…" with answer choices 1) high and 2) low. 2) *Perceived Severity*- The perceived severity of COVID-19 is measured based on the preventative behaviors, focusing on populations' attitude towards preventative measures question: "Suffering severe health consequences if infected with COVID-19 is..." with answer choices 1) high and 2) low. 3) *Health Motivation*- Health motivation is measured by COVID-19 preventative health actions taken by respondents: *"*Would you be willing or not to wear mask to prevent COVID-19" with answer choices 1) yes and 2) no. 4) *Perceived Benefits*- The perceived benefits are assessed by participant's perception on effectiveness of vaccines. "Do you believe that vaccines are effective?" with answer choices 1) yes and 2) no. 5) *Perceived barriers*- The perceived barriers are assessed by participant's perception on effectiveness of vaccines from survey question "COVID-19 vaccination is difficult to get or too costly…" with answer choices 1) yes and 2) no.

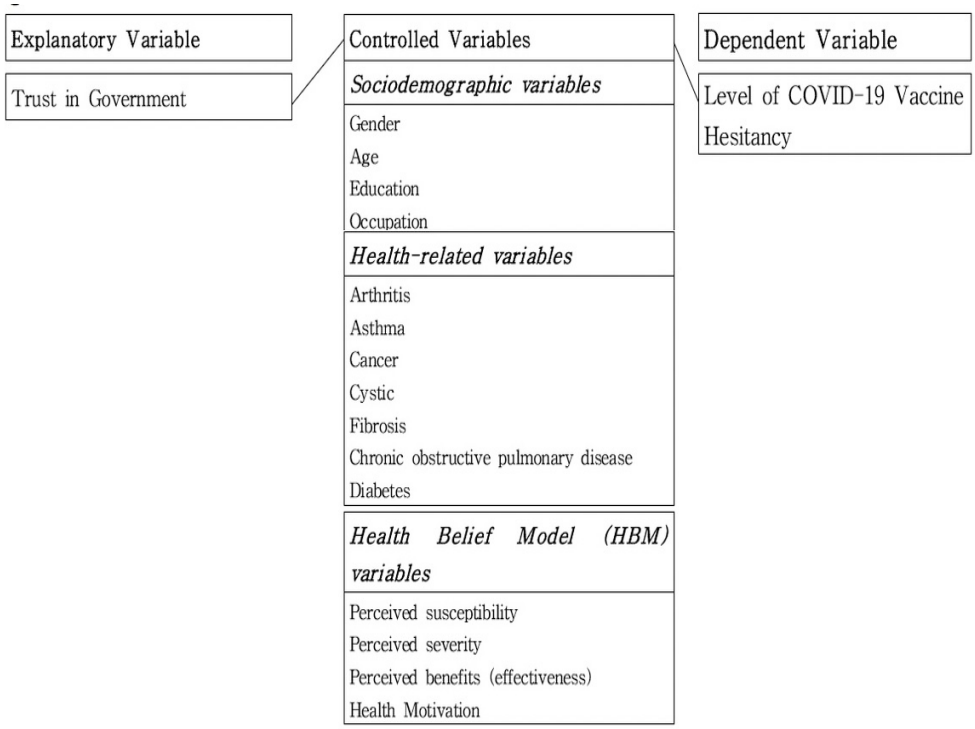

Figure 3. Independent, Controlled, and Dependent Variables used in the Analysis

3.4 Statistical Analysis

Adjusted multivariate logistic regression was performed to assess the association of general trust in government with COVID-19 vaccine hesitancy after other covariates are controlled. All statistical analysis was performed using SAS 9.3 Studio software (SAS Institute Inc., Cary, NC). The relationships between dependent and independent variables were determined by univariate analysis, using either t-tests on independent samples or chi-squared tests, depending on the characteristics of the examined variable either categorical or continuous. To evaluate the association of the level of government trust and vaccine hesitancy, multivariate logistic regression models were used to calculate Relative Risk

Ratio (RRR) and 95% confidence intervals. The multivariate logistic regression models were further adjusted for health-related variable as well as HBM variables. Two statistical analysis models were used adjusting for different controlled variables, considering the effect of each controlled variables on level of vaccine hesitancy: 1) Model 1 shows crude RRR and 2) Model 2 is controlled for the independent variables from health belief model (HBM), demographic variables, and health-related variables, and 3) Model 3 excludes HBM variables as controlled variables. Different models of analysis were used with different controlled variables as the outcome of vaccine hesitancy is known to be associated with diverse factors from previous studies (King et al., 2021).

Chapter 4. Results

4.1 Study participants and characteristics

Table 3 provides the demographics characteristics of 44,573 participants by each country. In Thailand and Philippines, the average age was slightly higher compared to Vietnam and Indonesia. In Thailand, the proportion of female was higher in vaccine hesitancy population compared to no hesitancy population with p value of 0.003 ($P < 0.05$). For occupational status, the difference was observed only in Philippines. However, differences were not observed in gender, occupation level, size of household, number of children in household, and age group in Malaysia and in Vietnam. When classified by vaccine hesitancy status, significant difference was observed in household size in Thailand with p value of 0.013 ($P < 0.05$).

Table 4 shows the distribution of health status and HBM attributes of the study participants. For Indonesia, the disease status of Arthritis was statistically significant with p value of 0.045 and for HBM variables, perceived susceptibility of disease has shown significance difference in distribution among the population with p value of 0.023. In Malaysia, statistically significant difference in distribution was observed in disease status of Asthma and COPD with p value of 0.042 and 0.018, respectively. For HBM variables, there were no difference in distribution observed among the study population for Thailand. For Vietnam, statistically significant difference in distribution was observed in disease status of arthritis and asthma with p value of 0.016 and 0.004, respectively. For Philippines, statistically significant difference in distribution was observed in HBM variable, Perceived Benefits of health intervention (vaccines) among no vaccine hesitancy and vaccine hesitancy groups.

4.2 Association between demographic characteristics and vaccine hesitancy

In multivariate regression analysis, associations were observed between demographic characteristics and vaccine hesitancy as shown in Table 5. For Indonesia, age groups of 30-49 and 50-65 was observed to be negatively associated vaccine hesitancy in Model 1 (Crude RRR) and Model 2 (Adjusted RRR). Gender was positively associated comparing male to female populations in Model 3 (Adjusted RRR excluding HBM).

In Model 3 for occupation, full time employment was positively associated while retired was negatively associated compared to unemployment as reference. Number of household children was positively associated in Model 2 and Model 3. For Thailand, age groups were observed to be negatively associated with vaccine hesitance in Model 3.

For occupation, full time employment and full-time student was positively associated in Model 2 and Model 3, both models adjusting for socioeconomic status and health related variables. For Vietnam, age group older than 65 years was negatively associated in Model 1 and female was positively associated in Model 2 with male respondents as comparison. Furthermore, in Model 2, positive association was observed in household size and number of household children. For Philippines, 30-49 age group was negatively associated in Model 1 showing crude RRR, but the associate was not observed in adjusted analysis in Model 2 and Model 3 (Table 5).

4.3 Association between disease status, Health Behaviors Model (HBM) attributes and vaccine hesitancy

Health related variables are based on self-reported health status of the participants. For Indonesia, the self-reported arteritis and asthma was associated with vaccine hesitancy in Model 2 with adjusted RRR of 1.07

(95% CI 1.08-1.93) and 1.49 (95% CI 1.10-2.02). In contrast, cancer was negatively associated in Model 2 with adjusted RRR 0.71(95% CI 0.54-0.93). respectively. For HBM variables, Perceived Barriers of health intervention and Perceived Severity of disease was observed to have statistically significant association in Model 2 with adjusted RRR 2.39 (95% CI 1.33-4.32) and 1.40 (95% CI 1.01-1.96).

For Thailand, there were no association observed in disease status in all three analysis models. For HBM variables, negative association was observed in perceived benefits of health intervention in Model 2 and Model 3 while positive association was observed in perceived susceptibility of disease in crude RRR in Model 1. For Vietnam, only asthma was associated with vaccine hesitancy with adjusted RRR 1.11 (95% CI 1.04-2.28) in Model 3. Lastly, the disease status of arthritis in Philippines was positively associated in all three analysis models as well as in cystic fibrosis in Model 1 and Model 2. In HBM variables, Perceived Susceptibility of disease was associated in all three models while Perceived Severity of disease was negatively associated in only Model 3 (Table 6).

4.4 Association between trust in government and vaccine hesitancy

Table 7 shows the association of trust in government and vaccine hesitancy. In Indonesia, negative association was observed in level of trust in government for ‘Somewhat trustworthy’ with crude RRR 0.86 (95% CI 0.78- 0.95) when compared to ‘Completely trustworthy’. However, in Model 2 with adjusted RRR with socioeconomic, HBM, health-related controlled variables and in Model 3 adjusted RRR without HBM variables, significant association was not observed. In Indonesia, significant positive association was observed in ‘Not at all trustworthy’ with adjusted RRR in

Model 3, 1.33 (95% CI 1.06- 1.88), and in Model 3, 1.30 (95% CI 1.20 - 1.82). In Thailand, positive association was observed in crude RRR for 'Not trustworthy': 1.08 (95% CI 1.00- 1.91) and 'Not at all trustworthy':1.23 (95% CI 1.10 - 1.75), but the association was not observed after adjusting for controlled variables in Model 2 and Model 3.

In contrast to Indonesia in the 'Higher trust in government countries' group, a positive association was observed in Vietnam for 'Somewhat trustworthy' with crude RRR 1.10 (95% CI 1.08-2.11). However, there were no significant association observed after adjusting for controlled variables in Model 2 and Model 3. In Vietnam, significant association was observed in 'Not trustworthy' in Model 2 and Model 3 with adjusted RRR 1.07 (95% CI 1.02-2.33) and 1.03 (95% CI 1.11-2.21), respectively. In Philippines, a positive association was observed for 'Not trustworthy' in in all three models, with adjusted RRR in Model 2, 2.14 (95% CI 1.62-3.59). There were no significant association observed in 'Trustworthy' for all four countries. In 'lower trust in government countries' group, positive associations were found in Model 2 in Vietnam and Indonesia. Similar results were observed in the 'higher trust in government countries' group with a statistically significant association observed in Philippines in Model 2 (Table 7).

