Exploring the correlation between conspiracy theories and vaccine intentions: Characteristics, dynamics, and strategies to generate resistance to it

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Declaration and Note on Inclusion of Published Work

I, Indro Adinugroho, confirm that the Thesis is my own work. I am aware of the University's Guidance on the Use of Unfair Mean (www.sheffield.ac.uk/ssid/unfair-means). This work has not previously been presented for an award at this, or any other, university.

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Thesis Abstract

Conspiracy theories are considered as one of the factors that influence vaccine propensity. Not only specific vaccine conspiracy theories, those who endorse conspiracy theories in general or having conspiracy mindsets, for instance: "The government agencies monitor all citizens" can influence vaccine evaluation. During the COVID-19 pandemic, conspiracy theories became a prominent issue, gaining a significant amount of attention from psychology and public health scholars. Numerous studies have demonstrated a significant association between conspiracy theories and vaccine hesitancy where increases in conspiracy theories correspond to higher levels of vaccine hesitancy. Why do conspiracy theories influence vaccine hesitancy? What possible factors might strengthen or weaken the correlation between variables? What are potential strategies to generate resistance to anti-vaccine conspiracy beliefs? This thesis will address these by testing specific hypotheses to explore the correlation between conspiracy theories and vaccine intentions, providing current evidence to understand the association between them. By relying on cross sectional and longitudinal data, four studies were conducted to provide evidence to explore the association between the study variables. The first study examined the confirmation bias hypotheses where anti-vaccine conspiracy beliefs were presumed as an expressive responding-an intention to accept misinformation to reinforce their pre-existing beliefs. This hypothesis suggests that those who endorse conspiracy theories may not genuinely believe in the conspiracy proposition. Unfortunately, study 1 failed to test this hypothesis due to non-significant effects of the experimental treatments. We continued to follow up this hypothesis in study 2 using the the data from the Trust in Scientists & Science-Related Populism (TISP) project initiated by Harvard University. Here, we tested the confirmation bias hypotheses from study 1 using non-experimental approaches and found that correlation between vaccine conspiracy beliefs and vaccine intentions was stronger in those who mistrust scientists. In study 3, we explored

the correlation between conspiracy mentality and vaccine intentions with longitudinal panel data from the COVID-19 Psychological Research Consortium (C19PRC) project initiated by University of Sheffield, Ulster University, University College London, University of Liverpool and Royal Holloway University of London. This study extended the correlational analysis between conspiracy mentalities and vaccine intentions and found social events as the possible moderator where the correlation between conspiracy mentalities and vaccine intentions were stronger during the initial introduction of COVID-19 vaccines in December 2021. For the final study (study 4), we replicated Banas et al. (2023) to re-examine the effect of inoculation messages on anti-vaccine conspiracy attitudes. Although we failed to replicate the significant effect of the original study, this replication provided a valuable contribution for the inoculation theory.

Table of Contents

List of Tables

List of Figures

Chapter 1

Introduction & Literature Review

This Chapter provide comprehensive elaboration on psychological frameworks to explore why some groups of people believe and endorse conspiracy theories and why vaccine became the object of conspiracy theories.

Contributions: I wrote this Chapter. Tom Stafford and Richard Bentall (primary supervisors) provided feedback on the draft.

Conspiracy theories have become a significant factor in influencing vaccine hesitancy. Based on the Oxford English dictionary, the term conspiracy refers to a secret agreement to engage in unlawful or harmful activities. Many studies worldwide have demonstrated significant correlations between conspiracy beliefs and vaccine hesitancy, indicating that higher levels of conspiracy beliefs are associated with greater vaccine reluctance to be vaccinated. As a behavioural science, psychology plays a role in exploring variables that contribute to this association and in identifying potential strategies to reduce the effect of conspiracy theories on vaccine hesitancy. Psychology provides empirical frameworks to explore potential antecedent variables associated with conspiracy theories and vaccine hesitancy.

This chapter attempts to describe the context of my thesis with seven subchapters. The first section provides the historical perspective of conspiracy theories, examining how scholars have studied them and the meaning they attributed to them. The second section explores the definition of beliefs, how beliefs influence decision-making, and examples of institutionalised beliefs. The third section elaborates three psychological approaches– cognitive psychology, social and political psychology, and clinical psychology–in exploring conspiracy beliefs. Following this, a discussion describing types of conspiracy beliefs will be provided in section four and various scales to assess conspiracy beliefs will be discussed in section five. Subsequent sections will focus on potential interventions to foster resistance to conspiracy theories. The final section of this chapter elaborates the association between conspiracy beliefs and vaccine hesitancy, including a basic definition of conspiracy beliefs, exploration of why vaccine hesitancy is an essential issue and the association between these variables.

1.1 Research in conspiracy theories: A historical perspective

Previous studies from the 1960s trace the origins of conspiracy theories from two major theses: The Paranoid Style of American Politics (Hofstadter, 1965) and The Open Society and Its Enemies (Popper, 1966). These theses attempt to explain the role of conspiracy theories and why societies of that era conceptualise them in specific ways. The concept of “paranoid style” in American politics is a political view that is distinct from specific clinical reports that can be provided by psychologists. This term was applied to address the characteristics of Americans that exhibited deep suspicions toward authoritarian governments, particularly in how they develop policies and utilise political power. The essay was written by Richard Hofstadter, a well-established historian, in response to the political situation in America around 1960. Specifically, the essay critiques a conservative politician, Barry Goldwater, an extreme conservative who won the presidential nomination over other nominees in 1964. The view of paranoid style can be characterised by seven elements: (1) Feeling of persecution accompanied by conspiratorial thinking, (2) the view of seeing conspiracy as an enormous thing, (3) the matter of confrontation is between "good" and "evil”, (4) the shape of the enemy is clear and represent malicious parties, (5) the enemy is seen as a representation of “us”, but they have specific trait that needs to be countered and (6) beliefs that state enemy has been existed from the inside and brings negative consequences and (7) the evidence of this secret agreement can be seen clearly in great quantities (Parsons, 1970). The paranoid style was constructed as an instrument of thought that can be utilised to oppose social welfare policies driven by political interest rather than the essence of the welfare itself.

Another essay mentioning conspiracy theories was written by Karl Popper (1966). Popper addressed the idea of "the conspiracy of the society" in his book, "Open Society and Its

Enemies". To understand conspiracy theories, he defined conspiracy theories from his version as:

"*It is the view that an explanation of a social phenomenon consists in the discovery of the men or groups who are interested in the occurrence of this phenomenon (sometimes the interest is hidden) and who have planned and conspired to bring it about*"

Similar to Hofstadter's essay, Popper viewed conspiracy theories as the thinking system, exposing critiques to authorities who engaged in extreme political movements, such as: Nazism, fascism and other forms of dictatorship worldwide. Adolf Hitler was the primary subject discussed in this essay, where he was perceived as the most influential leader in Europe between 1933 to 1945. Hitler was perceived as a successful leader who often utilised conspiracy theories to spread false narratives promoting that Jews are the threat to the world, thereby justifying their persecution (Fay, 2019). Popper argues that conspiracy theories are often used as a tool to rationalise oppression, particularly in the case of antisemitism. Although the essay seems to provide a view where all social events are the outcomes of conspiracy theories, Popper did not claim that all historical events were the consequences of conspiracy theories. This view was introduced to highlight how conspiracy theories have been utilised to justify oppression worldwide.

Beyond academic discourse, history also records some "unresolved" political events that have become the focal point of conspiracy theories. This term refers to a perception that certain groups remain unsatisfied with the official explanations provided by the government or law enforcement agencies. Two major political events mostly associated with conspiracy theories are the assassination of J.F Kennedy in 1963 and the death of Princess Diana in 1997.

Despite formal government reports explaining the cause of events, some groups of people continue to believe that secret agreements between powerful parties were causing the incidents. A survey by the New York Times in 1992 (New York Times, 1992) has found approximately 60% of participants believed that the CIA was involved behind Kennedy's assassination. Similarly, conspiracy theories regarding Princess Diana's death suggest that The British Intelligence Agency, MI6, played a significant role in orchestrating the accident (Wood et al., 2012).

These events illustrate that conspiracy theories function as political attitudes, often emerging as a response to specific political events perceived as suspicious by certain groups. Once a conspiratorial mindset develops, the effect can occur for a long time, even after formal clarifications have been released to the public. To elaborate why this condition occurs, psychological studies are required to assess potential factors associated with conspiracy theories. Psychology provides empirical approaches studying information processing and human behaviour as valuable insight to elaborate conspiracy theories. A few theories that can be applied to explore conspiracy beliefs as attitudes are decision theories (Tang et al., 2018), motivated reasoning theories (Kunda, 1990) and social identity theories (Turner, 2004).

1.1.1 Why is research in conspiracy theories important?

Research in the field of conspiracy theories is vital because conspiracy beliefs propose dual consequences, positive and negative consequences. On the positive side, they can stimulate more elaborative thinking on specific objects, even though with scepticism (Stojanov & Halberstadt, 2019; Wood, 2017). For example, those who endorse anti-vaccine conspiracy theories may elaborate vaccine development thoroughly, explore specific pharmaceutical industries as the producers and investigate political processes involved in vaccine approval

than those who comply with vaccination programs. Related to politics, conspiracy theories can widen the opportunity to engage in political debates and fact-checking (S. Miller, 2002). Conspiracy theories can stimulate the public to be more politically active in participating in politics and monitoring the Government (Y. Kim, 2022). Beyond elaborative thinking, conspiracy theories can also stimulate positive experiences. A recent systematic review by van Prooijen (2022) found that conspiracy beliefs can drive an entertaining experience related to sensation-seeking perception. The logic behind this is that most conspiracy messages contain appealing messages rather than harmful arguments, where it can stimulate positive emotions and affect psychological well-being (Fredrickson & Joiner, 2002; Silton et al., 2020).

Conspiracy beliefs can also lead to harmful consequences. A few studies have shown that conspiracy beliefs were associated with political scepticism, negative public health attitudes, and science rejection. For example, a study by Butler et al. (1995) found that conspiracy beliefs influence participants to avoid voting and reduce political engagement. This attitude was shown after participants were exposed to Oliver Stone's controversial movie about J.F Kennedy, portraying some government agents involved in the assassination of the President, as the experimental treatment. Those in the experimental group were shown with the story where politics are dissatisfactory and only benefited some powerful parties, while in the baseline condition, they did not watch the same movie. Results showed that participants in the experimental condition reported to have lower engagement in politics, measured by survey. Also, conspiracy beliefs have been associated with environmental and health issues. Various studies have demonstrated the findings that conspiracy beliefs were significant predictors of vaccine hesitancy (Jolley & Douglas, 2014; Milošević Đorđević et al., 2021); climate change refusal (Uscinski et al., 2017) and radical behaviours (Rousis et al., 2020). A

study by Rousis et al. (2020) utilised text analysis software to code passages from six randomised groups, one of those was radical violent extremist. The analysis showed that radical violent groups utilised more conspiratorial arguments to justify violence compared to other non-radical groups.

The dual consequences of conspiracy beliefs address the scientific reason of the importance of research in this field. Although conspiracy beliefs may lead to some advantages, no cognitive strategies reported to focus solely on their positive consequences. The consequences of conspiracy beliefs can be harmful not only to other individuals and groups, but also to the society (i.e., terrorism and radical behaviours). Thus, research in psychology of conspiracy theories is vital to continue exploring the nature of conspiracy theories and testing potential interventions to mitigate the harmful effects.

1.2 Conspiracy theories as beliefs

Psychology defines conspiracy theories as a belief that secret agreements between powerful and malevolent parties are the potential factors causing specific social events (Brotherton et al., 2013a; Douglas & Sutton, 2023; Prooijen, 2022; Stojanov & Halberstadt, 2019). Some conspiracy theories could be misleading and lack empirical evidence, yet some of them may be true (e.g., the Watergate scandal). People who endorse might believe in the existence of specific covert groups who have the power to control the entire population and hide some essential information. They believe that the groups are operating in secrecy and remaining untraceable.

Formal and informal institutions play a crucial role in preserving conspiracy theories. For example, political parties, as a formal institution in democratic countries, can stimulate

conspiracy theories by exposing individuals to conflicting political ideologies. During the election period, every political party competes for power and authority, they often apply conspiracy theories as the tool to derogate others, particularly opposite groups. Similar to these, communities and peers can also become informal institutions that encourage people to rely on conspiracy theories. Information shared by family members or working colleagues can influence one's perception to believe in conspiracy theories. A study conducted by Winter et al. (2022) demonstrated the role of supportive subjective norms–the perception of close others provides more accurate information-in influencing vaccine evaluations. This study found that subjective norm moderated the strength of the correlation between conspiracy mentality and vaccine intentions when their close circles perceive vaccines as the safe medical instrument.

The likelihood to believe in conspiracy theories is acquired through social learning and repetition. They can be determined by the exposure to conspiracy-related stimuli. Studies have identified the positive correlation between social media usage and conspiracy theories misinformation, showing that increases in social media engagement will lead to a condition where they can be more vulnerable to conspiracy theories (Allington et al., 2021; Enders et al., 2023). Those who spend longer in engaging in social media are at greater risk of exposure to conspiracy theories shared online. In some situations, exploring information from social media can be beneficial to obtain a quick update, but consuming those uncritically, may lead to misinformation. Sutton and Douglas (2022) have proposed a rabbit hole syndrome hypothesis, explaining that conspiracy theories appear as appealing messages that can be understood easily. By receiving these messages frequently, unconsciously they can be trapped in a rabbit hole, leading them to accept conspiracy theories as true claims. This view supports the notion of conspiracy beliefs as an outcome of social learning and repetition.

In this situation, media literacy, an ability to measure the validity of information from the mass media, is vital in determining susceptibility to conspiracy theories (Austin et al., 2016). When people activate this ability, they are capable of setting boundaries to distinguish between rational and irrational propositions. In conclusion, conspiracy theories serve as a belief, supporting people to rationalise certain events, and the extent to which they believe in such theories can be varied depending on multiple factors, such as personality, emotion, and involvement to the specific issue.

1.2.1 What is belief?

To obtain a more comprehensive understanding of conspiracy theories as beliefs, it is essential to identify the definition of beliefs. Beliefs, as empirical concepts, have been investigated in numerous fields, including philosophy, sociology, psychology, and political science. Definition of belief can be varied, ranging from mental representations of conscious thoughts (Churchland & Churchland, 2012) up to representations of feeling and thoughts toward a particular object (Jervis, 2006). In general definition, beliefs can be seen as a cognitive element that is associated with attitudes and behaviours. The classical theory of reasoned action includes beliefs as the vital component in predicting intentions (Fishbein, 1979). Three types of beliefs are categorised by this theory: Behavioural beliefs as the attitude toward the behaviour, normative beliefs or subjective norms, and control beliefs, which are categorised as perceived capabilities in completing specific tasks. For some people, beliefs can serve as a guiding principle to legitimate specific actions, including extreme commitments. For example, among the Aztecs, human sacrifice is considered essential as a ritual to ensure agricultural prosperity (Winkelman, 1998). Similarly, religious

fundamentalists may hold specific beliefs to justify violence towards other groups (Wibisono et al., 2019).

A narrative review conducted by Usó-Doménech and Nescolarde-Selva (2016) proposes a view for understanding beliefs as a system. Belief systems are interrelated structures of norms that vary depending on their relationship with other existing beliefs. This perspective suggests beliefs as the interconnected variables, not as single and independent variables and activating the system may function as an evaluation tool. For example, when an individual activates religious beliefs, it can also include morality to determine positive and negative emotional reactance. They propose 13 key characteristics of belief systems:

1. Beliefs require personal commitment.
2. Belief systems exist independently. This means, believers only access some parts of the social information, and belief systems will generate meanings.
3. Belief systems require cognitive congruence.
4. Belief systems have a longer life span than believers.
5. Belief systems differ from one another.
6. Belief systems have boundaries, and the boundaries are general.
7. The elements of belief systems (concepts, propositions and guidance) are not consensual, which means every individual holds different beliefs.
8. Belief systems consist of existential and non-existential entities.
9. Belief systems include representations of alternative worlds, the perception of the world as it is and the expectation of what the world should be.
10. Belief systems rely on evaluative (cognitive) and affective (emotions) components.
11. Belief systems include substantial contents of information, from personal experience to propaganda.

12. The content of belief systems is open, which means it is unclear to set a boundary of belief systems. Belief systems can be formed through individual experience about family and colleagues up to collective perception on global politics.

13. Beliefs consist of varying degrees of certitude. At some points, they can confidently agree to one substantial thing, however, at the extreme view, they can also justify whether one condition is more probable than not. This dimension of variation is absent from knowledge systems.

These characteristics highlight the argument of why beliefs are resistant to change with psychological interventions. In some conditions, changing beliefs with false intervention can lead to backfire effects, reinforcing the original beliefs instead of reducing the adverse consequences.

Another perspective on defining beliefs also comes from Goertzel (1994) in his book "*Chaotic Logic*". He proposes two perspectives in understanding beliefs, monological and dialogical. Monological beliefs are a set of expectations in which particular knowledge cannot be shared to others and no intention is given to test the validity of them. In contrast, dialogical beliefs are open to any constructive discussion to assess their credibility. Goertzel contrasted science and conspiracy theories to illustrate the difference between dialogical and monological beliefs. Science is considered dialogical, while conspiracy theories are considered monological. Science acknowledges the perspectives where findings should be shared to others and let other scholars critique and falsify them. For example, when Galileo first introduced his lunar maps, he argued that his telescope could provide a correct view of space because it could generate the accurate distance of earth. This scientific argument was shared to stimulate other scholars to investigate and refine the true reality of space. Galileo's belief was productive because it fostered a dialogue between scholars, ultimately leading

scholars to provide more robust empirical evidence about space. In contrast, conspiracy theories function in opposite directions. Rather than inviting critiques from another view, they serve to reinforce their own expectations and produce the meaning for their in-groups.

Beliefs are essential components to generate meaning of social realities. Without beliefs, there will be no motivation for any significant actions. Even though beliefs are not the only variable that can predict behaviours, the significance of beliefs cannot be ruled out. Psychological theories have included beliefs as the essential variables within decision-making processes. The next section will explore how beliefs influence decision-making processes.

1.2.2 Beliefs in decision-making processes

Decision-making is a central issue in psychology. Effective decision-making processes will lead to optimum results, whereas false decisions can lead to errors that might cause harm for organisations and societies. An example of errors within the decision-making process can be seen in groupthink, a group decision-making that produces poor decisions due to the intention to maintain solidarity within the group that finally overrides the motivation to achieve optimal results (Janis, 1973). A case of groupthink can be traced from the Bay of Pigs invasion in April 1961 under the administration of J. F Kennedy. The action to invade the area was made based on irrational presumptions (Raven, 1998). Another example is the invasion of Iraq, which was justified by the false alarm that Iraq possessed the weapons of mass destruction (Badie, 2010).

There are a few decision theories that can be applied as the empirical framework to study decision-making in various contexts. One of the earliest theories investigating the decision-making process is rational decision theory or normative model. This framework focuses on

the quality of decision makers (person) to optimise their decisions and identify strategies to generate most effective decisions. Two major theories proposed from this model are: The utility theory (Fishburn, 1968; Stigler, 1950) and the subjective probability theory (Kadane & Larkey, 1982). The utility theory conceptualises decision-making as the behaviour driven by the utility of specific actions (e.g., people purchase foods because they are hungry). Different from utility theories, the subjective probability theory is an approach that concerns the logical consequences behind one's action. Both theories elaborate how individuals, as the decision makers, gain optimum profit and minimise loss. Rationality is the key element in this approach, where decision making is made based on the purpose of maximising utility and avoiding loss. Utility perceptions can be measured with various scales (e.g., ordinal, interval, or ratio), reflecting the level of satisfaction derived from the chosen actions. Rational decision theories have been applied in numerous fields, including psychology, economy, and management, to explore how decision makers generate judgement across different conditions.

Rational decision theories are grounded in the belief of maximising benefits; however, this rationality is not constantly associated with numerical calculations. Rationality can convey more general meanings of self-enhancement. Although this approach has been used by many scholars to explain human decision-making, they face several limitations. Simon (1997), through his view on bounded rationality, explores a proposition where humans do not always seek to maximize utilities. Instead, bounded rationality suggests the argument that individuals generate decisions that are *satisficing*–the decision that is good enough rather than optimal. This perspective argues that decisions are made based on multiple considerations of others, such as social identity and well-being.

The limitations of rational decision theory have led many scholars to assess alternative approaches to study decision-making, one of those is descriptive theories (Tang et al., 2018). Descriptive theories suggest that social interactions play a significant role within decision-making processes. Evidence from cognitive science, psychology, and sociology contributes to develop this theory. Three key theories supporting this descriptive model are: Prospect theory (Tversky & Kahneman, 1992); social judgement theory (Hammond et al., 1975a), and ecological rational theory (Gigerenzer & Selten, 2001).

Prospect theories emphasize risks as an essential factor in the process of making decisions. It suggests that some people tend to be risk-seeking when the stakes are high and avoid them when the stakes are low. Beliefs in taking the risk are argued more important than focusing on the utility. The earliest study to support this view is the study of framing decisions and the psychology of choice by (Tversky & Kahneman, 1981) suggesting that different choices can be made depending on how options are framed, even though the outcomes of the decision are equivalent. Related more to psychology, support for the prospect theory can be traced from the study conducted by Loewenstein et al. (2001) which suggests that emotional reaction to risks significantly influence decision-making processes, increasing the likelihood of decision makers becoming more biased.

If prospect theory focuses on risk and rationality, social judgement, and ecological theories concern more on the importance of social and ecological factors in shaping decisions. Social judgement theory describes that the quality of a decision is determined by how individuals interpret environmental cues and how they can incorporate them with their prior knowledge (Hammond et al., 1975a). This framework has been applied to explore decision-making across various contexts, such as political attitudes (Bochner & Insko, 1966), health (Dillard &

Shen, 2005) and conspiracy theories (Jolley & Douglas, 2014). Yet, in some conditions, people are restricted to consider multiple social cues and calculate probabilities to form decisions, for example during COVID-19 pandemic or world war. Ecological theories offer the perspective that adaptation and adjustment in those situations are essential factors determining the quality of decision-making. People often apply heuristics–fast and frugal cognitive mechanisms–rather than complete calculations to form decisions when they face uncertain or rapidly changing situations. The empirical concept of heuristics has been applied in many fields, including psychology (Lewandowsky et al., 2013) and political science (Taber & Lodge, 2006).

Two perspectives of decision-making theories emphasize beliefs as a crucial element in decision-making processes. Beliefs function as a mindset, guiding decision makers, shaping perspectives, and interpreting social realities. For example, those who prioritise profits tend to adopt rational beliefs to form decisions. Although decision making process often involves deliberative thinking, in some situations, people are not able to apply them due to specific conditionalities. To resolve this, they can rely on mental shortcuts (heuristics), generating quick decisions to adapt with the situation. In conclusion, beliefs are essential components within decision-making process.

1.3 How psychology explores conspiracy beliefs?

Psychology, as a behavioural science offers multi-perspectives in exploring the antecedent variables associated with conspiracy beliefs. This chapter will explore three approaches to elaborate conspiracy theories from cognitive, social, and clinical psychology perspectives.

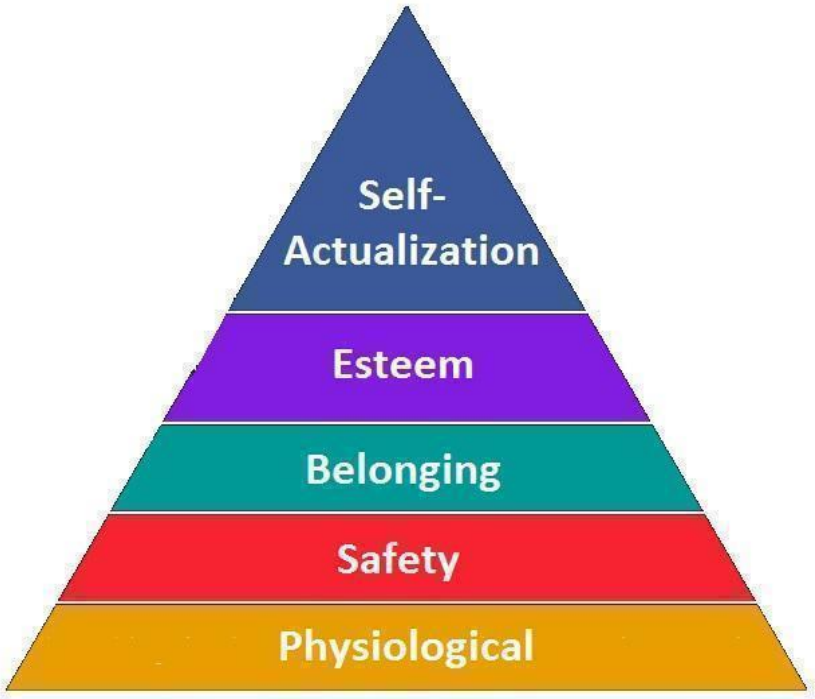
1.3.1 Cognitive psychology: The role of motivation, reasoning, and bias

Motivation is a psychological state that drives individuals to continue or terminate specific behaviour at a particular time (Ryan & Deci, 2000). This variable is knowledge that is acquired through social learning. Through motivation, individuals generate meanings behind their actions. Motivation is categorised into two dimensions: Intrinsic (internal) motivation and extrinsic (external) motivation (Touré-Tillery & Fishbach, 2014). Intrinsic motivation is driven by internal factors, such as subjective goals, values, emotions, traits, personality and life purpose, whereas extrinsic motivation is elicited through social influences, such as social support and peer advice. Both dimensions are crucial in determining behavioural responses. Moreover, motivation is fundamental in psychology because it is closely linked with significant psychological outcomes, including academic achievement (Amrai et al., 2011) and mental health quality (McAdams & Bryant, 1987).