Table 8 shows the association of trust in government and vaccine hesitancy by high trust in government countries group and low trust in government countries group. In low trust government countries group, there were no statistically significant association observed. In high trust in government countries group, positive association was observed in crude RRR for 'Not at all trustworthy' in Model 1, 1.21 (95% CI 1.08 – 1.88), and in Model 2, 1.20 (95% CI 1.04 - 1.59), but the association was not observed after adjusting for controlled variables in Model 2 and Model 3.

Table 3. Distribution of demographic characteristics of study populations [a]

	Higher Trust in Government Countries*						Lower Trust in Government Countries*					
	Philippines			**Thailand**			**Vietnam**			**Indonesia**		
	No vaccine hesitancy (n = 11056)	Vaccine hesitancy (n = 946)	*P*-value [b]	No vaccine hesitancy (n = 11179)	Vaccine hesitancy (n = 954)	*P*-value	No vaccine hesitancy (n = 11104)	Vaccine hesitancy (n = 970)	*P*-value	No vaccine hesitancy (n = 11234)	Vaccine hesitancy (n = 907)	*P*-value [b]
Age (years), Mean	36.26±13.44	34.74±12.58		33.30±11.27	32.67±11.30		31.18±8.76	31.47±10.71		30.40±10.05	30.12±9.30	
Age group (years)												
≤18-29	5882 (52.97)	488 (50.31)	0.210	5354 (47.89)	439 (46.02)	0.605	5882 (52.97)	488 (50.31)	0.392	6325 (56.30%)	511 (56.34)	0.188
30-49	4307 (38.79)	399 (41.13)		4758 (42.92)	415 (42.92)		4307 (38.79)	399 (41.13)		4296 (38.24)	358 (39.47)	
50-65	815 (7.34)	72 (7.42)		911 (8.15)	87 (9.12)		815 (7.34)	72 (7.42)		550 (4.90)	358 (39.47)	
≥65	100 (0.90)	11 (1.13)		156 (1.40)	13 (1.36)		100 (0.90)	11 (1.13)		63 (0.56)	511 (56.34)	
Gender												
Male	5264 (47.61)	448 (47.36)		4762 (42.60)	403 (42.24)	0.003	5844 (52.63)	509 (52.47)	0.008	6155 (54.79)	414 (45.64)	0.063
Female	5792 (52.39)	498 (52.64)		6417 (57.40)	57.76 (57.76)		5260 (47.37)	461 (47.53)		5079 (45.21)	493 (54.36)	
Occupation Status												
Unemployed	1481 (13.40)	125 (13.21)	0.013	1706 (15.26)	163 (17.09)	0.278	1211 (12.22)	243 (18.64)	0.181	1467 (16.92)	126 (17.80)	0.039
Full time employment	4505 (40.75)	417 (44.08)		5911 (52.88)	505 (52.94)		4299 (42.20)	483 (48.60)		5012 (44.61)	402 (56.7)	
Full time student	529 (14.80)	33 3.49)		1234 (11.04)	153 (16.)		1274 (14.80)	157 (11.40)		1825 (16.25)	157 (17.31)	
Part time employment	2802 (25.34)	238 (5.16)		335 (3.00)	94 (9.85)		1211 (12.20)	243 (18.60)		2564 (22.82)	199 (21.94)	
Retired	1392 (12.59)	107 (11.31)		236 (2.11)	28 (2.94)		122 (4.40)	26 (5.20)		88 (0.78)	5 (0.55)	
Other	347 (3.14)	26 (2.75)		22 (9.73)	11 (1.15)		78 (15.60)	70 (14.00)		278 (2.47)	18 (1.98)	

Table 3. Distribution of demographic characteristics of study populations [a] (continued)

	Philippines			Thailand			Vietnam			Indonesia		
Household size												
1	341 (3.20)	27 (2.95)	0.737	414 (3.95)	35 (3.82)	0.023	410 (3.95)	35 (3.79)	0.317	386 (3.58)	39 (4.41)	0.285
2	833 (7.81)	70 (7.64)		1129 (10.76)	85 (9.27)		668 (6.43)	60 (6.49)		832 (7.72)	75 (8.48)	
3	1764 (19.19)	143 (15.61)		1864 (17.77)	166 (18.10)		1993 (19.19)	186 (20.13)		2403 (22.30)	194 (21.95)	
4	2342 (21.96)	219 (23.91)		2209 (21.06)	204 (22.25)		3529 (33.98)	309 (33.44)		3216 (29.85)	251 (28.39)	
5	2009 (18.8)	179 (19.54)		1999 (19.05)	155 (16.90)		2158 (20.78)	183 (19.81)		2110 (19.58)	180 (20.36)	
≥6	3375 (31.65)	278 (30.35)		2876 (27.41)	272 (29.66)		1627 (15.67)	151 (16.34)		1827 (16.96)	145 (16.40)	
Number of household children												
0	3303 (32.04)	232 (33.75)	0.279	4398 (42.05)	383 (42.94)	0.012	3263 (30.32)	299 (31.57)	0.506	3860 (35.59)	283 (32.27)	0.307
1	3087 (29.91)	232 (26.54.)		2533 (24.22)	218 (24.44)		4274 (39.71)	364 (38.44)		3772 (34.78)	322 (36.72)	
2	2283 (22.15)	209 (23.91)		2032 (19.43)	169 (18.95)		2772 (25.76)	250 (26.40)		2369 (21.84)	207 (23.60)	
3	1108 (10.75)	95 (10.87)		1028 (9.83)	78 (8.74)		356 (3.31)	30 (3.17)		665 (6.13)	50 (5.70)	
≥4	528 (5.12)	43 (4.92)		468 (4.47)	44 (4.93)		97 (0.90)	4 (0.42)		179 (1.65)	15 (1.71)	

[a] Data are presented as n (%)

[b] Data were analyzed using chi-square test (for categorical variables) and t-test (for continuous variables).

* Countries are grouped by ‘ Wellcome Global Monitor 2020’ government trust score.

Table 4. Distribution of health status and Health Behaviors Model (HBM) attributes of study populations [a]

	Higher Trust in Government Countries*						Lower Trust in Government Countries*					
	Philippines			**Thailand**			**Vietnam**			**Indonesia**		
	No vaccine hesitancy (n = 11056)	Vaccine hesitancy (n = 946)	*P*-value	No vaccine hesitancy (n = 11179)	Vaccine hesitancy (n = 954)	*P*-value	No vaccine hesitancy (n = 11104)	Vaccine hesitancy (n = 970)	*P*-value	No vaccine hesitancy (n = 11234)	Vaccine hesitancy (n = 907)	*P*-value [b]
Disease status												
Arthritis												
No	5882 (52.97)	488 (50.31)	0.012	10220 (92.04)	897 (92.47)	0.531	5882 (52.97)	488 (50.31)	0.016	11130 (99.07)	902 (99.45)	0.048
Yes	4307 (38.79)	399 (41.13)		884 (7.96)	73 (7.53)		4307 (38.79)	399 (41.13)		104 (0.93)	5 (0.55)	
Asthma												
No	9264 (97.61)	448 (47.36)		10703 (96.39)	944 (97.32)	0.042	9351 (52.63)	509 (92.47)	0.025	10570 (94.0)	849 (93.61)	0.233
Yes	5792 (2.39)	498 (52.64)		401 (3.61)	26 (2.68)		5260 (47.37)	461 (7.53)		664 (5.9)	58 (6.39)	
Cancer												
No	9810 (93.40)	125 (93.21)	0.257	10931 (98.44)	961 (99.07)	0.031	10110 (92.22)	243 (98.64)	0.004	11163 (99.37)	900 (99.23)	0.159
Yes	4505 (40.75)	417 (44.08)		173 (1.56)	9 (15.77)		4299 (42.20)	483 (48.60)		71 (0.63)	7 (0.77)	
Cystic fibrosis												
No	10341 (93.20)	827 (92.95)	0.526	10947 (98.59)	959 (98.8)	0.063	10410 (93.95)	735 (93.79)	0.317	11169 (99.42)	899 (99.12)	0.226
Yes	833 (7.81)	70 (7.64)		157 (1.41)	11 (1.13)		668 (6.43)	60 (6.49)		65 (0.58)	8 (0.88)	
Chronic obstructive pulmonary disease (COPD)												
No	10303 (92.04)	232 (33.75)	0.126	10977 (127)	954 (98.35)	0.018	10263 (30.32)	299 (31.57)	0.506	11134 (99.11)	892 (98.35)	0.253
Yes	87 (29.91)	232 (26.54)		127 (1.14)	16 (1.65)		4274 (39.71)	364 (38.44)		100 (0.89)	15 (1.65)	
Diabetes												
No	9341	827	0.263	10782	942	0.236	410	35	0.624	11169	899	0.263