The levels of motivation increase when individuals adopt personally meaningful goals (Elliott & Dweck, 1988). Goals and motivation are closely intertwined; goals set a direction for having a clear perspective and encourage individuals to manage their future expectations. By setting a clear goal, individuals can develop effective strategies to fill their needs and achieve their desired goals. The link between goal and motivation can be explained with the theory of needs proposed by (Maslow, 1943). The framework describes human needs throughout the hierarchical system (see Figure 2). According to this theory, human needs are categorised into five dimensions, where lower-level needs must be achieved before they can progress to higher-level needs. The framework can also be conceptualised into three levels: Physical needs at the base (physiological and safety needs), psychological needs in the middle (belonging and esteem) and self-fulfilment (self-actualisation needs) at the top, with every dimension represent distinct type of goals.

Figure 1. 1

The hierarchy of needs (Maslow, 1943)



Motivation also influences individuals to process social information. Kunda (1990) developed the motivated reasoning theory which connects motivation, belief, and reasoning process. Motivated reasoning is a cognitive method applied to process information when motivation and beliefs are taken into consideration. According to this conception, information processing is affected by two types of motivation: Accuracy-oriented motivation and goal-oriented motivation. Reasoning based on accuracy is a condition when motivation to seek accuracy and validity influences information processing, for example when taking an exam, individuals are motivated to identify the correct answers to obtain higher scores. On the contrary, when strict conditionalities are not applied to motivate individuals seeking accuracy, they mostly rely on goal-oriented reasoning to process information, a thinking

mechanism focuses on reinforcing previous existing beliefs rather than ensuring accuracy (e.g., when supporting a political party).

The role of motivated reasoning in influencing public opinion has been investigated in many fields, including political science and psychology. An experimental study conducted by Bolsen et al. (2014) has shown the consequences of goal-oriented reasoning on partisan opinion. The experiment manipulated partisan goal-oriented reasoning with vignettes with three conditionalities: Neutral (no motivation), accuracy-oriented motivation and goal-oriented motivation. Results showed that participants tend to strongly form opinions based on their pre-existing beliefs when they were endorsed by the politically congruent party. Similar to these, (J. M. Miller et al., 2016) used motivated reasoning theories to assess the correlation between ideologically conspiracy beliefs (liberal vs conservative), political ideology and political knowledge using the existing data taken from 2012 American National Election Survey (ANES). The analysis demonstrated that participants with high political knowledge, but low political trust were more susceptible to ideologically motivated conspiracy endorsement.

The theory of motivated reasoning is grounded in the empirical phenomenon of confirmation bias. Nickerson (1998) defines confirmation bias as the likelihood to process relevant information to strengthen the existing beliefs. Confirmation bias manifests in various domains, including science, policy rationalisation, mysticism, judicial reasoning, and medicine. Several symptoms have been identified supporting this conception, such as hypotheses-determined information seeking (HDI) (Koriat et al., 1980); the primacy effect (N. H. Anderson & Barrios, 1961; Ostrom, 1982) and own-judgement evaluation (Einhorn & Hogarth, 1978). HDI is the behavioural tendency to identify information that confirms one's

hypotheses rather than those that are contradictory. This selective process can lead to attention restrictions, limiting attention to solely focus on specific information that aligns with the purpose of thinking. Another symptom is the primary effect, a condition where people often weigh the information acquired early as more trustable than the later information. The primacy effect is closely related to belief persistence, a condition when existing beliefs are difficult to alter even by exposing empirical evidence. Interaction between HDI and primacy effect can stimulate own-judgement evaluation where overconfidence becomes the most dominant factor within decision making processes (Moore & Cain, 2007).

The theory of motivation, goal achievement and bias are core components that can be applied to explain why some individuals endorse conspiracy theories. Douglas et al. (2017) mentioned various motivations play roles as the antecedent variables of conspiracy beliefs. They propose three basic motives behind conspiracy theories: Epistemic, existential, and social motives. These motives are supported by evidence from a few research and theories in psychology, such as social identity theories. Epistemic motive is a drive to seek for causal explanations of unresolved events, particularly when existing explanations are insufficient, thereby defending the previous beliefs against disconfirmation. The existential motives address the desire to control social environments. By means, conspiracy theories can alleviate factors that may threaten their existing point of views. On the other hand, social motives reflect the need to maintain social identities, particularly their in-group identities. Identity is a key component of self-reflection and it supports them to set life purposes (Turner, 2004). Additionally, each motive can be activated independently or interact with the others, depending on goals and contextual factors.

Conspiracy theories can be applied to reinforce pre-existing beliefs when conditionalities to pursue accuracy are not available. However, when individuals are prompted to engage in deliberative thinking, the likelihood of endorsing conspiracy theories can be reduced. A study conducted by Swami et al. (2014) demonstrated evidence that conditionality and information-processing strategies influence the likelihood to endorse conspiracy theories. The study used experimental designs with two conditions where the experimental group was exposed to verbal fluency tasks to stimulate analytical thinking, whereas in the baseline group, no stimulus was given. To note, analytical thinking is distinct from intelligence (IQ), but it refers more to system 2 thinking, a deliberate and effortful process aimed to pursue accuracy (Kahneman, 2012; Petty & Cacioppo, 1986). Findings showed that participants who were exposed to the task have lower intention to endorse conspiracy theories compared to the baseline condition. The study suggests that using deliberative thinking reduces conspiracy beliefs due to activation of accuracy-oriented motivation.

Motivated reasoning theories offer a specific framework for understanding conspiracy beliefs from the cognitive perspective. Under some conditions, conditionalities to encourage accuracy-oriented reasoning cannot be made and individuals process conspiracy theories to strengthen their existing beliefs. Moreover, conspiracy theories consist of appealing messages rather than harmful descriptions that stimulate threat. As a result, individuals can accept conspiracy theories without engaging in deliberative evaluation. This tendency can lead to entrenchment of conspiracy beliefs, a phenomenon described by Sutton & Douglas (2022) as the *rabbit-hole hypothesis*. According to this hypothesis, once individuals adopt conspiracy theories–perceiving them as appealing messages–they become unlikely to reconsider the view as incorrect, using them as a reference for decision-making. In conclusion, thinking

mechanisms, goals and how people interpret the situation play a significant role in why people rely on conspiracy theories.

1.3.2 Social psychology: Conspiracy theories and socio-political identity

Conspiracy theories are conceptions that are closely related to political attitudes. Historical records indicate that the origin of conspiracy theories came from theses to criticise authoritarian regimes, as reflected in the seminal works of Hofstadter, (1965) and Popper (1966). Some major political events also contributed to shaping conspiracy theories in societies, such as the assassination of J.F Kennedy (JFK) and the Watergate scandal in the US. A public survey by the New York Times (1992) has shown that more than 60% of the US citizens believed that secret agreements were involved behind the assassination of JFK, despite the official investigation of Lee Harvey Oswald as the perpetrator from the national police. Similar to these, the death of Princess Diana in an accident in 1997 has become the subject of conspiracy theories. Some people in the UK believe that this action was not ordinary, but there was an involvement of CIA and MI6 behind those (Wood et al., 2012). Also, a study conducted by van Prooijen et al. (2015) showed a quadratic correlation between political ideology and conspiracy beliefs in various political issues. Specifically, this study suggests that the desire to believe in a simple political solution mediates the association between conspiracy beliefs and political ideologies among right and left-wing extremists.

Politics are also related to group identities, an essential issue in social psychology where it conveys social meanings for individuals and groups. They are formed through social interactions, a situation where individuals could generate meaning from social realities. The framework that explains the association between social interactions and social identities is social identity theory (Turner, 2004). This framework explores the importance of group

membership in determining self-pride and self-esteem. Two key concepts proposed in this theory are: In-group and out-group. The relation between these groups are fundamental elements of social identity theories (Hornsey, 2008; Turner, 2004). Ingroup refers to the specific groups to which individuals belong, such as political parties, families, or those with similar characteristics. Whereas outgroup refers to the group outside the circle (e.g., different political affiliations or others from different ethnicities). The concept of ingroup and outgroup distinction originated from three mental processes: (1) Social categorisation; (2) social identification; and (3) social comparison. Social categorisation involves classifying specific objects affiliated with groups. Social identification refers to a process of identifying groups with the given labels, and social comparison is the process of comparing the identity between two groups.

Social identity theory originated from the research on minimal group paradigms, which stated that ingroup favouritism could occur by social evaluations from simple and minimal cues (Diehl, 1990; Gaertner & Insko, 2000; Otten, 2016). An essential experiment that supported this was Tajfel (1970) study on painting preferences. Throughout this experiment, participants, mostly dominated by young boys, were asked to complete similar sets of reward booklets after they rated the paintings as the key stimulus. Results found that most participants experience the "maximum difference", giving the largest differences between members of the different groups (outgroup) even though they did not receive complete information regarding the group membership. This experiment demonstrated that ingroup favouritism can emerge from the presence of minimum cues (without any actual information and comprehensive data).

The concepts of ingroup favouritism and outgroup derogation provide a framework to explore the cause of social conflicts. This theory suggests that conflicts can be the outcome of social comparisons, not merely due to resource scarcity. Various studies have investigated the causes of social conflicts using this approach, such as the conflict in Northern Ireland (Galagher, 1989); Indonesia (Fauzi et al., 2019) and the longstanding conflict between Palestine and Israel (Abu-Nimer, 2004). Identities, such as religious beliefs and ethnicities, are assessed as the potential contributors. Furthermore, when identity becomes sacred or strongly held by some groups, a conflict can be more severe and more difficult to recover through social interventions. The concept of sacred identity has been explored by Sheikh et al. (2013) through the construct of sacred values and has been used to investigate the roots of the Israel - Palestine conflict. Findings from the study found that interventions to reduce the conflict can be misleading and even counterproductive when focusing only on rational perspectives (i.e., scarcity of resources).

Identity, social conflicts, and conspiracy beliefs are intercorrelated concepts. In some situations, people utilise conspiracy theories to justify their actions against perceived outgroups during conflicts. Cassam (2023) mentioned the nature of conspiracy theories as a form of political propaganda, as some political groups apply conspiracy theories as a political instrument, containing specific motives and purposes, to legitimate their actions. For example, anti-zionist views were constructed as a form of protest against Israel and as a movement to advocate sovereignty in Palestine. In this situation, this view represents a specific identity from the Palestinian.

Different identities can foster groups to exploit conspiracy theories to denigrate others. (Douglas et al., 2017) have mentioned this social motive as the desire to maintain in-group

identities. For example, the 2019 presidential election in Indonesia is an illustration where strong political identities can spark among voters (Fitri et al., 2021). During the election, two political labels emerged–"*cebong*" (or tadpole) and "*kampret*" ("shucks")–describing opposing supporters. *Kampret* groups accused Joko Widodo as the incumbent, as an active member of communist groups, while *cebong*, the opposing group, claimed that Prabowo, the rival, would lead Indonesia back to the totalitarian regime. Similarly, conspiracy theories have been observed in other countries, such as QAnon conspiracy theories in the US (Alter, 2020) and Macron-media conspiracy theories in France (Dolan, 2022).

Numerous empirical studies and political events have demonstrated the association between group identities and conspiracy theories. As an attempt to reinforce in-group identities, conspiracy theories can become a promising option, yet not the only available strategy. When conspiracy theories are repeated, they can serve as a supporting mindset to legitimate social comparison and satisfy in-group members.

1.3.3 Clinical psychology: Conspiracy theories as irrational beliefs

Cognitive and social psychology have brought some significant evidence of how motivation influences the likelihood to endorse conspiracy theories. Clinical psychology offers additional insights to elaborate conspiracy theories as a clinical symptom. Studies have shown that conspiracy beliefs correlated with loneliness (Bierwiaczonek et al., 2024), low self-esteem (Cichocka et al., 2016) and paranoid belief (Alsuhibani et al., 2022). Some features of conspiracy beliefs are aligned with irrational beliefs, a perspective that is incongruent with established social and rational norms (Žeželj & Lazarević, 2019). Those who endorse conspiracy mindsets might argue that external threats exist and could be harmful to them, a proposition that might be relevant to the symptom of delusion. However, delusion

and conspiracy beliefs have distinct characteristics. People diagnosed with delusions argue that "*there is something out there that may harm me*", sensing the threat for themselves, yet conspiracists might perceive that "*there is something out there that may harm us*", perceiving the threat for in-groups (Alsuhibani et al., 2022). Delusion and conspiracy beliefs share similar ideas, but the perceived consequences can be different.

Many studies have investigated the correlation between conspiracy beliefs and various clinical variables, such as stress and anxiety. A study by Swami et al. (2016) showed significant correlations between conspiracy beliefs and stressful situations that stimulated anxiety. Specifically, stress due to pressuring life events significantly predicts the likelihood to endorse conspiracy theories. According to the core affect theory, distress and anxiety can be classified as unpleasant emotions, stimulating individuals to avoid the emotional object (stressor) (Russell, 2003). According to dual cognition system theories, involving (unpleasant) emotions in reasoning processes will restrict effortful thinking (system 2) and lead individuals to utilise fast, frugal, and effortless thinking to generate decisions (Kahneman, 2012; Tversky & Kahneman, 1973).

Social exclusion is another variable that has been associated with conspiratorial thinking (Graeupner & Coman, 2017; Schnepf et al., 2021). Social exclusion occurs when social interactions are restricted and negatively affect psychological well-being (Hutchison et al., 2007; Syrjämäki & Hietanen, 2019). This condition may cause individuals experiencing loneliness, an unwelcome feeling of lack or less companionship (Heinrich & Gullone, 2006; Lim et al., 2020; Reichmann, 1959). Social exclusion and loneliness may arise from specific conditions or even without any clear precipitating situations. For example, policies to enforce mass quarantine and social restrictions during the Covid-19 pandemic can be contributing

factors that may increase social exclusion, leading to depression, stress, and anxiety due to the absence of significant others (e.g., families and peers). Feeling of abandonment and perception of unfair realities can make individuals more susceptible to conspiracy theories. Graeupner and Coman (2017) conducted an experimental study categorising participants into three conditions: Social inclusion (selected for collaborative tasks by other participants), social exclusion (not selected for collaborative tasks), and the control condition (no instructions for collaboration). The experiment showed that social inclusion groups had higher intention to believe in conspiracy theories with intention to search for a meaning found as a significant mediator.

Studies concerning paranoid beliefs support the evidence that conspiracy beliefs are, in part, irrational beliefs. Paranoid beliefs or paranoia are the expectation that a perceived threat will cause harm despite no valid evidence described (Raihani & Bell, 2019; Statham et al., 2019). A survey study conducted by (Grzesiak-Feldman & Ejsmont, 2008) has shown significant correlations between conspiracy thinking and paranoia. The study measures conspiracy thinking among several ethnicities: Jews, Arabs, Germans, and Russians within a Polish sample where each ethnicity might share a different perception and some of them share a negative image of Polish people. This finding showed that conspiracy beliefs against a few ethnicities are positively correlated with paranoid beliefs. Although conspiracy beliefs share similarities with paranoia, these two variables are distinct. This argument is supported by Alsuhibani et al. (2022) study, showing both variables consist of suspiciousness; however, conspiracy beliefs are more closely related to political attitudes, for example a symptom of low trust to Government, while paranoia is more related with clinical conditions, such as issues self-control.

Conspiracy beliefs are also linked with personality–a key concept in clinical psychology. Personality reflects the general disposition of structured behavioural patterns, involving thoughts, feelings and behaviours (Loehlin et al., 1998; McCrae & Costa, 1987). A study assessing the correlation between personality dimensions and the tendency to believe in conspiracy theories was conducted by Cichocka et al. (2016), aiming to assess the correlation between narcissistic personality, self-esteem, and conspiracy belief. Literature related to narcissism has shown that individuals with this type of personality tend to believe that they are unique and special (Reynolds & Lejuez, 2011), showing that social evaluations are crucial (Horvath & Morf, 2010). Relying on self-report scales, Cichocka's study found that narcissistic personality can be a significant predictor for conspiracy beliefs when it is associated with low self-esteem.

Studies investigating the relationship between conspiracy beliefs and clinical variables have shown significant correlations between variables. However, there is no strong evidence suggesting that those who believe in conspiracy theories are mentally ill. Research in clinical psychology provides empirical evidence, where in some conditions, characterised by stress, anxiety and uncertainty, individuals can be more vulnerable to conspiracy theories.

1.4 Three perspectives of conspiracy beliefs: Content-specific, general, and conspiracy mentality

Studies in the field of conspiracy beliefs offer three perspectives to assess this attitude: Content-specific conspiracy, general conspiracy, and conspiracy mentality. Content-specific conspiracy focuses on specific events or objects that are associated with conspiracy theories, for example HIV/AIDS, area 51, flat earth, vaccine, and climate change. This perspective can emerge due to social interactions discussing social events in specific areas. For example,

issues regarding political conspiracy in the US are distinct from Asian countries due to multiple factors. Psychological theories have shown that endorsing specific conspiracy theories does not indicate that individuals also believe another.

Not only specific conspiracy theories, research in conspiracy theories have provided evidence where some groups can rely on conspiracy theories, even though those are contradictory (Brotherton et al., 2013b; Imhoff, Bertlich, et al., 2022a). A study supporting this proposition came from (Wood et al., 2012), which examines the association between various contradictory conspiracy theories. The findings showed that individuals who endorse the propositions of: (1) Princess Diana faked her own death, also believe that (2) MI6 is the main actor who assassinated Princess Diana. These two arguments are inherently contradictory–the first argument argues that Princess Diana is still alive, while the other offers the argument that Princess Diana had died. Evidence of this association has led scholars to conceptualise general conspiracy belief as a variable. Those who endorse general conspiracy beliefs do not only accept conspiracy theories as valid propositions but can generate another view by linking existing conspiracy theories.

The general likelihood to believe in various conspiracy theories can be an indication that some individuals possess conspiracy mentalities. This variable reflects the susceptibility to believe in conspiracy propositions (Imhoff, Bertlich, et al., 2022b; Imhoff, Zimmer, et al., 2022; Stojanov & Halberstadt, 2019). The study on conspiracy mentality originated from the idea that studies on conspiracy should not only address the degree of conspiracy attitudes–high and low. The mindset that precedes one's action to rely on conspiracy theories is also essential to be investigated. This mindset, influenced by multiple psychological factors will determine the vulnerability of people in believing conspiracy theories. Stojanov &

Halberstadt (2019) have identified scepticism–rational and irrational scepticisms–as the core element within conspiracy mentalities.

In the context of vaccine hesitancy, general conspiracy beliefs, conspiracy mentality and anti-vaccine conspiracy theories have been studied by many scholars as potential predictors. Studies have shown significant correlations between different types of conspiracy beliefs and vaccine hesitancy, even though the coefficients are different (Adinugroho et al., 2024; Jolley & Douglas, 2014; Milošević Đorđević et al., 2021; K. Winter et al., 2022). Three types of conspiracy beliefs offer complete approaches for scholars to study why and how individuals endorse conspiracy theories.

1.5 Measures of conspiracy beliefs

There are two perspectives to explore conspiracy theories as a cognitive reflection: Generalist and particularist (Dentith, 2023). Generalist offers a view that individuals adopt various conspiracy theories as a general worldview without classifying it to more specific approaches, whereas particularist views conspiracy theories on a case-by-case basis where each case possesses its own unique characteristics. This view serves as a foundation for behavioural scholars in developing measurements scales measuring conspiracy beliefs. Currently, attitudinal scales are the primary measures of conspiracy beliefs, even though this instrument has some limitations, such as social desirability bias (Gordon, 1987; Krumpal, 2013). This kind of bias may occur in survey research when participants exaggerate their responses, making them seem worse or minimise the issue to be seen favourable. To mitigate this limitation, several strategies have been introduced, such as disguising the true aim of the survey at the introduction page (Brenner & DeLamater, 2016).

The earliest scale measuring conspiracy beliefs focuses on several conspiracy events. The initial measures of conspiracy beliefs were constructed by Goertzel (1994) and Abalakina-Paap et al. (1999) for the US population. Some items used to measure this belief are "*Anita Hill was part of an organised conspiracy against Judge Clarence Thomas*" and "*The FBI was involved in the assassination of Martin Luther King*". These studies aimed to assess the levels of conspiracy beliefs and identify how conspiracy beliefs correlated with other variables. They served as a milestone for scholars to examine other measurement scales with more robust psychometric properties and apply psychological theories, moving beyond presenting conspiracy statements for participants to rate numerically.

Relying on the pre-existing instruments of conspiracy beliefs, Brotherton et al. (2013b) developed the scale to measure general conspiracy beliefs, namely Generic Conspiracy Belief Scale (GCB-S). This instrument was developed with psychometric evaluation of 75 novel items. After several investigations, they finally decided to utilise 15 final items, representing five dimensions of generic conspiracy beliefs: Government malfeasance, extra-terrestrial cover-up, malevolent global, personal well-being, and information control. Some examplse of the items are: "*Evidence of alien contact is being concealed from the public*" and "*new and technology which would harm current industry is being suppressed*". Exploratory factor analysis (EFA) was applied to assess the validity of GCB-S items. Findings from this analysis found: Bartlett's test of sphericity, $\chi^2(1711) = 23820.85$, $p < .001$ and the Kaiser-Meyer-Olkin to measure sampling adequacy, KMO = .97, indicating that every item has adequate common variance. Related to criterion validity, GCB-S was significantly correlated ($r = .82$; $p < .001$) with Belief in Conspiracy Theories Inventory (BCTI) developed by Swami et al. (2010).

Different from Brotherton's scale that identifies conspiracy theories as a likelihood to believe in secret agreements behind some events, Wood (2017) proposed alternative approaches to measure conspiracy beliefs that emphasise suspiciousness as the central component. When individuals experience ambiguity, their suspiciousness can lead them to adopt conspiracy theories to resolve uncertainty. Suspicious individuals could generate counter arguments about specific topics even though the argument is not entirely congruent. Based on this proposition, Wood developed the Flexible Inventory of Conspiracy Suspicions (FICS) to measure conspiracy suspicions. FICS was constructed to assess suspicions of conspiracy theories with three-level models: General conspiracist ideation, vague conspiracy suspicion, and specific conspiracy belief. This instrument consisted of a series of statements rated on Likert scales from 1 (strongly disagree) to 5 (strongly agree). In each statement, the blank space was provided for participants to fill with any topic they wish. For example, an item in the scale might be: "*The real truth about ____ is being kept from the public*", where the blank space encourages participants to apply for free association.

The concept of suspiciousness and general conspiracy beliefs inspired Bruder et al. (2013) and Stojanov & Halberstadt (2019) to develop scales measuring conspiracy mentality–the general propensity to engage in conspiracist ideation. Bruder et al. (2013) developed an instrument to assess the general tendency to believe in conspiracy theories across cultures (e.g., "*I think that government agencies closely monitor all citizens*"). This measure consisted of five statements with 11-point Likert scale from 0 (0% - certainly not) to 10 (100% - certain). All items focus on assessing conspiracy mindsets by stimulating participants to provide their responses about the role of world governments and secret organisations. The scale mentions several institutions, such as government agencies, politicians, and secret organisations as the subjects to provide a clear view of conspiracy ideation. The scale has

been used in many studies concerning specific issues on vaccines (K. Winter et al., 2022) and political orientations (Imhoff, Zimmer, et al., 2022).