	(93.20)	(92.95)		(97.10)	(97.11)		(3.95)	(3.79)		(99.42)	(99.12)	
Yes	833 (6.81)	70 (7.64)		322 (2.90)	28 (2.89)		668 (6.43)	60 (6.49)		65 (0.58)	8 (0.88)	
Heart disease												
No	10311 (97.50)	930 (95.20)		10819 (97.10)	937 (96.60)		11119 (97.10)	917 (96.30)		11193 (99.64)	902 (99.45)	
Yes	285 (2.50)	23 (4.43)		285 (2.57)	33 (3.40)		182 (2.27)	31 (3.40)		41 (0.36)	5 (0.55)	
Health Belief Model (HBM) variables												
Perceived Benefits of health intervention (vaccines)												
Low	36 (2.65)	128 (2.28)	0.362	56 (1.68)	103 (2.78)	0.621	24 (2.68)	99 (2.88)	0.353	23 (0.72)	62 (1.60)	0.362
Same	51 (3.54)	85 (5.29)		50 (1.50)	85 (2.29)		60 (7.30)	55 (2.29)		22 (0.69)	55 (1.42)	
High	3007 (95.83)	510 (94.55)		3227 (96.82)	518 (94.93)		3257 (92.42)	318 (94.53)		3160 (98.60)	761 (96.98)	
Perceived Barriers of health intervention (vaccines)												
Low	73 (3.63)	121 (4.25)	0.125	121 (3.63)	171 (5.61)	0.624	100 (6.13)	98 (8.61)	0.264	63 (1.97)	181 (4.16)	0.125
Same	94 (3.15)	134 (4.08)		105 (3.15)	114 (3.08)		95 (5.15)	47 (3.75)		51 (1.59)	102 (2.63)	
High	3107 (93.52)	411 (95.11)		3107 (93.22)	421 (92.31)		3107 (89.22)	321 (92.39)		3091 (96.44)	595 (92.70)	
Perceived Susceptibility of disease												
Low	125 (12.36)	241 (26.25)	0.023	125 (25.99)	144 (26.72)	0.772	67 (22.12)	99 (26.72)	0.263	116 (25.61)	145 (25.99)	0.023
Same	26 (9.25)	6 (22.43)		48 (9.98)	57 (10.58)		91 (9.98)	36 (10.23)		61 (13.47)	77 (13.80)	
High	3234 (49.03)	423 (36.71)		3308 (64.03)	338 (62.31)		3144 (54.3)	802 (62.71)		3276 (60.93)	336 (60.22)	
Perceived Severity of disease												
Low	71 (14.76)	85 (15.77)	0.013	71 (14.76)	85 (15.77)	0.264	71 (14.76)	85 (15.77)	0.732	105 (23.18)	121 (21.68)	0.013
Same	46 (9.56)	71 (13.17)		46 (9.56)	71 (13.17)		46 (9.56)	71 (13.17)		61 (13.69)	77 (13.80)	
High	3364 (75.68)	383 (71.06)		3364 (75.68)	383 (71.06)		2364 (75.68)	383 (71.06)		3286 (63.13)	360 (64.52)	

[a] Data are presented as n (%)

[b] Data were analyzed using chi-square test (for categorical variables) and t-test (for continuous variables).

Table 5. Association of demographic variables and vaccine hesitancy using multivariate regression analysis.

	Higher Trust in Government Countries*						Lower Trust in Government Countries*					
	Philippines			**Thailand**			**Vietnam**			**Indonesia**		
	Model 1 Crude RRR (95% CI)	Model 2 Adjusted RRR* (95% CI)	Model 3 Adjusted RRR excluding HBM** (95% CI)	Model 1 Crude RRR (95% CI)	Model 2 Adjusted RRR* (95% CI)	Model 3 Adjusted RRR excluding HBM** (95% CI)	Model 1 Crude RRR (95% CI)	Model 2 Adjusted RRR* (95% CI)	Model 3 Adjusted RRR excluding HBM** (95% CI)	Model 1 Crude RRR (95% CI)	Model 2 Adjusted RRR* (95% CI)	Model 3 Adjusted RRR excluding HBM** (95% CI)
Age group (years)												
≤18-29	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
30-49	**0.71 (0.51-0.99)**	0.71 (0.50-1.00)	0.78 (0.27-1.25)	1.06 (0.22-4.33)	1.01 (0.30-1.96)	**0.96 (0.47-0.99)**	0.97 (0.45-1.01)	1.06 (0.22-4.33)	1.00 (0.68-1.48)	**0.71 (0.51-0.99)**	0.71 (0.50-1.00)	1.06 (0.22-4.33)
50-65	0.60 (0.41-1.26)	0.28 (0.40-1.85)	0.66 (0.33-1.33)	0.84 (0.29-3.43)	1.46 (0.21-6.33)	**0.64 (0.42-0.97)**	0.64 (0.41-1.29)	0.84 (0.29-3.43)	1.11 (0.74-1.67)	**0.60 (0.41-0.86)**	**0.58 (0.40-0.85)**	0.84 (0.29-3.43)
≥65	0.81 (0.54-1.22)	0.76 (0.49-1.17)	0.81 (0.54-1.22)	1.24 (0.35-5.61)	1.35 (0.63-9.73)	1.74 (0.45-1.20)	**0.64 (0.41-0.99)**	0.84 (0.29-3.43)	1.00 (0.68-1.48)	0.81 (0.54-1.22)	0.76 (0.49-1.17)	0.74 (0.35-5.61)
Gender												
Male	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Female	0.93 (0.55-1.56)	1.03 (0.58-1.85)	1.80 (0.92-3.53)	1.13 (0.87-1.45)	1.04 (0.79-1.37)	0.98 (0.67-1.42)	1.93 (0.61-3.41)	**1.88 (1.06-3.33)**	1.75 (0.97-3.15)	1.08 (0.87-1.33)	0.98 (0.79-1.23)	**1.08 (1.06-3.33)**
Occupation Status												
Unemployed	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Full time employment	1.06 (0.22-4.33)	0.93 (0.55-1.56)	1.03 (0.58-1.85)	3.25 (0.67-6.33)	**1.40 (1.07-1.83)**	**1.37 (1.03-1.80)**	**2.23 (1.30-3.83)**	**2.39 (1.33-4.32)**	2.71 (0.50-4.00)	1.40 (0.98-2.00)	1.40 (0.96-2.03)	**1.33 (1.75-3.35)**
Full time student	0.84 (0.29-3.43)	0.70 (0.42-1.16)	0.94 (0.53-1.66)	0.52 (0.21-1.31)	**1.50 (1.16-1.95)**	**1.48 (1.13-1.95)**	2.05 (0.26-3.32)	1.17 (0.27-3.74)	1.58 (0.40-2.85)	1.16 (0.82-1.63)	1.11 (0.77-1.59)	1.18 (0.27-1.25)
Part time employment	1.24 (0.35-5.61)	0.90 (0.71-1.14)	0.90 (0.71-1.14)	0.57 (0.24-1.36)	0.78 (0.53-1.15)	0.76 (0.52-1.18)	1.40 (0.07-1.83)	1.37 (0.03-1.80)	0.76 (0.49-1.17)	2.98 (1.31-6.78)	3.13 (1.28-7.69)	2.66 (0.33-6.33)
Retired	0.70 (0.71-1.14)	0.94 (0.75-1.17)	0.90 (0.71-1.14)	0.64 (0.41-1.29)	0.84 (0.59-1.43)	0.89 (0.67-1.18)	0.70 (0.16-1.95)	0.78 (0.13-0.95)	**0.74 (0.41-0.89)**	0.68 (0.90-1.35)	0.64 (0.41-1.99)	**0.64 (0.42-0.97)**
Other	1.40 (0.61-1.96)	1.39 (0.66-1.91)	1.40 (0.31-2.86)	0.74 (0.45-1.22)	0.74 (0.45-1.22)	1.54 (0.04-2.28)	0.97 (0.64-1.45)	0.94 (0.60-1.47)	0.74 (0.45-1.22)	1.16 (0.22-2.22)	0.74 (0.45-1.42)	0.84 (0.45-2.20)
Household size												

1	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
2	1.24 (0.35-5.61)	0.90 (0.71-1.14)	**1.37 (1.03-1.80)**	1.02 (0.55-1.90)	0.96 (0.63-1.45)	1.02 (0.55-1.90)	0.96 (0.63-1.45)	**1.37 (1.03-1.80)**	0.76 (0.49-1.17)	0.71 (0.50-1.00)	0.58 (0.27-1.25)	0.96 (0.63-1.45)
3	0.90 (0.71-1.14)	0.94 (0.75-1.17)	**1.48 (1.13-1.95)**	0.35 (0.27-1.74)	0.58 (0.40-0.85)	0.54 (0.29-3.43)	2.05 (0.26-3.32)	**1.48 (1.13-1.95)**	1.64 (0.41-2.99)	1.58 (0.40-3.85)	1.66 (0.33-3.33)	1.68 (0.56-3.32)
4	1.24 (0.35-5.61)	0.77 (0.52-1.15)	0.83 (0.55-1.26)	1.02 (0.55-1.90)	0.96 (0.63-1.45)	1.02 (0.55-1.90)	0.96 (0.63-1.45)	1.37 (1.03-1.80)	0.76 (0.49-1.17)	1.03 (0.83-1.27)	1.00 (0.80-1.25)	0.96 (0.63-1.45)
5	0.52 (0.21-1.31)	0.93 (0.63-1.39)	1.09 (0.71-1.69)	1.03 (0.58-1.85)	0.93 (0.55-1.56)	0.78 (0.53-1.15)	0.76 (0.52-1.18)	0.78 (0.53-1.15)	0.58 (0.27-1.25)	0.92 (0.70-1.20)	0.89 (0.67-1.18)	0.93 (0.55-1.56)
≥6	0.57 (0.24-1.36)	0.77 (0.52-1.15)	0.83 (0.55-1.26)	0.94 (0.53-1.66)	0.70 (0.42-1.16)	0.66 (0.45-0.97)	0.75 (0.50-1.12)	**0.66 (0.45-0.97)**	0.66 (0.33-1.33)	**1.50 (1.03-2.18)**	**1.54 (1.04-2.28)**	0.70 (0.42-1.16)
Number of household children												
0	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
1	0.76 (0.49-1.17)	1.24 (0.35-5.61)	0.76 (0.52-1.18)	1.37 (1.03-1.80)	0.76 (0.49-1.17)	1.24 (0.35-5.61)	0.76 (0.52-1.18)	1.40 (1.07-1.83)	1.37 (0.03-1.80)	1.37 (0.03-1.80)	0.76 (0.52-1.18)	**1.40 (1.07-1.83)**
2	0.64 (0.41-0.99)	0.90 (0.71-1.14)	0.89 (0.67-1.18)	0.48 (0.13-1.95)	0.64 (0.41-0.99)	0.90 (0.71-1.14)	0.89 (0.67-1.18)	**1.50 (1.16-1.95)**	1.48 (0.13-1.95)	1.48 (0.13-1.95)	0.89 (0.67-1.18)	**1.50 (1.16-1.95)**
3	0.58 (0.40-0.85)	0.84 (0.29-3.43)	**1.48 (1.13-1.95)**	2.17 (0.27-3.74)	0.58 (0.40-0.85)	0.84 (0.29-3.43)	1.48 (0.13-1.95)	2.05 (0.26-3.32)	2.17 (0.27-3.74)	0.84 (0.39-3.43)	**1.48 (1.13-1.95)**	**2.05 (1.26-3.32)**
≥4	0.76 (0.49-1.17)	1.24 (0.35-1.61)	0.76 (0.52-1.18)	1.37 (0.03-1.80)	0.76 (0.49-1.17)	1.24 (0.35-5.61)	0.76 (0.52-1.18)	1.40 (0.07-1.83)	1.37 (0.03-1.80)	0.24 (0.45-2.61)	0.76 (0.52-1.18)	0.40 (0307-1.83)

[a] Data are presented as n (%)
[b] Data were analyzed using chi-square test (for categorical variables) and t-test (for continuous variables).
* Countries are grouped by ‘ Wellcome Global Monitor 2020’ government trust score.