Unlike Bruder's, Stojanov and Halberstadt (2019) extended the scale by considering scepticism as the underlying mechanism of conspiracy mentality. Scepticism is a feeling of doubt in the face of uncertain information (Foley, 1990; Van Prooijen, 2019). Scepticism differentiates between rational suspicion (i.e., critical thinking) and irrational suspicion (i.e., conspiracy beliefs). Their scale, which is mostly used in political contexts, assesses two dimensions using 15 items rated on a 7-point Likert scale from 1 (very unlikely) to 7 (very likely). Examples of the items in the scale are: "*Powerful entities are controlling matters behind the scenes*" and "*The public is misled in order to hide great evil*".

General conspiracy beliefs are strongly associated with content-specific conspiracy beliefs (Brotherton et al., 2013b; Bruder et al., 2013; Imhoff, Bertlich, et al., 2022b). However, in some studies, scholars need to measure specific conspiracy theories to address specific hypotheses. In such cases, attitudinal scales can be constructed by relying on the key framework of conspiracy theories: Secret agreements and malicious actors. Using these conceptual frameworks, various social events can be interpreted as conspiracy theories, such as communism in Indonesia (Temby, 2019); Jews conspiracy in Malaysia (Swami, 2012); HIV/AIDS conspiracy among African American communities (Simmons & Parsons, 2005); anti-vaccine conspiracy theories (Jolley & Douglas, 2014) and the recent emergence of QAnon in the US (Moskalenko & McCauley, 2021).

Various measures of conspiracy beliefs offer a complete perspective for measuring the degree of conspiracy beliefs and specific motives underlying them. These scales have served as the

academic foundation for many scholars worldwide to develop more contextual-based instruments. Many conspiracy theories remain unaddressed by these scales, and those beliefs may be associated with various psychological outcomes.

1.6 Strategies to generate resistance to conspiracy theories

Belief in conspiracy theories is a significant predictor for various behavioural outcomes with profound societal impacts. Some studies have shown conspiracy theories were associated with low political engagement (Ardèvol-Abreu et al., 2020); resistance to prevent climate change (Douglas & Sutton, 2015); lower adherence to health & safety behaviours (Allington et al., 2021) and reducing vaccine intentions (Jolley & Douglas, 2014). Moreover, a few studies have explored models in describing how general conspiracy beliefs and specific conspiracy beliefs predict human behaviours. For example, some models suggest that mistrust in science and medical institutions mediates the correlation between anti-vaccine conspiracy beliefs and vaccine intentions (Milošević Đorđević et al., 2021). Beyond public health issues, endorsing conspiracy theories–such as those concerning climate change–is associated with scientific rejection, particularly in the issue of climate change and global warming evidence (Rutjens & Većkalov, 2022).

Behavioural sciences have identified several intervention strategies to foster resistance of conspiracy theories and reduce the negative impact. To assess the efficacy of potential interventions in reducing conspiracy beliefs, O'Mahony et al., (2023) conducted systematic reviews comparing the effect size from previous existing studies. The protocol was written based on PRISMA-P 2015 guidelines, applying three electronic databases: PubMed, PsychINFO and Scopus. Out of 2168 articles, 44 full-texts were assessed for eligibility and 13 final studies were included in the qualitative analysis. The interventions identified in this

study include prevention regulatory focus, rationality priming, ridiculing belief, rational counterargument, inoculation message, exposing anti-conspiracy argument, and narrative persuasion. Those interventions could be classified into two dimensions, debunking and pre-bunking. Each strategy yielded different effect sizes (measured with Cohen's d). The largest effect size can be traced from the study applying logic-based inoculation (d = .90) and fact-based inoculation (d = 1.31). Inoculation is a pre-bunking strategy, stimulating a sense of threat, with weakened counter arguments (Banas & Miller, 2013). In contrast, some interventions with medium effect sizes can be categorised as debunking, such as exposing anti-conspiracy/ conspiracy arguments (Jolley & Douglas, 2017) and priming resistance to persuasion (Bonetto et al., 2018).

Interventions to reduce conspiracy beliefs have shown promising results, however, they face several limitations. Many of these can only be effectively applied during the situation where confounding variables, such as educational background and objective knowledge can be totally controlled by the experimenters. Realistically, conspiracy theories can occur outside classroom settings, sometimes with uncontrollable confounding variables, from intergroup relations up to economic and political propaganda (Hornsey et al., 2023). For example, interventions to foster resistance to conspiracy theories with pseudoscience classrooms (Dyer & Hall, 2019) or by eliciting analytical thinking with specific tasks (Swami et al., 2014) might be effective in laboratory conditions, but they are less applicable during crises. Thus, more empirical studies are needed to identify potential interventions that can be applied across contexts and real-world scenarios.

1.7 Conspiracy beliefs and vaccine hesitancy

Studies have shown that conspiracy mentality (K. Winter et al., 2022) and anti-vaccine conspiracy beliefs (Jolley & Douglas, 2014) are associated with vaccine hesitancy. This

significant correlation was found not only in specific countries, but in various countries across Europe and the UK (Jolley & Douglas, 2014; Milošević Đorđević et al., 2021; Tomljenovic et al., 2020). Increases in conspiracy beliefs are associated with greater levels of vaccine hesitancy and vaccine refusal, evaluating vaccines as the harmful medical instrument. Following sections will explore the definition of vaccine hesitancy, providing empirical arguments on why conspiracy beliefs are associated with vaccine intentions and why vaccines become the object of conspiracy theories.

1.7.1 What is vaccine hesitancy?

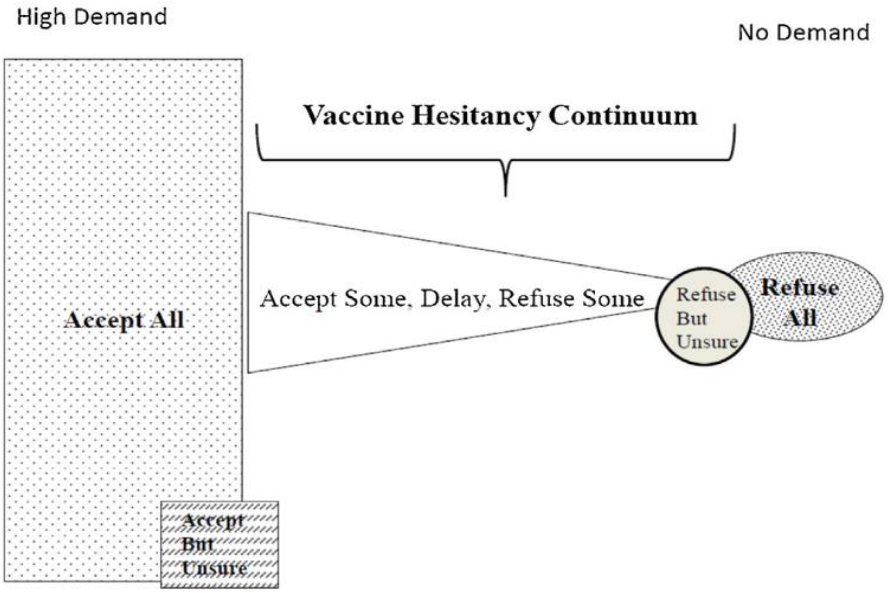
Although vaccines are widely recognised by scientists and healthcare professionals as effective instruments preventing the spread of infectious diseases, such as *pox*, *rubella*, *mumps*, and *polio* (Center for Disease Control, 2022), some individuals remain hesitant and even refuse vaccinations. Vaccine hesitancy is a complex problem involving context-specific issues varying regions and types of vaccines. Multiple factors contribute to this attitude, such as misinformation, mistrust, low perceived risk towards the disease, and little knowledge about the vaccine. Given its complexity, the World Health Organization (WHO) considered vaccine hesitancy as one of the top ten global public health challenges in 2019 (World Health Organization, 2019).

To address the global challenge of vaccine hesitancy, the WHO initiated a specialist working group–the SAGE working group on vaccine hesitancy. This group aims to define vaccine hesitancy, assess several factors influencing individuals and communities to delay vaccinations, and examine potential interventions to stimulate vaccine acceptance. According to the SAGE, vaccine hesitancy is an attitude to delay vaccinations contributed by internal and external factors (MacDonald, 2015). Internal factors that may contribute to shaping this

attitude are: Low-risk perceptions of the disease (Caserotti et al., 2021); fear of needles (McLenon & Rogers, 2019) and specific medical conditions or comorbidities (Savoia et al., 2021). Whereas, external factors can be contributed by misinformation on vaccine safety (van Stekelenburg et al., 2020); conspiracy theories (Jolley & Douglas, 2014; Milošević Đorđević et al., 2021) and low knowledge on vaccines (Di Martino et al., 2020; Dror et al., 2020). Figure 6 describes the spectrum of vaccine intentions, with vaccine hesitancy positioned between vaccine acceptance (far left) and vaccine refusal (far right).

Figure 1. 2

The spectrum of vaccine hesitancy developed by the SAGE Working Group Model (MacDonald, 2015)

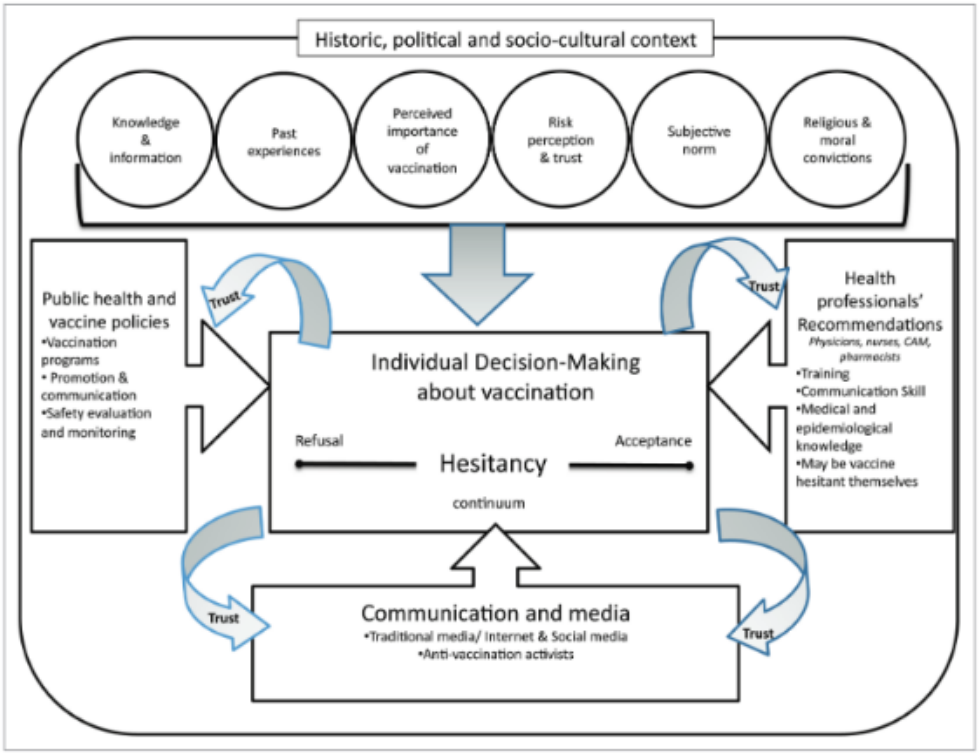


An integrative theoretical model is needed to scaffold between factors influencing vaccine hesitancy and decision making. Dubé et al. (2013) proposed a model that addresses four elements influencing individuals to evaluate vaccine efficacy (see Figure 7) consisted of: Psychological-public health factors, vaccine policies, healthcare professionals' recommendations and communication strategies promoting vaccine safety. These elements

outline the importance of individual differences, community factors and national levels as the interacting factors influencing trust in vaccines. Throughout the model, public engagement and communication strategies related to vaccine safety can be improved to encourage vaccine uptake. The model also argues that vaccine hesitancy is a public health issue involving various scholars, from public health, psychology, and communication.

Figure 1. 3

Conceptual model of vaccine hesitancy (Dubé et al., 2013)



In conclusion, vaccine hesitancy is a major issue that requires multi-disciplinary approaches. Addressing this issue will involve responsibilities from multiple stakeholders, from the government, healthcare professionals, scholars, and communities to promote vaccine safety. Beyond these, an infrastructure to facilitate vaccine-related complaints is necessary to build stranger trust on vaccines. Several actions can be called for this, including developing a

chatbot where individuals can ask anything related to vaccines or establishing an information desk in hospitals.

1.7.2 Vaccines and conspiracy theories

Vaccine development is a long and complex process that extends well beyond the laboratory. The procedure involves required specialised knowledge in medicine, vaccinology, chemistry, and biotechnology–fields that are inaccessible to laypersons. Beyond laboratory settings, vaccines also require political approval from the senate and the government. Political approval will involve dialogues among politicians, scientists, and pharmaceutical industries discussing the process of vaccine developments up to the side effect of the vaccine. Various political perceptions and ideologies may contribute to vaccine evaluation, leading some individuals and groups to perceive vaccines as a harmful medical treatment. As a consequence, misinformation on vaccine safety can mix with vaccine conspiracy theories, stimulating individuals to be more sceptical about the vaccine and use these to justify their attitudes (Jolley & Douglas, 2014; Milošević Đorđević et al., 2021).

Anti-vaxxers are groups that criticise vaccines and offer irrational movements to boycott vaccines. They often claim, for instance, vaccines contain microchips to control human population or the predisposition that vaccines cause autism. Beyond these, they also view that corporations and political elites will obtain profits from vaccine developments (Burgess & Elms, 2021; Roose, 2021). Anti-vax shares their perspectives throughout the internet, such as open-access web pages where everyone can view this idea and join them in a movement against authorities. Historically, the origin of this movement can be traced back to 1796 when the English doctor, Edward Jenner introduced the first smallpox vaccine (Gallegos et al., 2023). Although the vaccine dramatically reduced smallpox rates, several politicians and

religious groups decided to join the movement to challenge the scientific credibility of the vaccine. Various studies have addressed potential factors influencing individuals to join anti-vaccine movements, such as lack of trust in government (May, 2020) and the intention to reduce consumption (Chaney & Lee, 2022).

During the COVID-19 pandemic, anti-vax movements re-emerged to challenge the efficacy of COVID-19 vaccines, perceiving that this vaccine may cause severe injuries and even death. In the United States, some rallies were organised to protest mandatory vaccination policies, arguing that COVID-19 vaccines should remain optional rather than compulsory (Bergengruen, 2022). Similarly, in the UK, anti-vaccine protests occurred in London to oppose COVID passport policies–a required document certifying full vaccination to travel abroad and across the UK (Waterson & editor, 2021). Anti-vax offers irrational arguments about vaccines, ranging from adverse medical consequences up to specific missions from vaccine developers, for example Bill Gates included a special chip in the vaccine. Although anti-vaxxers represent a small segment of population, members of this group are highly motivated to mobilise, and their actions can invite mass social movements with potential harmful consequences. For example, in North Wales, UK, anti-vaxxers vandalised vaccination centres, causing damage estimated at £11,000 (BBC, 2022).

Multiple factors influence anti-vaxxers to engage in vandalism, and one of those is because their perspectives are largely dismissed by the government. A literature review conducted by Boodoosingh et al., (2020) found that the proposition of anti-vaccine is often considered as a national distraction rather than rational arguments from specific groups. During the COVID-19 pandemic, political leaders from several countries, including the UK (McGuinness, 2022); the US (Mason et al., 2021) and France (Henley, 2022) continued to view these perspectives

as a disturbance. The rejection of this view could foster out-group derogation, a situation where political leaders are perceived as a threat by anti-vaccine groups (Johnson et al., 2012). Thus, involving this group in a dialogue could be the alternative to shift their views. Brand and Stafford (2022) supported this view by engaging participants in their study in a dialogue with a chatbot. Results indicated that high engagement with the chatbot was associated with lower vaccine hesitancy.

Various articles suggest several reasons why vaccines become the object of conspiracy theories. The first preposition is vaccines mostly invented to overcome public health crises. In this situation unpleasant emotions can dominate the decision-making process, making individuals more susceptible to misinformation, including using conspiracy theories to evaluate vaccination programs. A second proposition, vaccine developments involve political processes between government institutions and private sectors. These processes are often associated with scandals and hidden agreement–key elements of conspiracy theories (Munira & Fritzen, 2007; Park et al., 2020).

1.8 Critical perspectives and why is this PhD important?

Numerous studies have provided evidence where conspiracy beliefs can foster critical thinking, although with a biased lens. However, in vaccination issues, conspiracy theories were more associated with negative outcomes. Although the decision to avoid vaccinations are due to multiple factors, many studies have demonstrated the evidence that conspiracy beliefs significantly predict vaccine hesitancy, supported with cross-sectional data (Jolley & Douglas, 2014; Milošević Đorđević et al., 2021) and longitudinal data (Coelho et al., 2022a; van Prooijen & Böhm, 2023).

Psychological theories offer multiple perspectives in exploring conspiracy theories from various perspectives. Also, many studies have started to examine conspiracy theories using these approaches. However, most of those studies applied correlational design to establish empirical claims where causal inferences cannot be established. In this thesis, we offer multiple methods to examine the nature of conspiracy beliefs, focusing on vaccine-related conspiracy beliefs. During our literature review, we identified potential interventions that can be applicable to foster resistance to conspiracy theories. Yet, replication studies to re-examine the effect on different populations remain limited. To address these two research gaps, we conducted four individual projects from January 2022 to December 2024:

1. Study 1 (2022) explored the association between institutional trust, anti-vaccine conspiracy beliefs and vaccine attitudes. Specifically, this was an experimental study testing the interaction effect between trust in vaccine providers and anti-vaccine conspiracy beliefs in influencing vaccine attitudes. I expected significant interaction between vaccine conspiracy theories and institutional trust in affecting vaccine hesitancy.

2. Due to non-significant results in study 1, my study 2 (2023-2024) re-tested confirmation bias hypothesis using the data from TISP Many Labs Project, a global survey project involving 68 countries with more than 70.000 participants. We used the data from Indonesia and Malaysia due to the availability of the study variables, general conspiracy beliefs, anti-vaccine conspiracy beliefs and vaccine attitudes. In this study, I expected significant interaction between trust in scientists and vaccine conspiracy theories in predicting vaccine hesitancy.

3. After establishing significant correlations between vaccine conspiracy theories and vaccine hesitancy in the previous studies, study 3 (2022-2023) examined the correlation between conspiracy mentality and vaccine intentions with longitudinal panel data. We analysed data from COVID-19 Psychological Research Consortium Study (C19PRC) project initiated by University of Sheffield, Ulster University, University of College London, University of Liverpool and Royal Holloway University of London in four countries in the UK: England, Wales, Scotland and Northern Ireland. In this study, I hypothesised different social events measured in three time points moderate the strength of the correlation between conspiracy mentality and vaccine intentions.

4. Different from three previous studies which established correlation between study variables, study 4 (2024) attempted to replicate Banas et al. (2023) experiments on inoculation messages and vaccine conspiracy attitudes. Inoculation is a communication strategy involving weakened counterargument to generate resistance to upcoming false information, including vaccine conspiracy theories. This study was conducted to: (1) Re-evaluating the effect of previous inoculation treatment and (2) providing more robust evidence of the effect of inoculation in influencing resistance to vaccine conspiracy theories.

Chapter 2

Anti-vaccine Conspiracy Theories: Genuine Response or Expressive Responding?

This first study aimed to assess the true characteristics of vaccine conspiracy theories as content-specific conspiracy beliefs. Many studies have shown significant correlation between vaccine conspiracy theories and vaccine hesitancy, but the evidence exploring the nature of vaccine conspiracy theories remains limited.

Contributions: I designed the study, which approved by Tom Stafford as my primary supervisor. In conducting the experiment, I used Qualtrics integrated with Prolific to recruit participants. After the data collection, I analysed the data using R and wrote the Chapter. Tom Stafford provided feedback on the draft.

Abstract

Many reasons drive individuals to become hesitant to vaccines or even decline the vaccination. One factor may be “anti-vax” conspiracies. We ask if different trust in vaccine providers affects the degree of vaccine conspiracy which may lead to different vaccine attitudes? Through experiments, we attempted to manipulate trust in vaccine providers by contrasting the NHS and UK Government (UK Gov). Findings from this study revealed a significant negative correlation between anti-vaccine conspiracy theories and vaccine attitudes. However, there was no difference between conditions in the levels of vaccine conspiracy and vaccine intentions, nor was there a difference in the strength of relationship between conspiracy beliefs and vaccine attitudes. Our hypotheses cannot be answered by the data due to manipulating vaccine providers that did not create a different condition of trust level.

Keywords: vaccines, conspiracy, attitudes, trust, expressive responding

2.1 Introduction

During the situation of COVID-19 pandemic, anti-vaccine conspiracy beliefs emerged not only to criticise vaccine efficacy, yet as an action to blame the government for unnecessary policies or covering up essential evidence. Those who refuse vaccinations, often called as anti-vaxxers, propagate conspiracy theories about the adverse effects of the vaccine (i.e., COVID-19 vaccines cause severe injury and deaths). However, some of them also express mistrust to the government due to incapability to manage the situation (e.g., the government is lying about vaccine effectiveness). In the UK, the action to oppose policies related to COVID-19 vaccines was evident from the movement to decline COVID passports (Petition, 2021) and acts of vandalism targeting vaccination centres (BBC, 2022). COVID passport policies required UK citizens to obtain full vaccinations to travel domestically and internationally. Many studies published during the COVID-19 pandemic have shown institutional trust (Chen et al., 2022) and conspiracy belief (Jennings et al., 2021; Yang et al., 2021) are significant predictors of vaccine hesitancy. In some cases, conspiracy theories might be overlapped with institutional mistrust. However, no studies have explicitly tested the similarities and distinctions between these two concepts in influencing vaccine uptake.

Mistrust of vaccine providers is also considered as a significant predictor of vaccine hesitancy (MacDonald, 2015). To express mistrust, people can utilise conspiracy theories to complement their feelings, where this condition can be called as expressive responding. Expressive responding is the likelihood to rely on feelings rather than their true beliefs to make judgement on social realities (Fahey, 2022; Schaffner & Luks, 2018). The empirical framework that can be applied in explaining expressive responding is motivated reasoning theory (Kunda, 1990). The theory describes the conception where people are motivated to process specific information to strengthen their existing beliefs, however, a conditionality can

be designed to drive them relying on analytic thinking to process information. Expressive responding as an empirical concept has been applied in psychology and political science to examine various political attitudes, such as partisanship. Examples of expressive responding study are shown by an experimental study conducted by Schaffner & Luks (2018). The study shows that Trump voters valued Trump's inauguration events as having more people than Obama's inauguration in 2009 and 2013 even though aerial photographs have shown more people attending Obama's.

The theory of motivated reasoning posits the framework that individuals are processing information based on two motivations: Accuracy goals and directional goals (Kunda, 1990). The accuracy goal can be defined as a drive to seek for the true validity of any upcoming information, while directional goals refer to the intention to reinforce their pre-existing beliefs when processing some information. In situations where no specific stimulus triggers the deliberative thinking process, individuals mostly rely on directional goals as a motivation to generate meanings where this strategy is effective to reduce cognitive burden and generate quick conclusions. Related to this, conspiracy theories can be one potential predisposition that can support people in utilising directional goals. Conspiracy theories offer appealing, and mostly short messages identifying potential causes of social events. For example, people can rely on conspiracy theories to express mistrust in vaccine providers (e.g., NHS or UK Government) without specifically articulating those. Thus, instead of believing in the true proposition of conspiracy theories, some people might use this belief to reinforce their existing beliefs and signal their mistrust.

There are multiple factors influencing people not trusting the government as the vaccine provider. During the COVID-19 pandemic, various social events occurred and influenced

public perception about vaccines. Some of those were related to adjustments in various social policies, such as lockdown and social limitations, yet some of them invited people to think conspiracy theories. One of the decisions from the UK Government that triggered public uncertainty was the inconsistency of them to allow Christmas celebration in December 2020. After there was some criticism from many scientists, finally Boris Johnson had to revise this policy and declared a lockdown. Another political scandal also revealed in 2021 where Boris Johnson as the Prime Minister found to be violating COVID-19 rules during Christmas 2020 in the PM's office at Downing Street No. 10 (Walker et al., 2020). Psychological burden generated by COVID-19 pandemic and distressing political events in the UK could be strong factors that influenced public trust during the COVID-19 pandemic and lead to many consequences, such as increasing vaccine hesitancy and reducing compliance to public health policies.