Table 6. Association of disease status, Health Behaviors Model (HBM) attributes and vaccine hesitancy

	Higher Trust in Government Countries*						Lower Trust in Government Countries*					
	Philippines			**Thailand**			**Vietnam**			**Indonesia**		
	Model 1 Crude RRR (95% CI)	Model 2 Adjusted RRR* (95% CI)	Model 3 Adjusted RRR excluding HBM** (95% CI)	Model 1 Crude RRR (95% CI)	Model 2 Adjusted RRR* (95% CI)	Model 3 Adjusted RRR excluding HBM** (95% CI)	Model 1 Crude RRR (95% CI)	Model 2 Adjusted RRR* (95% CI)	Model 3 Adjusted RRR excluding HBM** (95% CI)	Model 1 Crude RRR (95% CI)	Model 2 Adjusted RRR* (95% CI)	Model 3 Adjusted RRR excluding HBM** (95% CI)
Disease status												
Arthritis												
No	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Yes	**2.23 (1.30-3.83)**	**2.39 (1.33-4.32)**	**2.05 (1.26-3.32)**	0.93 (0.55-1.56)	1.03 (0.58-1.85)	1.37 (0.07-1.89)	1.26 (0.90-1.77)	1.19 (0.87-1.63)	1.15 (0.83-1.60)	1.40 (1.07-1.83)	**1.07 (1.03-1.80)**	**1.37 (1.02-2.89)**
Asthma												
No	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Yes	**1.50 (1.03-2.18)**	1.30 (0.68-1.48)	1.05 (0.61-1.46)	1.02 (0.55-1.90)	1.19 (0.87-1.63)	1.15 (0.83-1.60)	0.89 (0.67-1.18)	0.92 (0.70-1.20)	**1.11 (1.04-2.28)**	**1.44 (1.08-1.93)**	**1.49 (1.10-2.02)**	1.33 (0.63-1.45)
Cancer												
No	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Yes	0.76 (0.52-1.18)	0.66 (0.33-1.33)	0.57 (0.24-1.36)	0.66 (0.33-1.33)	0.76 (0.49-1.17)	1.78 (0.78-1.52)	1.15 (0.81-1.64)	1.03 (0.58-1.85)	0.78 (0.53-1.15)	0.68 (0.52-0.88)	**0.71 (0.54-0.93)**	0.77 (0.24-1.36)
Cystic fibrosis												
No	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Yes	**0.68 (0.52-0.88)**	**0.68 (0.52-0.89)**	0.76 (0.52-1.10)	0.98 (0.79-1.23)	1.13 (0.87-1.45)	1.04 (0.79-1.37)	0.81 (0.54-1.22)	0.76 (0.49-1.17)	0.84 (0.29-1.43)	0.73 (0.37-1.45)	0.79 (0.38-1.61)	0.78 (0.87-1.33)
Chronic obstructive pulmonary disease (COPD)												
No	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Yes	1.08 (0.87-1.33)	0.98 (0.79-1.23)	0.52 (0.21-1.31)	0.76 (0.52-1.10)	0.74 (0.45-1.20)	0.74 (0.45-1.22)	1.34 (0.54-2.40)	1.13 (0.87-1.45)	1.04 (0.79-1.37)	0.58 (0.27-1.25)	0.52 (0.21-1.31)	0.73 (0.51-1.03)
Diabetes												
No	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Yes	1.15 (0.81-1.64)	1.04 (0.79-1.37)	1.03 (0.58-1.85)	1.34 (0.54-2.40)	1.19 (0.52-2.69)	1.08 (0.87-1.33)	**1.13 (1.01-1.45)**	**1.04 (1.02-1.77)**	1.78 (0.78-1.52)	0.93 (0.63-1.39)	1.09 (0.71-1.69)	0.81 (0.54-1.22)

Heart disease												
No	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Yes	1.09 (0.71-1.69)	1.11 (0.74-1.67)	1.06 (0.69-1.63)	1.15 (0.81-1.64)	0.77 (0.52-1.15)	0.83 (0.55-1.26)	0.93 (0.63-1.39)	1.09 (0.71-1.69)	1.11 (0.74-1.67)	**0.64 (0.42-0.97)**	**0.64 (0.41-0.99)**	1.78 (0.78-1.52)
Health Belief Model (HBM) variables												
Perceived Benefits of health intervention (vaccines)												
Low	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
High	0.77 (0.52-1.15)	0.83 (0.55-1.26)	1.16 (0.82-1.63)	1.06 (0.69-1.63)	**0.60 (0.41-0.86)**	**0.58 (0.40-0.85)**	1.40 (1.28-1.78)	0.77 (0.52-1.15)	0.83 (0.55-1.26)	1.00 (0.68-1.48)	0.92 (0.61-1.39)	1.11 (0.74-1.67)
Perceived Barriers of health intervention (vaccines)												
Low	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
High	1.15 (0.81-1.64)	**1.88 (1.06-3.33)**	1.11 (0.74-1.67)	0.98 (0.79-1.23)	0.81 (0.54-1.22)	0.76 (0.49-1.17)	1.78 (0.78-1.52)	1.15 (0.81-1.64)	**1.88 (1.06-3.33)**	**2.23 (1.30-3.83)**	**2.39 (1.33-4.32)**	1.08 (0.87-1.33)
Perceived Susceptibility of disease												
Low	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
High	1.56 (0.89-2.74)	**1.57 (1.11-2.21)**	**1.64 (1.14-2.36)**	**1.71 (1.07-2.73)**	1.56 (0.89-2.74)	1.11 (0.68-1.81)	1.71 (0.07-2.73)	1.56 (0.89-2.74)	**1.57 (1.11-2.21)**	1.06 (0.81-1.37)	1.28 (0.98-1.65)	1.06 (0.81-1.37)
Perceived Severity of disease												
Low	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
High	0.92 (0.21-1.39)	0.93 (0.13-1.39)	0.73 (0.11-1.03)	0.95 (0.61-1.46)	0.96 (0.63-1.45)	1.02 (0.55-1.90)	1.00 (0.68-1.48)	0.92 (0.21-1.39)	0.93 (0.13-1.39)	**1.39 (1.01-1.91)**	**1.40 (1.01-1.96)**	1.00 (0.68-1.48)

[a] Data are presented as n (%)
[b] Data were analyzed using chi-square test (for categorical variables) and t-test (for continuous variables).
* Countries are grouped by ' Wellcome Global Monitor 2020' government trust score.

Table 7. Association of trust in government and vaccine hesitancy

	High Trust in Government Countries[a]						Low Trust in Government Countries[a]					
	Philippines			**Thailand**			**Vietnam**			**Indonesia**		
	Model 1 Crude RRR (95% CI)	Model 2 Adjusted RRR* (95% CI)	Model 3 Adjusted RRR excluding HBM** (95% CI)	Model 1 Crude RRR (95% CI)	Model 2 Adjusted RRR* (95% CI)	Model 3 Adjusted RRR excluding HBM** (95% CI)	Model 1 Crude RRR (95% CI)	Model 2 Adjusted RRR* (95% CI)	Model 3 Adjusted RRR excluding HBM** (95% CI)	Model 1 Crude RRR (95% CI)	Model 2 Adjusted RRR* (95% CI)	Model 3 Adjusted RRR excluding HBM** (95% CI)
Level of Trust in Government												
Completely trustworthy	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Somewhat trustworthy	1.16 (0.82-1.63)	1.11 (0.37-1.59)	0.92 (0.61-1.72)	1.38 (0.98 - 1.94)	1.34 (0.28 - 1.54)	1.38 (0.89 - 1.87)	**1.10 (1.08-2.11)**	1.07 (0.92-2.15)	0.83 (0.55-2.26)	**0.86 (0.78-0.95)**	0.87 (0.67 - 1.08)	0.90 (0.26 - 1.26)
Trustworthy	1.13 (0.57-2.24)	1.14 (0.34-2.13)	1.02 (0.61-1.39)	1.18 (0.86-2.21)	1.20 (0.36-2.61)	1.18 (0.45-2.82)	1.10 (0.15-1.50)	1.07 (0.92-2.15)	0.83 (0.55-2.26)	1.77 (1.50-2.09)	1.79 (0.66-2.80)	1.80 (0.72-2.73)
Not trustworthy	**2.60 (1.26-2.99)**	**2.14 (1.62-3.59)**	**2.92 (1.61-3.39)**	**1.08 (1.00-1.91)**	1.06 (0.51-1.98)	0.98 (0.41-1.91)	**1.18 (1.05-1.75)**	**1.15 (1.03-1.91)**	**1.17 (1.06-1.89)**	1.48 (0.14-1.75)	1.55 (0.21-1.91)	1.57 (1.16-1.89)
Not at all trustworthy	0.82 (0.75-1. 96)	0.92 (0.72-1.17)	0.92 (0.41-2.39)	**1.23 (1.10 - 1.75)**	1.21 (0.98 - 2.15)	**1.28 (1.01 - 2.35)**	1.09 (0.98-1.50)	1.07 (1.02-2.33)	1.03 (0.81-2.21)	1.38 (0.18-1.78)	1.30 (0.21 - 1.82)	**1.33 (1.06 - 1.88)**

*Adjusted RRR including socioeconomic, HBM, health-related controlled variables.
**Adjusted RRR excluding HBM related controlled variables.
[a] Countries are grouped by ' Wellcome Global Monitor 2020' government trust percentage score

Table 8. Association of levels of government trust and vaccine hesitancy by high trust and low trust in government groups

	High Trust in Government Countries [a] (Philippines, Thailand)			Low Trust in Government Countries [a] (Vietnam, Indonesia)		
Level of Government Trust	Model 1 Crude RRR (95% CI)	Model 2 Adjusted RRR* (95% CI)	Model 3 Adjusted RRR excluding HBM** (95% CI)	Model 1 Crude RRR (95% CI)	Model 2 Adjusted RRR* (95% CI)	Model 3 Adjusted RRR excluding HBM** (95% CI)
Completely trustworthy	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Somewhat trustworthy	1.02 (0.45-2.34)	0.85 (0.34-2.12)	0.68 (0.47-0.97)	0.68 (0.47-0.97)	0.86 (0.71-1.04)	0.89 (0.73-1.07)
Trustworthy	0.75 (0.54-1.62)	1.00 (0.56-1.82)	0.72 (0.56-0.91)	0.73 (0.57-0.94)	0.83 (0.61-1.14)	0.82 (0.59-1.14)
Not trustworthy	1.13 (0.69-1.85)	1.22 (0.71-2.09)	0.93 (0.58-1.48)	1.05 (0.57-1.93)	0.80 (0.63-1.01)	0.80 (0.62-1.03)
Not at all trustworthy	**1.21 (1.08-1.88)**	1.26 (0.71-2.26)	1.20(0.04-1.59)	0.91 (0.70-1.20)	0.91 (0.70-1.20)	0.95 (0.71-1.27)

*Adjusted RRR including socioeconomic, HBM, health-related controlled variables.
**Adjusted RRR excluding HBM related controlled variables.
[a] Countries are grouped by ' Wellcome Global Monitor 2020' government trust score

Chapter 5. Discussion

This study examined the association of trust in government and vaccine hesitancy in Southeast Asian countries, considering different effects of variables related to health and health belief model. From 'YouGov Covid19 Behavior Tracker', a total of 41,430 respondents of Indonesia, Thailand, Philippines, and Vietnam were included in the analysis. From Our findings suggest positive association between low government trust and vaccine hesitancy in Philippines and Vietnam. When countries are grouped into 'high trust in government countries' and 'low trust in government countries', statistical association were not observed.

Several previous societal studies reported the similar association observed in our study. In a systemic review of 4 studies conducted by Peterson et al. in 2012, trust in institution was positively associated with refusal of vaccines and potential vaccine hesitancy in both male and female population (Peterson et al., 2022). Also, in another systematic review of 3 articles yielding 12,199 participants involved in behavior survey, they found a 25% increased risk of vaccine hesitancy in individual who scored low government trust or government authorities(Murphy et al., 2022). Moreover, same finding were evident European studies where a European cohort study has observed a positive association of society trust and health intervention and social campaigns (Bouckaert & Van de Walle, 2001). Our findings support the linkage of government trust with high vaccine hesitancy, which lead us to evaluate of the result of adjusting variables that also associate with vaccine hesitancy.

Government trust is widely known as one of the contributing factors of social behaviors and health judgement (Arthur et al., 2022; Miyachi et al., 2020). The association was observed across populations of diverse ethnicity and is claimed to have the largest impact in young adulthood (Bronfman et

al., 2022). Adults who have low trust in institutions have shown to have higher probability of rejection of health services and interventions in previous studies (Yu et al., 2021). Especially in young adults, trust and confidence in government seem to have a critical impact where government and social confidence is associated with health status and condition of severe diseases (Min et al., 2020). Specifically, studies suggested that low confidence in society and health system is strongly associated with poor health conditions and health utilization (Ruan et al., 2022). The findings from previous studies align with the association of government and vaccine hesitancy observed in this study.

This study is significant as it includes different attribute of vaccine hesitancy, specifically using the Health Belief Model. Though the exact mechanisms contributing health belief to making health or medical decision may not be precise, there are strong evidence that interaction or association of different health belief and environment factors contribute to vaccine coverage and acceptance(Chen et al., 2021; Jones et al., 2014). The HBM is used in various behavior studies to examine the association of health behavior and individual belief system. The conceptual model of vaccine hesitancy developed by Opel et al (Dubé et al., 2013a) model also highlights the role of trust and how it affects the individual decision-making about vaccination, the status of refusal or acceptance of vaccines (Dubé et al., 2013a). Thus, HBM was adopted in our analysis to prevent confounders and HBM variables can support the observed association of government trust and vaccine hesitancy in our study.

Though there are a lack of studies on government trust in public health fields and its relation to vaccine uptake, studies suggest reasons for low vaccine coverage and uptake level(Hou et al., 2021; Ye & Lyu, 2020). One study conducted in China explores trust in government and perceived

risk of COVID-19 infection and vaccination(Ye & Lyu, 2020). First, there are disbelief in government to provide timely information on vaccine effectiveness and side effects. Also, there are disbelief in equitable distribution of vaccines, mistrusting that the government will be fair and provide equal services to all population groups and ethnicity. In the country's specific context, previous studies show that there are concerns on governments' decisions and actions in vaccine procurement, public opinion, prioritization, and administration of vaccines to general population(Ye & Lyu, 2020). Thus, there are further needs to conduct research on the relation of government trust and its role in vaccine coverage in Southeast Asian countries.

There are several strengths in this study. There are few studies done to observe the association of government trust and vaccine hesitancy in Southeast Asian countries. Aside from this study which exclusively includes Caucasian population, there are not many studies conducted in Asian populations. Also, this study considered various other contributing factors of vaccine hesitancy including socioeconomic status, health-related factors including preexisting symptoms, and adaptation of HBM.

This study has several limitations. First, because this study is a based on secondary data, the controls may not be sufficient representatives to reflect the general population. However, enough participants from the large health data included in this study can overcome the potential problem of secondary data analysis. Second, the result may have recall bias as the demographic information was solely based on self-conducted questionnaires dependent on memory of participants. Furthermore, the measurement of vaccine hesitancy was made based on the respondents' refusal or delay of COVID-19 vaccination. Additionally, this study aimed to observe the association between trust in the government and vaccine hesitancy in Southeast Asian

countries including Vietnam, Philippines, Thailand, and Indonesia. However, due to limitation of availability in the country datasets in Imperial College London YouGov Covid-19 Behavior Tracker Data, not all Southeast Asian countries were included in this study, thus four countries with available data were intentionally selected for analysis. Furthermore, this study did not observe the interaction effect of HMB variables. Thus, the reason for refusal and delay in vaccination could be other than vaccine hesitancy, relating to other attributing factors in delay of vaccination or low vaccine coverage. Lastly, the questionnaire was not designed for HBM analysis, and the response may not truly reflect the five pillars in HMB model.

Chapter 6. Conclusion

This study shows the association of the level of trust in the government and COVID-19 vaccine hesitancy in some Southeast Asian countries, considering the effect of HBM and health-related variables. The observed association suggests that the level of government trust among the population may contribute to vaccine hesitancy in certain populations in Southeast Asia and requires public health attention in increasing vaccine coverage. Though the underlying mechanism is still in need of further investigation, this study might provide improved understanding the health behavior and belief system that affect vaccine hesitancy. Additional study on the association of HBM variables and vaccine hesitancy will contribute to understanding the increasing vaccine hesitancy trend worldwide and within Southeast Asia. Further studies with more sample size and primary data collection are required to contribute to and support the findings of existing studies.

Bibliography

Abraham, C., & Sheeran, P. (2015). The health belief model. *Predicting health behaviour: Research and practice with social cognition models*, *2*, 30-55.

Ahn, J., Kim, H. K., Kahlor, L. A., Atkinson, L., & Noh, G. Y. (2021). The Impact of Emotion and Government Trust on Individuals' Risk Information Seeking and Avoidance during the COVID-19 Pandemic: A Cross-country Comparison. *J Health Commun*, *26*(10), 728-741. https://doi.org/10.1080/10810730.2021.1999348

Al-Metwali, B. Z., Al-Jumaili, A. A., Al-Alag, Z. A., & Sorofman, B. (2021). Exploring the acceptance of COVID-19 vaccine among healthcare workers and general population using health belief model. *J Eval Clin Pract*, *27*(5), 1112-1122. https://doi.org/10.1111/jep.13581

Androniceanu, A. (2021). Transparency in public administration as a challenge for a good democratic governance. *Administratie si Management Public*(36), 149-164.

Arthur, R. F., Horng, L. M., Bolay, F. K., Tandanpolie, A., Gilstad, J. R., Tantum, L. K., & Luby, S. P. (2022). Community trust of government and non-governmental organizations during the 2014-16 Ebola epidemic in Liberia. *PLoS Negl Trop Dis*, *16*(1), e0010083. https://doi.org/10.1371/journal.pntd.0010083

Barley, E., & Lawson, V. (2016). Using health psychology to help patients: theories of behaviour change. *Br J Nurs*, *25*(16), 924-927. https://doi.org/10.12968/bjon.2016.25.16.924

Batty, G. D., Deary, I. J., & Altschul, D. (2022). Pre-pandemic mental and physical health as predictors of COVID-19 vaccine hesitancy: evidence from a UK-wide cohort study. *Annals of Medicine*, *54*(1), 274-282.

Bouckaert, G., & Van de Walle, S. (2001). Government performance and trust in government. Ponencia presentada en la annual conference of the European group on public administration, vaasa (Finlandia),

Bronfman, N., Repetto, P., Cisternas, P., Castañeda, J., & Cordón, P. (2022). Government Trust and Motivational Factors on Health Protective Behaviors to Prevent COVID-19 Among Young Adults. *Int J Public Health*, *67*, 1604290. https://doi.org/10.3389/ijph.2022.1604290

Chaudhary, J. K., Yadav, R., Chaudhary, P. K., Maurya, A., Kant, N., Rugaie, O. A., Haokip, H. R., Yadav, D., Roshan, R., Prasad, R., Chatrath, A., Singh, D., Jain, N., & Dhamija, P. (2021). Insights into COVID-19 Vaccine Development Based on Immunogenic Structural

Proteins of SARS-CoV-2, Host Immune Responses, and Herd Immunity. *Cells*, *10*(11). https://doi.org/10.3390/cells10112949

Chen, H., Li, X., Gao, J., Liu, X., Mao, Y., Wang, R., Zheng, P., Xiao, Q., Jia, Y., Fu, H., & Dai, J. (2021). Health Belief Model Perspective on the Control of COVID-19 Vaccine Hesitancy and the Promotion of Vaccination in China: Web-Based Cross-sectional Study. *J Med Internet Res*, *23*(9), e29329. https://doi.org/10.2196/29329

Ciotti, M., Ciccozzi, M., Terrinoni, A., Jiang, W.-C., Wang, C.-B., & Bernardini, S. (2020). The COVID-19 pandemic. *Critical reviews in clinical laboratory sciences*, *57*(6), 365-388.