By relying on the framework of expressive responding and motivated reasoning, this study aims to test whether endorsing anti-vaccine conspiracy theories is believing in the true proposition or signalling institutional mistrust. To test this hypothesis, we manipulate the levels of institutional trust (i.e., trust in vaccine providers) between experimental and baseline groups. We apply vignettes as our stimulus, describing two different providers, National Health Services (NHS) and the UK government, responsible for COVID-19 vaccination program in the UK.

NHS is expected as an institution that can stimulate higher trust compared to the UK government. This empirical assumption is built from the result of British Social Attitudes survey where NHS is considered as a trustable institution with high satisfaction rate, greater than 50% for the last 3 years (Morris et al., 2023), while the UK government is expected as

an institution that stimulate low trust and conspiracy theories during the COVID-19 pandemic. As an outcome, we expect different correlational strength between anti-vaccine conspiracy beliefs and vaccine attitudes in the two groups, where the correlation is weaker in the NHS group (H1). This means, vaccine conspiracy theories are expressive responding, applied by participants to reinforce institutional mistrust, not believing in conspiracy proposition. However, if we found significant different in trust levels, but non-significant interaction, we propose the view that vaccine conspiracy theories reflect the true proposition of conspiracy theories (H2).

2.2 Method

2.2.1 Preregistered hypotheses

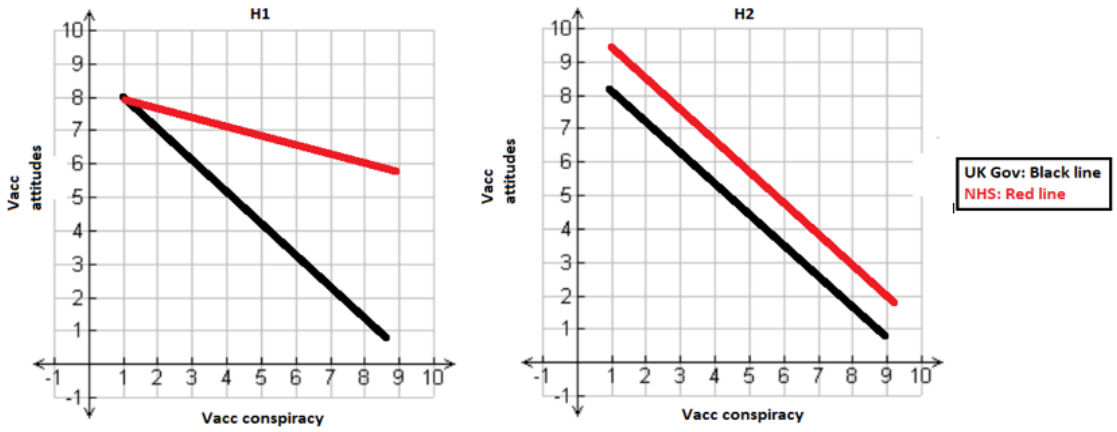
Our hypotheses were pre-registered prior to data collection following the open science practice, and they are publicly available at https://osf.io/ngtfz. Also, to support reproducibility and replicability, all research data and materials, including anonymous data, stimuli, and scales can be accessed in https://osf.io/dcmn7/files/osfstorage. This enables other scholars to re-analyse the data with different statistical models.

If the vignettes successfully stimulate different levels of trust, but no interaction effect is generated to influence vaccine attitudes, we argue that vaccine conspiracy reflects the commitment about the nature of reality (H2). In this case, manipulating trust will influence vaccine attitudes, yet it would not alter the strength of the correlation between conspiracy beliefs and vaccine attitudes. Consequently, the correlation will be equivalent for NHS and UK Gov. Illustrations of both hypotheses are described in Figure 1.

Figure 2. 1

Illustration for the first (H1) and the second (H2) hypotheses

Note. H1 describes the pattern of correlation when trust in vaccine providers influences the correlation between study variables, while H2 reflects no effect for trust.



2.2.2 Data quality measures

We ensured the quality of the data by filtering participants based on two criteria: (1) those categorised as "speedy" and (2) those who failed to answer the attention-check questions. The average completion time for the study was 229.55 seconds (3.82 minutes) calculated from all participants. We utilised the first quartile (Q1) from the total completion time as the cut off score and eliminated participants whose completion time fell below Q1. Following this phase, we also removed participants who failed two attention-check questions: "*People sometimes don't read questions carefully. Show you are paying attention by clicking "disagree" for this item*" for question 1 and "*I'm reading each question carefully and will answer "strongly agree" here to show this*" for question 2.

2.2.3 Participants

We recruited 500 participants in July 2022 through Prolific, with equal proportion for the two groups, NHS and UK Gov. This period represented the condition when social restriction

policies were lifted by the UK government, and vaccination centres operated delivering vaccine boosters. Participants who participated in this study were adults aged 18 years older. Participants were UK citizens, as we expected them to have prior experiences with receiving health services from the NHS. Additionally, participants were required to be fluent in English to complete our survey questions.

2.2.4 Research material

We applied vignettes describing different vaccine providers to generate different levels of institutional trust between the two groups. The vignettes consisted of short passages identifying either NHS or UK Gov as the responsible stakeholders assuring the safety and the efficacy of COVID-19 vaccines. Three essential elements were included within the vignettes: (1) vaccine side effect, (2) vaccine efficacy, and (3) vaccine safety. To assess the effect of the vignette in stimulating institutional trust, participants responded to a manipulation check question measuring trust of vaccine providers on a scale from 1 (extremely untrustworthy) to 7 (extremely trustworthy) after reading the vignette. The vignette is presented below:

The COVID-19 pandemic has had a lot of negative impacts on people in the UK. The most effective strategy to overcome this situation is through vaccination. However, some people are hesitant to get vaccinated for several reasons. For example, there are rumours that the COVID-19 vaccine is hazardous. Vaccination is fundamental to achieving herd-immunity and helping life return to normal. Therefore, [NHS/UK Gov] works very hard to guarantee the availability of the vaccine so that everyone can be vaccinated. Also, the [NHS/UK Gov] assures the safety of the vaccine and that it's safe for everyone, including the elderly, pregnant mothers, children and others who have comorbidities.

To measure the study variables, we applied two self-report scales: The Vaccine Conspiracy Beliefs Scale (VBS) (Shapiro et al., 2016) and the Attitude and Belief in Vaccination Scale (ABVS) (Di Martino et al., 2020), which was developed as a part of the *HPro-Immune* project. The VBS consists of seven items designed to assess the degree of anti-vaccine conspiracy beliefs. The validity of VBS has been examined by correlating the scale with other similar scales, such as Conspiracy Mentality Questionnaire (CMQ) with the correlation coefficient of $r = .44$, $p < .01$. The scale also demonstrated a high reliability with an internal consistency of $\alpha = .937$) and item total correlation ranging from .77 to .82. Examples of the VBS items include: "*Vaccine safety data is often fabricated*" and "*immunising children is harmful, and this fact is covered up*".

To measure vaccine attitudes, we applied ABVS consisting of positive and negative items. The scale has been previously utilised by Di Martino et al. (2020) to assess knowledge and attitude on vaccinations for healthcare workers in Italy. The scale consists of twelve Likert scale items without sub-dimensions. Examples of the items include: "*I believe vaccines are important for reducing or eliminating serious diseases*" and "*I think vaccinations do more harm than good*".

2.2.5 Procedure

This experiment was conducted using Qualtrics as the survey platform, integrated with Prolific to recruit participants. Data collection took place in August 2022, during a period when COVID-19 restrictions had been relaxed, and the mass vaccination program was ongoing. Participants who consented to participate in the study were randomised into two groups, where they received different conditions. Each group received the vignette describing different vaccine providers, NHS for the experimental group and UK Gov for the baseline

group. After viewing the vignette, they proceeded to the next page to complete the manipulation check questions and all the study scales. At the end of the session, participants were provided with a debriefing explaining the study's aim. Only participants who passed the attention check were eligible to receive payment in Prolific.

2.2.6 Statistical analysis

This study employed descriptive statistics and moderation analysis using linear regression. Descriptive statistics were applied to compare the means of our study variables and manipulation check questions between two sub-groups: the NHS and UK Gov groups. To test the hypotheses, linear regressions were used to identify the interaction effect between anti-vaccine conspiracy beliefs and institutional trust. All the statistical analyses were conducted in R with several packages, including *tidyverse* for data wrangling and *lm.beta* to compute regression analyses.

2.3 Result

2.3.1 Pre-processing stage

A total of 26 participants were categorised as "speedy" responders, and eight participants failed the attention check. Thus, 466 participants remained in this study. The mean age of participants was 40.53 (SD = 13.06) dominated by female participants (67.16%). Related to educational background, most participants had an undergraduate degree (34.12%), followed by A-level (25.53%), O-level (13.30%), postgraduate degree (12.66%), technical qualification (7.72%) and diploma (5.15%).

2.3.2 Manipulation check

We conducted a manipulation check by asking participants to rate their level of trust in vaccine providers after being exposed to the vignette. The mean trust ratings were calculated for both groups, and an independent sample t-test was used to identify differences in trust levels. The result indicated that the UK Gov was rated numerically higher in assuring COVID-19 vaccines (M = 5.74; SD = 1.10) than the NHS group (M = 5.64; SD = 1.22). However, this difference was not significant between the two groups ($t(464) = .86$, $p > .05$). This finding suggested that our vignettes could not generate different levels of trust between the two sub-groups.

2.3.3 Descriptive analysis

Descriptive statistics in Table 1 show differences in anti-vaccine conspiracy beliefs and vaccine attitudes between the two sub-groups. There were no significant differences in anti-vaccine conspiracy beliefs ($t(464) = -1.80$; $p > .05$), but significant differences resulted for vaccine attitudes ($t(464) = 2.52$; $p < .05$). To assess the effect of manipulating trust in vaccine providers with our vignettes, we applied Cohen's d and found small effect size ($d = .23$) for the vignette in influencing institutional trust.

Table 2. 1

Descriptive statistics of anti-vaccine conspiracy beliefs and vaccine attitudes

	Vaccine conspiracy beliefs	**Attitude and belief toward vaccinations**
NHS group		
(n = 235)	19.97 (9.65)	40.31 (6.56)
Mean (SD)	9	14
Min score	50	50
Max score		
UK Gov group		
(n = 231)	18.48 (8.09)	41.74 (5.61)
Mean (SD)	9	15
Min score	48	50
Max score		

2.3.4 Hypotheses testing

The vignettes failed to stimulate different levels of trust between NHS and UK Gov groups. Our model showed no significant interaction between institutional trust and anti-vaccine conspiracy beliefs ($\beta = .05$; $p > .05$). However, anti-vaccine conspiracy beliefs negatively predict vaccine attitudes ($\beta = -.56$; $p < .01$). Even though our analysis showed no significant interaction, they confirmed some previous analysis where anti-vaccine conspiracy beliefs and vaccine attitudes were correlated significantly.