Cooper, S., Schmidt, B. M., Sambala, E. Z., Swartz, A., Colvin, C. J., Leon, N., & Wiysonge, C. S. (2021). Factors that influence parents' and informal caregivers' views and practices regarding routine childhood vaccination: a qualitative evidence synthesis. *Cochrane Database Syst Rev*, *10*(10), Cd013265. https://doi.org/10.1002/14651858.CD013265.pub2

Corpuz, J. C. G. (2021). Multisectoral Approach on COVID-19 vaccination: a proposed solution on vaccine hesitancy. *J Public Health (Oxf)*, *43*(2), e370-e371. https://doi.org/10.1093/pubmed/fdab085

De Figueiredo, A., Simas, C., Karafillakis, E., Paterson, P., & Larson, H. J. (2020). Mapping global trends in vaccine confidence and investigating barriers to vaccine uptake: a large-scale retrospective temporal modelling study. *The Lancet*, *396*(10255), 898-908.

Dubé, E., Laberge, C., Guay, M., Bramadat, P., Roy, R., & Bettinger, J. A. (2013a). Vaccine hesitancy. *Human vaccines & immunotherapeutics*, *9*(8), 1763-1773. https://doi.org/10.4161/hv.24657

Dubé, E., Laberge, C., Guay, M., Bramadat, P., Roy, R., & Bettinger, J. A. (2013b). Vaccine hesitancy: an overview. *Human vaccines & immunotherapeutics*, *9*(8), 1763-1773.

Ehde, D. M., Roberts, M. K., Humbert, A. T., Herring, T. E., & Alschuler, K. N. (2021). COVID-19 vaccine hesitancy in adults with multiple sclerosis in the United States: A follow up survey during the initial vaccine rollout in 2021. *Multiple sclerosis and related disorders*, *54*, 103163.

Fall, E., Izaute, M., & Chakroun-Baggioni, N. (2018). How can the health belief model and self-determination theory predict both influenza vaccination and vaccination intention ? A longitudinal study among university students. *Psychology & Health*, *33*(6), 746-764. https://doi.org/10.1080/08870446.2017.1401623

Gotanda, H., Miyawaki, A., Tabuchi, T., & Tsugawa, Y. (2021). Association Between Trust in Government and Practice of Preventive Measures During the COVID-19 Pandemic in Japan. *J*

Gen Intern Med, *36*(11), 3471-3477. https://doi.org/10.1007/s11606-021-06959-3

Gupta, R. K., & Topol, E. J. (2021). COVID-19 vaccine breakthrough infections. *Science*, *374*(6575), 1561-1562. https://doi.org/10.1126/science.abl8487

Hossain, M. B., Alam, M. Z., Islam, M. S., Sultan, S., Faysal, M. M., Rima, S., Hossain, M. A., & Mamun, A. A. (2021). Health Belief Model, Theory of Planned Behavior, or Psychological Antecedents: What Predicts COVID-19 Vaccine Hesitancy Better Among the Bangladeshi Adults? *Front Public Health*, *9*, 711066. https://doi.org/10.3389/fpubh.2021.711066

Hou, Z., Tong, Y., Du, F., Lu, L., Zhao, S., Yu, K., Piatek, S. J., Larson, H. J., & Lin, L. (2021). Assessing COVID-19 Vaccine Hesitancy, Confidence, and Public Engagement: A Global Social Listening Study. *J Med Internet Res*, *23*(6), e27632. https://doi.org/10.2196/27632

Hoy, C., Wood, T., & Moscoe, E. (2022). Addressing vaccine hesitancy in developing countries: Survey and experimental evidence. *PLoS One*, *17*(11), e0277493. https://doi.org/10.1371/journal.pone.0277493

Huynh, G., Nguyen, H. T. N., Van Tran, K., Le An, P., & Tran, T. D. (2022). Determinants of COVID-19 vaccine hesitancy among parents in Ho Chi Minh City, Vietnam. *Postgrad Med*, *134*(3), 303-308. https://doi.org/10.1080/00325481.2022.2044142

Jafar, A., Dambul, R., Dollah, R., Sakke, N., Mapa, M. T., & Joko, E. P. (2022). COVID-19 vaccine hesitancy in Malaysia: Exploring factors and identifying highly vulnerable groups. *PLoS One*, *17*(7), e0270868. https://doi.org/10.1371/journal.pone.0270868

Jamison, A. M., Quinn, S. C., & Freimuth, V. S. (2019). "You don't trust a government vaccine": Narratives of institutional trust and influenza vaccination among African American and white adults. *Soc Sci Med*, *221*, 87-94. https://doi.org/10.1016/j.socscimed.2018.12.020

Janz, N. K., & Becker, M. H. (1984). The health belief model: A decade later. *Health education quarterly*, *11*(1), 1-47.

Jones, C. J., Smith, H., & Llewellyn, C. (2014). Evaluating the effectiveness of health belief model interventions in improving adherence: a systematic review. *Health Psychol Rev*, *8*(3), 253-269. https://doi.org/10.1080/17437199.2013.802623

Jusril, H., Rachmi, C. N., Amin, M. R., Dynes, M., Sitohang, V., Untung, A. S. B., Damayanti, R., Ariawan, I., & Pronyk, P. M. (2022). Factors affecting vaccination demand in Indonesia: a secondary analysis and multimethods national assessment. *BMJ Open*, *12*(8), e058570. https://doi.org/10.1136/bmjopen-2021-058570

Kalok, A., Loh, S. Y. E., Chew, K. T., Abdul Aziz, N. H., Shah, S. A., Ahmad, S., Mohamed Ismail, N. A., & Abdullah Mahdy, Z. (2020). Vaccine hesitancy towards childhood immunisation amongst urban pregnant mothers in Malaysia. *Vaccine*, *38*(9), 2183-2189. https://doi.org/10.1016/j.vaccine.2020.01.043

Khatiwada, M., Kartasasmita, C., Mediani, H. S., Delprat, C., Van Hal, G., & Dochez, C. (2021). Knowledge, Attitude and Acceptability of the Human Papilloma Virus Vaccine and Vaccination Among University Students in Indonesia. *Front Public Health*, *9*, 616456. https://doi.org/10.3389/fpubh.2021.616456

King, W. C., Rubinstein, M., Reinhart, A., & Mejia, R. (2021). Time trends, factors associated with, and reasons for COVID-19 vaccine hesitancy: A massive online survey of US adults from January-May 2021. *PLoS One*, *16*(12), e0260731.

Lazarus, J. V., Wyka, K., Rauh, L., Rabin, K., Ratzan, S., Gostin, L. O., Larson, H. J., & El-Mohandes, A. (2020). Hesitant or Not? The Association of Age, Gender, and Education with Potential Acceptance of a COVID-19 Vaccine: A Country-level Analysis. *J Health Commun*, *25*(10), 799-807. https://doi.org/10.1080/10810730.2020.1868630

Levi, M., & Stoker, L. (2000). Political trust and trustworthiness. *Annual review of political science*, *3*(1), 475-507.

Lim, V. W., Lim, R. L., Tan, Y. R., Soh, A. S., Tan, M. X., Othman, N. B., Borame Dickens, S., Thein, T. L., Lwin, M. O., Ong, R. T., Leo, Y. S., Lee, V. J., & Chen, M. I. (2021). Government trust, perceptions of COVID-19 and behaviour change: cohort surveys, Singapore. *Bull World Health Organ*, *99*(2), 92-101. https://doi.org/10.2471/blt.20.269142

Limbu, Y. B., Gautam, R. K., & Pham, L. (2022). The Health Belief Model Applied to COVID-19 Vaccine Hesitancy: A Systematic Review. *Vaccines*, *10*(6), 973.

MacDonald, N. E. (2015). Vaccine hesitancy: Definition, scope and determinants. *Vaccine*, *33*(34), 4161-4164.

Marian, A. J. (2021). Current state of vaccine development and targeted therapies for COVID-19: impact of basic science discoveries. *Cardiovasc Pathol*, *50*, 107278. https://doi.org/10.1016/j.carpath.2020.107278

Marzo, R. R., Sami, W., Alam, M. Z., Acharya, S., Jermsittiparsert, K., Songwathana, K., Pham, N. T., Respati, T., Faller, E. M., Baldonado, A. M., Aung, Y., Borkar, S. M., Essar, M. Y., Shrestha, S., & Yi, S. (2022). Hesitancy in COVID-19 vaccine uptake and its associated factors among the general adult population: a cross-

sectional study in six Southeast Asian countries. *Trop Med Health*, *50*(1), 4. https://doi.org/10.1186/s41182-021-00393-1

Migriño, J., Jr., Gayados, B., Birol, K. R. J., De Jesus, L., Lopez, C. W., Mercado, W. C., Tolosa, J. C., Torreda, J., & Tulagan, G. (2020). Factors affecting vaccine hesitancy among families with children 2 years old and younger in two urban communities in Manila, Philippines. *Western Pac Surveill Response J*, *11*(2), 20-26. https://doi.org/10.5365/wpsar.2019.10.2.006

Min, C., Shen, F., Yu, W., & Chu, Y. (2020). The relationship between government trust and preventive behaviors during the COVID-19 pandemic in China: Exploring the roles of knowledge and negative emotion. *Prev Med*, *141*, 106288. https://doi.org/10.1016/j.ypmed.2020.106288

Miyachi, T., Takita, M., Senoo, Y., & Yamamoto, K. (2020). Lower trust in national government links to no history of vaccination. *Lancet*, *395*(10217), 31-32. https://doi.org/10.1016/s0140-6736(19)32686-8

Murphy, K., McCarthy, M., Sargeant, E., & Williamson, H. (2022). COVID-19 conspiracies, trust in authorities, and duty to comply with social distancing restrictions. *International Criminology*, *2*(1), 44-58.

Nelson, R. (2020). COVID-19 disrupts vaccine delivery. *Lancet Infect Dis*, *20*(5), 546. https://doi.org/10.1016/s1473-3099(20)30304-2

Opel, D. J., Mangione-Smith, R., Taylor, J. A., Korfiatis, C., Wiese, C., Catz, S., & Martin, D. P. (2011). Development of a survey to identify vaccine-hesitant parents: the parent attitudes about childhood vaccines survey. *Human vaccines*, *7*(4), 419-425.

Peterson, C. J., Lee, B., & Nugent, K. (2022). COVID-19 vaccination hesitancy among healthcare workers—a review. *Vaccines*, *10*(6), 948.

Pronyk, P., Sugihantono, A., Sitohang, V., Moran, T., Kadandale, S., Muller, S., Whetham, C., & Kezaala, R. (2019). Vaccine hesitancy in Indonesia. *Lancet Planet Health*, *3*(3), e114-e115. https://doi.org/10.1016/s2542-5196(18)30287-0

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the Health Belief Model. *Health Educ Q*, *15*(2), 175-183. https://doi.org/10.1177/109019818801500203

Rosenthal, S., & Cummings, C. L. (2021). Influence of rapid COVID-19 vaccine development on vaccine hesitancy. *Vaccine*, *39*(52), 7625-7632. https://doi.org/10.1016/j.vaccine.2021.11.014

Ruan, H., Qiu, L., Chen, J., Liu, S., & Ma, Z. (2022). Government Trust, Environmental Pollution Perception, and Environmental Governance Satisfaction. *Int J Environ Res Public Health*, *19*(16). https://doi.org/10.3390/ijerph19169929

Safar, H. A., Mustafa, A. S., & McHugh, T. D. (2020). COVID-19 vaccine development: What lessons can we learn from TB? *Ann Clin Microbiol Antimicrob*, *19*(1), 56. https://doi.org/10.1186/s12941-020-00402-x

Shahzamani, K., Mahmoudian, F., Ahangarzadeh, S., Ranjbar, M. M., Beikmohammadi, L., Bahrami, S., Mohammadi, E., Esfandyari, S., Alibakhshi, A., & Javanmard, S. H. (2021). Vaccine design and delivery approaches for COVID-19. *Int Immunopharmacol*, *100*, 108086. https://doi.org/10.1016/j.intimp.2021.108086

Sharma, O., Sultan, A. A., Ding, H., & Triggle, C. R. (2020). A Review of the Progress and Challenges of Developing a Vaccine for COVID-19. *Front Immunol*, *11*, 585354. https://doi.org/10.3389/fimmu.2020.585354

Shmueli, L. (2021). Predicting intention to receive COVID-19 vaccine among the general population using the health belief model and the theory of planned behavior model. *BMC Public Health*, *21*(1), 804. https://doi.org/10.1186/s12889-021-10816-7

Shretta, R., Hupert, N., Osewe, P., & White, L. J. (2021). Vaccinating the world against COVID-19: getting the delivery right is the greatest challenge. *BMJ Glob Health*, *6*(3). https://doi.org/10.1136/bmjgh-2021-005273

Soleimanpour, S., & Yaghoubi, A. (2021). COVID-19 vaccine: where are we now and where should we go? *Expert Rev Vaccines*, *20*(1), 23-44. https://doi.org/10.1080/14760584.2021.1875824

Tagoe, E. T., Sheikh, N., Morton, A., Nonvignon, J., Sarker, A. R., Williams, L., & Megiddo, I. (2021). COVID-19 Vaccination in Lower-Middle Income Countries: National Stakeholder Views on Challenges, Barriers, and Potential Solutions. *Front Public Health*, *9*, 709127. https://doi.org/10.3389/fpubh.2021.709127

Trent, M., Seale, H., Chughtai, A. A., Salmon, D., & MacIntyre, C. R. (2022). Trust in government, intention to vaccinate and COVID-19 vaccine hesitancy: A comparative survey of five large cities in the United States, United Kingdom, and Australia. *Vaccine*, *40*(17), 2498-2505. https://doi.org/10.1016/j.vaccine.2021.06.048

Troiano, G., & Nardi, A. (2021). Vaccine hesitancy in the era of COVID-19. *Public health*, *194*, 245-251.

Tsai, R., Hervey, J., Hoffman, K., Wood, J., Johnson, J., Deighton, D., Clermont, D., Loew, B., & Goldberg, S. L. (2022). COVID-19 vaccine hesitancy and acceptance among individuals with cancer, autoimmune diseases, or other serious comorbid conditions: cross-sectional, internet-based survey. *JMIR public health and surveillance*, *8*(1), e29872.

Van Oost, P., Yzerbyt, V., Schmitz, M., Vansteenkiste, M., Luminet, O., Morbée, S., Van den Bergh, O., Waterschoot, J., & Klein, O. (2022). The relation between conspiracism, government trust, and COVID-19 vaccination intentions: The key role of motivation. *Soc Sci Med*, *301*, 114926. https://doi.org/10.1016/j.socscimed.2022.114926

Weintraub, R. L., Subramanian, L., Karlage, A., Ahmad, I., & Rosenberg, J. (2021). COVID-19 Vaccine To Vaccination: Why Leaders Must Invest In Delivery Strategies Now. *Health Aff (Millwood)*, *40*(1), 33-41. https://doi.org/10.1377/hlthaff.2020.01523

Wong, L. P., Alias, H., Danaee, M., Ahmed, J., Lachyan, A., Cai, C. Z., Lin, Y., Hu, Z., Tan, S. Y., Lu, Y., Cai, G., Nguyen, D. K., Seheli, F. N., Alhammadi, F., Madhale, M. D., Atapattu, M., Quazi-Bodhanya, T., Mohajer, S., Zimet, G. D., & Zhao, Q. (2021). COVID-19 vaccination intention and vaccine characteristics influencing vaccination acceptance: a global survey of 17 countries. *Infect Dis Poverty*, *10*(1), 122. https://doi.org/10.1186/s40249-021-00900-w

Wong, L. P., Wong, P. F., & AbuBakar, S. (2020). Vaccine hesitancy and the resurgence of vaccine preventable diseases: the way forward for Malaysia, a Southeast Asian country. *Hum Vaccin Immunother*, *16*(7), 1511-1520. https://doi.org/10.1080/21645515.2019.1706935

World Health Organization, W. (2022). *WHO Coronavirus (COVID-19) Dashboard*. Retrieved October 1 from https://covid19.who.int/

Wu, S., Feng, X., & Sun, X. (2020). Development and evaluation of the health belief model scale for exercise. *Int J Nurs Sci*, *7*(Suppl 1), S23-s30. https://doi.org/10.1016/j.ijnss.2020.07.006

Yasmin, F., Najeeb, H., Moeed, A., Naeem, U., Asghar, M. S., Chughtai, N. U., Yousaf, Z., Seboka, B. T., Ullah, I., Lin, C. Y., & Pakpour, A. H. (2021). COVID-19 Vaccine Hesitancy in the United States: A Systematic Review. *Front Public Health*, *9*, 770985. https://doi.org/10.3389/fpubh.2021.770985

Ye, M., & Lyu, Z. (2020). Trust, risk perception, and COVID-19 infections: Evidence from multilevel analyses of combined original dataset in China. *Social Science & Medicine*, *265*, 113517.

Yu, V. G., Lasco, G., & David, C. C. (2021). Fear, mistrust, and vaccine hesitancy: Narratives of the dengue vaccine controversy in the Philippines. *Vaccine*, *39*(35), 4964-4972. https://doi.org/10.1016/j.vaccine.2021.07.051

Abstract in Korean

국문 초록

인도네시아, 필리핀, 베트남, 태국의 정부 신뢰 수준과 코로나 19 백신 망설임의 연관성

송다영

서울대학교 보건대학원

보건학과 보건정책관리학 전공

배경 및 목적: 백신은 감염병을 예방하는 방법 중 최소 비용으로 최대 효율을 내는 수단이며 백신 접종률 관련 여러 장애물 중의 하나는 백신 망설임(vaccine hesitancy)이다(Hoy et al., 2022). 최근 백신 망설임은 전 세계적으로 예방 접종을 지연하는 공공보건 문제로 거론되며 세계보건기구 (WHO)는 백신 망설임을 '인류 건강에 대한 10 대 위협'에 포함했다. 선행연구에 따르면, 동남아시아 지역 국가들(특히 필리핀과 말레이시아)은 코로나 19 팬데믹 이전부터 백신에 대한 신뢰 수준이 상대적으로 낮은 경향을 보였다.

코로나 19 사태 초반인 2020 년에는 동남아시아 지역 대부분의 국가들은 제한된 자원, 보건 인력, 낙후된 보건 서비스 시스템 등으로 인해 백신을 확보하고 국민들에게 백신을

제공하는데 어려움을 겪었다. 이후 이들 국가에서도 백신 공급이 보다 원활해지고 무료 백신접종이 제공되었음에도 불구하고 다른 지역에 비해 동남아시아 국가들의 코로나 19 백신 접종률은 상대적으로 낮은 경향을 보여 왔다. 이는 각국 정부에 의한 백신 확보 관련 정책과 무료 접종 서비스 제공만으로는 국민들의 백신 접종 동기부여가 충분하지 않을 수 있음을 시사한다. 따라서 이들 국가의 백신 접종률 향상을 위해서는 국민들이 백신 접종을 꺼리거나 거부하는 원인 역시 파악해 보는 것이 필요하다.

선행연구에 따르면 코로나 19 이전부터 동남아시아 지역에서 나타난 백신 망설임의 주된 이유는 백신의 효과와 안정성에 대한 의구심이며, 접종 과정의 편의성, 거짓 정보, 종교적 신념, 인구통계학적 특성 (연령, 성별, 거주지, 소득, 직업 및 결혼 상태), 백신 관련 지식 부족, 백신에 대한 부정적 태도, 허위 정보, 종교적 믿음, 사회에 대한 전반적인 신뢰 부족 등인 것으로 보고되었다(Marzo et al., 2022). 한편, 각국 정부는 시민들에게 백신 및 관련 정보를 전달하는데 있어 일차적 책임이 있는 기관이며, 백신 관련 정책 및 규제 등 백신 접종 서비스의 관리자 역할을 한다는(Van Oost et al., 2022) 측면에서, 미국과 유럽 등 서구에서는 정부와 정부기관에 대한 신뢰가 백신 접종 의도 및 동기에 기여함을 밝힌 연구들이 있다. 정부 신뢰 수준과 백신 접종 동기의 정확한 메커니즘은 보고되지 않았지만, 시민들은 정부의 역량(competence)이 부족하여 안전하고 효과적인 백신을 제공할 능력이 없다고 인식하거나, 정부가 부패하고 청렴성, 개방성, 공정성이 부족하여 신뢰 수준이 낮다고 인식하면 백신 접종 동기에 영향을 끼칠 수 있다고 나타났다.

이는 백신 망설임이 상대적으로 높은 동남아시아 지역 국가들의 경우에도 개인수준의 특성에 초점을 둔 연구 외에 각국 정부의 역량 및 정부에 대한 신뢰 수준과 정도와 백신 망설임을 함께 살펴보는 연구가 필요함을 보여주나, 이러한 연구는 아직 동남아시아 지역에서는 전무한 실정이다(Jamison et al., 2019; Miyachi et al., 2020). 따라서 본 연구는 Imperial College London YouGov Covid-19 Behavior Tracker Data 에서 제공하는 데이터셋에 포함된 동남아시아 국가들(인도네시아, 태국, 필리핀, 베트남)의 데이터를 이용하여 정부 신뢰 수준과 코로나 19 백신 망설임의 연관성을 살펴보는 것을 목적으로 한다.

방법: 본 논문에 사용된 데이터의 자료원은 2020 년부터 2021 년까지 코로나 19 관련 행동과 태도변화를 알아보기 위해 Imperial College London's Institute of Global Health Innovation (IGHI)가 30 개국을 대상으로 전화인터뷰를 통해 수집한 'Imperial College London YouGov Covid-19 Behavior Tracker Data'이다. 해당 자료는 코로나 관련 정부 규제가 삶의 만족도 개인의 건강 또는 행동에 어떤 영향을 미치는지에 대한 정보와 코로나 백신 접종에 대한 결정 및 행동에 대한 정보를 수집한다. 조사 참여국 중 동남아시아 국가는 인도네시아, 태국, 필리핀, 베트남 4 개국이며, 본 연구는 이들 국가의 응답자 총 41,430 명의 응답을 분석하였다. 4 개국 전체 대상 분석 외에, 정부 신뢰 수준에 따른 결과를 비교하기 위해, 분석 대상인 4 개국을 'Wellcome Global Monitor 2020' 인덱스의 113 개국 정부 신뢰 수준 점수의 중위값(median)을 기준으로 높은 정부 신뢰 수준 국가군(필리핀,태국)과 낮은 국가군(베트남,

인도네시아)로 나누어 하위분석(subgroup analysis)을 진행했다. 또한 개별 국가 대상 분석도 진행하였다

본 연구에서 사용된 분석방법은 다중 로지스틱 회귀분석 (multivariate logistic regression)이며 결과는 relative risk ratio (RRR)로 나타냈다. 종속변수는 ““If a Covid-19 vaccine is safe and available to you, will you receive it?” 질문에 대한 예/아니오 대답을 기준으로 이분화하였다. 주 설명변수인 정부 신뢰 수준은 리커트 척도를 통해 측정된 다음 5 개의 응답을 범주형 변수로 삼았다: 완전한 신뢰 (completely trustworthy), 어느정도 신뢰 (somewhat trustworthy), 신뢰 (trustworthy), 신뢰할 수 없음 (Not trustworthy), 완전히 신뢰할 수 없음 (Not at all trustworthy). 통제 변수로는 사회인구학적 변수, 건강(기저 질환) 관련 변수, 그리고 건강 신념 모델 (HBM) 관련 변수를 포함하였다. HBM 관련 변수는 선행연구에서 HBM 의 5 가지 요소와 백신 망설임 간 유의한 연관성이 관찰되었기 때문이다. 본 논문에서는 3 가지 분석 모델이 사용되었다: 모델 1) Crude RRR (정부 신뢰 수준만 포함), 모델 2) 모든 통제 변수를 포함한 RRR, 모델 3) HBM 관련 통제 변수를 제외한 RRR 이다.

결과: HBM 변수들 중 ‘Perceived Barriers of health intervention’과 ‘백신 망설임 있음’의 연관성이 인도네시아와 필리핀에서 유의하게 나타났다 (모델 2). 태국에서는 HBM 변수인 ‘Perceived benefits of health intervention’과 ‘백신 망설임 있음’의 연관성이 유의하게 나타났다. 백신 망설임과 높은 정부 신뢰 수준의 연관성을 정부 신뢰 수준 그룹과 국가별로 분석했다.

국가별로 분석했을 때 태국에서 '완전히 신뢰할 수 없음'과 '백신 망설임 있음'의 연관성이 분석 모델 1 (crude RRR)과 모델 3 (HBM 변수가 제외된 adjusted RRR)에서 유의하게 나타나고 인도네시아에서는 모델 3 에 나타났으나, 모델 2(HBM 변수가 포함)에서는 유의한 결과가 관찰되지 않았다. 필리핀과 베트남에서는 세 가지 분석 모델로 분석한 결과, 모든 모델에서 정부 신뢰 수준 '신뢰할 수 없음'과 '백신 망설임 있음'과의 유의미한 결과가 나타났다. 따라서, HBM 변수를 포함한 모델 2 와 나머지 모델 1,3 으로 분석했을 베트남과 필리핀에서 백신 망설임과 정부 신뢰 수준의 연관성을 관찰할 수 있었다.

정부 신뢰 수준별로 결과를 살펴보면, 필리핀과 태국이 속한 '높은 정부 신뢰 수준 국가군'에서는 '완전히 신뢰할 수 없음'과 '백신 망설임 있음'의 연관성이 분석 모델 1 (crude RRR)에서 유의미하게 나타났으나, 모델 2 와 모델 3 에서는 유의한 결과가 관찰되지 않으며 베트남과 인도네시아가 속한 '낮은 정부 신뢰 수준 국가군' 또한 모든 모델에서 유의한 결과가 관찰되지 않았다.

결론: 본 논문은 태국, 필리핀, 베트남, 인도네시아 국가의 정부 신뢰 수준과 코로나 19 백신 망설임 간의 관계를 살펴보았다. 높은 정부 신뢰 수준 그룹별 비교 했을 때 높은 정부 신뢰 수준 국가군(필리핀,태국)과 낮은 국가군(베트남, 인도네시아)에서 유의미한 결과가 관찰되지 않았다. 그룹별로 비교했을 때 유의미한 결과가 관찰되지 않은 이유는 정부 신뢰 수준 그룹에

포함된 개별 나라들의 정부 신뢰 수준과 백신 망설임의 연관성 차이에 기인할 것일 수 있다. 높은 정부 신뢰 수준 국가군인 필리핀에서 '신뢰할 수 없음'과 '백신 망설임 있음'의 연관성이 모델 2 에서 나타났지만 같은 그룹인 태국에서는 나타나지 않았다. 또한 낮은 정부 신뢰 수준 그룹에서 베트남은 '신뢰할 수 없음'과 '백신 망설임 있음'의 유의한 결과를 보였지만 같은 그룹인 인도네시아에서는 유의미한 결과가 나타나지 않았다. 이렇게 상이한 결과는 각 나라별 국가의 정부 특성(정부 체제, 투명성, 정치 참여도), 사회인구학적 특성, 건강 수준의 차이 때문으로 생각해 볼 수 있다. 국가별로 분석했을 시 필리핀과 베트남에서 '신뢰할 수 없음'과 '백신 망설임 있음'의 유의미한 연관성이 관찰되었고 태국과 인도네시아에서는 HBM 변수를 포함한 모델에서 유의미한 결과가 관찰되지 않았다. 본 연구에서 HBM 의 5 개 요소 중 두가지 요소와 백신 망설임의 유의한 연관성이 관찰되었고, 모델 2 에서 HBM 변수의 상호 작용을 예측해 볼 수 있다.

선행 연구에서는 정부 신뢰 수준은 의료 서비스 사용 거부와 건강추구행위에 부정적인 영향을 끼친다고 나타냈다 (Yu et al., 2021). 하지만 선행연구에서 제시한 건강추구행위인 손 씻기, 마스크 착용 등의 건강추구행위와 의료 서비스 사용률을 비교했을 때 백신 접종과 백신 망설임은 더욱 복잡한 요인들이 수반된다. 백신 망설임은 대상자들이 인지하는 백신의 안정성, 개인적 신념, 허위 정보, 종교적 믿음, 미디어의 영향 등 다양한 요인들의 상호작용하여 백신 망설임을 도출할 수도 있다. 따라서 본 연구에서 도출한 결과는 정부 신뢰 수준과 코로나 백신 망설임의

연관성을 나타내며 백신 망설임의 요소를 더 이해하고 코로나 백신 망설임에 관련된 정책을 강화하는 데 기여할 수 있다고 예측된다. 본 연구의 한계는 사용된 데이터가 백신 망설임 연구를 위해 설계되지 않은 점이며 데이터에서 연구자가 도출한 HBM 의 요소 또한 설문의 의도와 설계에 포함되지 않은 점이다. 각 국가의 정부 신뢰 수준이 코로나 백신 망설임에 직접적으로 기여하는 기전(mechanism)은 추가 조사가 필요할 것으로 보인다. 이 연구는 동남아시아 국가들을 대상으로 한 정부 신뢰 수준과 코로나 백신 망설임의 관계를 살펴본 첫 연구라는 점에서 의의를 지닌다.

****

주요어: 코로나백신, 백신 망설임, 동남아시아, 백신접종, 백신 거부, 백신 접종률

학번: 2019-27887