Table 2. 2

Interaction analysis of trust in vaccine providers and anti-vaccine conspiracy beliefs

Variables	**B**	**SE**	**β**	***T***	**Sig**	**95% confidence interval**	
						Lower bound	**Upper bound**
(Constant)	52.27	.59		88.10	<.01	51.10	53.44
AVCS	-.56	.02	-8.27	-19.36	<.01	-.62	-.51
TVP	-1.11	.80	-.09	-1.38	.16	-2.69	0.46
AVCS*TVP	.02	.03	.05	.69	.49	-.04	.10

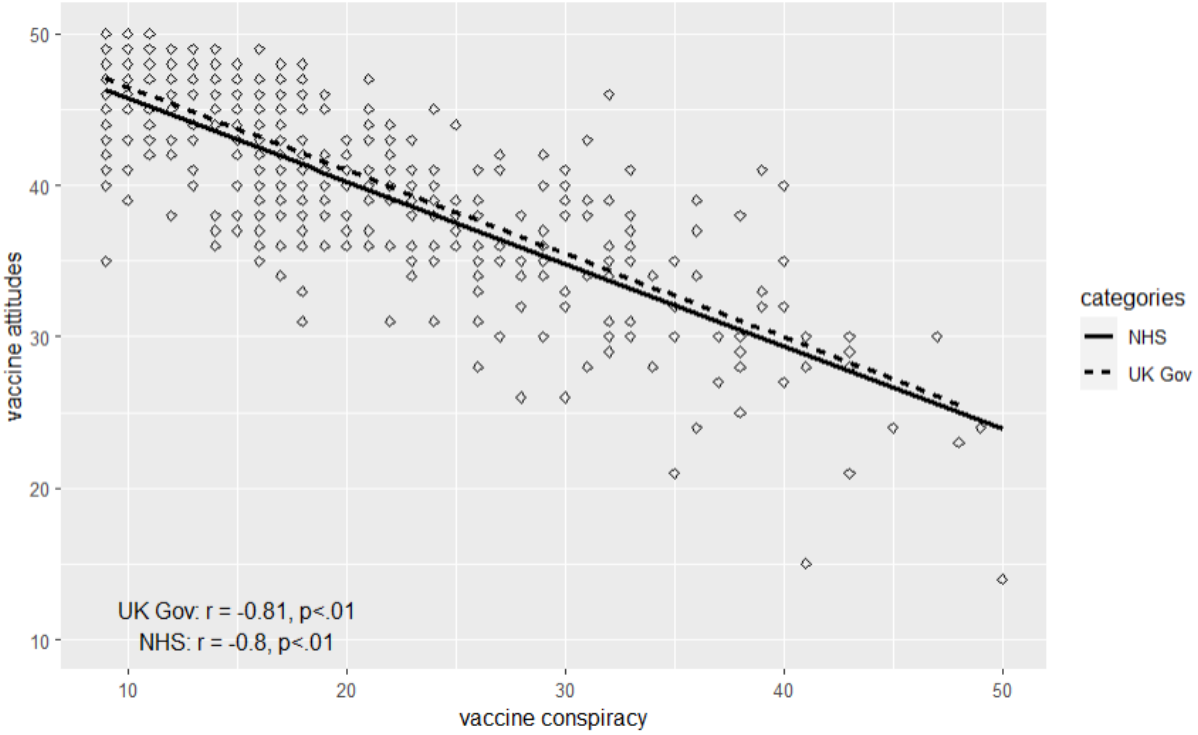
Note. R^2 = .65; F = 295,2; p < .05

AVCS = Anti-vaccine conspiracy beliefs, TVP = Trust in vaccine providers

Figure 2 illustrates strong negative correlation between study variables in NHS groups (r = .80; p < .01) and UK Gov groups (r = .82; p < .01), illustrating higher levels of conspiracy beliefs were associated with greater vaccine hesitancy.

Figure 2. 2

Interaction analysis between vaccine conspiracy and trust based on NHS and UK Gov as vaccine providers



2.3.5 Additional analysis: Contrasting high trust and low trust

We conducted a subsidiary analysis by testing the similar hypotheses, contrasting low trust and high trust in vaccine providers without considering the specific labels of NHS and UK Gov. We utilised the median score (4) or second quartile (Q2) as the cut off score. By relying on this, we consider participants with scores below and above the median. From this process, we obtained 30 participants categorised as the low trust group (M = 2.37; SD = .71) and 422 participants in the high trust group (M = 5.99; SD = .71). Our comparison test with t-test shows a significant difference between low and high trust groups ($t(464) = 24.14$; $p < .01$), despite the unequal sample sizes. Similar to the previous analysis, the model did not demonstrate an interaction effect, with vaccine conspiracy beliefs as the only significant predictor.

Table 2. 3

Interaction analysis of trust levels and anti-vaccine conspiracy beliefs

Variables	B	SE	β	*t*	Sig	95% confidence interval	
						Lower bound	Upper bound
(Constant)	50.12	2.64		18.93	<.01	44.92	55.33
AVCS	-.55	.07	-.80	-7.87	<.01	-.69	-.41
TC	.98	2.68	.04	.36	.71	-4.29	6.26
AVCS*TC	.03	.07	.05	.49	.62	-.10	.18

Note. R^2 = .67; F(3,227) = 159; p < .05

AVCS = Anti-vaccine conspiracy beliefs, TC = Trust category divided by low and high trust

2.4 Discussion

2.4.1 Pre-processing stage

The manipulation check revealed no significant differences between NHS and UK Gov groups. Contrary to our expectations, the NHS, which is generally perceived as a more trustworthy institution than the UK Gov, did not elicit a higher level of trust. A potential argument to explain this result is the decline of public satisfaction during the COVID-19 pandemic where the satisfaction levels in 2022 fell 7% from the previous year, 2021 (Morris et al., 2023).

2.4.2 Primary analysis

Although our hypotheses cannot be formally tested with the available data, we identify strong and significant correlations between anti-vaccine conspiracy beliefs and vaccine attitudes in both groups. These findings align with the previous study on the correlation between these variables (L. Chen et al., 2021; Islam et al., 2021; Jolley & Douglas, 2014; Milošević Đorđević et al., 2021). The correlation coefficient shows very strong correlation (r = -.81; p <

.05) between study variables due to data collection was conducted in early 2022 during COVID-19 pandemic. This data reflects that 65% of variance in vaccine intentions are contributed by vaccine conspiracy theories. COVID-19 pandemic can be one of the significant contributors encouraging people to rely on vaccine conspiracy theories in evaluating vaccine efficacy. The ecological rational theory supports this claim where in some conditions, for example emergency, people rely on ecological factors to generate decisions (Gigerenzer & Selten, 2001).

2.4.3 Additional analysis

The additional analysis also shows no interaction between anti-vaccine conspiracy beliefs and trust in vaccine providers. However, a significant correlation is observed between anti-vaccine conspiracy beliefs and vaccine attitudes.

2.5 Limitations

This study has several limitations related to the manipulation of independent variables and hypothesis testing. The primary limitation was related to the quality of the vignette, which failed to generate different levels of trust in vaccine providers. According to social attitude survey, NHS was expected to stimulate higher institutional trust than UK Government. However, during COVID-19 pandemic, NHS faced several challenges from significantly increased in patient load, staffing shortage up to ambulance hold times, stimulating mistrust to NHS. These conditions significantly affected the referral to treatment time (RTT), average patient's waiting time from referral until seen by medical staffs for the follow-up treatment (Shah et al., 2024), making NHS as an institution that obtain negative evaluation from the public. Thus, exposing participants with NHS and UK Gov as the vaccine providers did not

stimulate different levels of trust. Another limitation was the unequal sample size between high trust and low trust in the additional analysis. This imbalance can lead to statistical bias in comparing the strength of the correlation between anti-vaccine conspiracy beliefs and vaccine attitudes.

Chapter 3

Anti-vaccine conspiracy beliefs are a reflection of mistrust of scientist, but not of general conspiracy beliefs: Testing the confirmation bias hypotheses using Indonesian and Malaysian samples

The expressive responding hypotheses in study 1 (Chapter 2) cannot be tested due to non-significant effects of our manipulation. Thus, this chapter attempted to replicate study 1 hypotheses using data from the Trust in Science and Science-related Populism (TISP) study. In this chapter, I included two types of conspiracy beliefs, general conspiracy beliefs and vaccine conspiracy beliefs as predictors of vaccine intentions. Confirmation bias hypotheses were tested in this study.

Contributions: I designed the study, which approved by Tom Stafford and Richard Bentall as my primary supervisors. The data was collected by Bilendi & Respondi, an official partner of Harvard University, the primary initiator of the TISP project. I analysed Indonesian and Malaysian data for this study. I wrote the chapter. Tom Stafford and Richard Bentall provided feedback on the draft.

This Chapter has been presented at the Consequences of Conspiracy Theories Conference (CONSPIRACY_FX) at The University of Kent, Canterbury, UK (https://research.kent.ac.uk/conspiracy-fx/conspiracy_fx-conference-on-the-consequences-of-conspiracy-theoriess/)

Abstract

Many studies across various countries have shown the adverse impact of conspiracy beliefs on vaccine uptake, with mistrust as an important mediator of the effect. In this study, we propose a confirmation bias hypothesis, where endorsing conspiracy beliefs is expected as an action to reinforce previous existing beliefs, not believing the conspiracy proposition itself. To test this hypothesis, we measure trust in scientists as the moderator variable. We predict that, after categorising people into those with low and high trust in scientists, anti-vaccine conspiracy theories will adversely impact attitudes towards vaccines more in the former group. Relying on the data from TISP Many Labs survey collected from Indonesian and Malaysian samples, this study found that two dimensions of trust in scientists: Benevolence and openness, moderated the correlation between anti-vaccine conspiracy beliefs and vaccine attitudes, but not for the correlation between general conspiracy beliefs and vaccine attitudes. Openness significantly moderated the correlation in both countries, but the effect of benevolence was only present in the Malaysian sample.

Keywords: vaccine, general, conspiracy, trust, scientists

3.1 Introduction

Studies examining the association between conspiracy beliefs and vaccine intentions have found the similar results in the US (Romer & Jamieson, 2020), European countries (Jolley & Douglas, 2014; Milošević Đorđević et al., 2021; Seddig et al., 2022); New Zealand (T. Winter et al., 2022); Australia (Coelho et al., 2022b) and Asian countries (K. W. Lee et al., 2022; Wirawan et al., 2021), with conspiracy beliefs predicting vaccine hesitancy. Most anti-vaccine conspiracy arguments encourage the belief that vaccines may cause harmful effects to physical health. For example, some theories portray vaccines as medical instruments that cause injury and death or imply that there is a chip within the vaccine that can control human behaviour.

Some studies have identified mediator variables that affect whether conspiracy beliefs can lead to vaccine hesitancy, for example the perceived dangers of vaccines (Jolley & Douglas, 2014), mistrust in medical institutions and health care professionals, and vaccine knowledge (Milošević Đorđević et al., 2021). Studies have shown that endorsing anti-vaccine conspiracy beliefs will stimulate mistrust to medical institutions, make people less aware of objective knowledge of vaccines and amplify perceived dangers of the vaccine. Belief in anti-vaccine conspiracy theories may discourage people from exploring valid information regarding vaccines or counter arguments from experts (i.e., scientists or pharmaceutical companies).

Psychological studies have identified several factors that influence whether people believe and endorse conspiracy theories. Some implicate individual differences such as combination between low self-esteem and narcissistic personality (Cichocka et al., 2016) or low self-control (Rottweiler & Gill, 2022; van Prooijen & Acker, 2015). Others have emphasized the importance of external factors that stimulate distress and encourage people to be more

susceptible to them (Swami et al., 2016; van Prooijen & Douglas, 2017). During stressful situations, some people might not be able to apply analytical thinking due to high social pressures that stimulate unpleasant feelings (e.g., anger, anxiety, and frustration). A review conducted by van Prooijen and Douglas, (2017) found that some of conspiracy theories emerged from societal crisis events, such as Jewish conspiracy theories that arose during the economic and social crises of the Weimar Republic, and conspiracy theories about the assassination of J. F Kennedy that emerged during the Cold War. Societal crisis, events that can occur anytime and sometimes cannot be predicted, can also generate feelings of uncertainty, a psychological condition that may also encourage conspiracy beliefs (van Prooijen, 2016; van Prooijen & Jostmann, 2013).

Despite many studies investigating motivations to believe in conspiracy theories and the antecedent conditions of conspiracy beliefs, scholars remain divided about the essential conditions. Some studies argue that conspiracy theories are misleading information because the unavailability of correct information to explain puzzling events (De Coninck et al., 2021; Enders et al., 2023). Alternatively, the concept of conspiracy mentality or a general disposition towards conspiracy beliefs implies that some people are especially likely to use a conspiracy mindset to rationalise social realities (Brotherton et al., 2013b; Stojanov & Halberstadt, 2019). This study will examine the nature of conspiracy beliefs by applying the framework of confirmation bias (Nickerson, 1998) and motivated reasoning theories (Kunda, 1990) where in some conditions, people process information to strengthen their previous beliefs.

3.1.1 Political Situations, Values, Cultural Background and Trust in Indonesia and Malaysia

This study utilise data from Indonesia and Malaysia countries located in South-East Asia with similarities and differences in terms of history, economic conditions, and cultural backgrounds. The decision was made due to the availability of primary outcome variable, vaccine intentions, which only included in the two countries. Data from the World Bank shows that gross domestic product (GDP) per capita is higher for Malaysia and reached $28,384 compared to Indonesia's $12,410 in 2022 (World Bank Open Data, n.d). Studies have shown that Indonesia and Malaysia are embedded with collectivist cultural orientation where cordial relations between groups and in-group harmony are valued (Hofstede et al., 2010). Both countries are members of Association of South-East Asian Nation (ASEAN) community, a regional political and economic cooperation agreement between countries in South-East Asia, aiming to accelerate economic growth, social progress, and cultural development, promoting justice and stability and active collaboration, providing assistance to other countries in the same region, and maintaining close and beneficial cooperation with existing international and regional organisations (ASEAN, 2024).

The majority of citizens are Muslim in both Indonesia (85%) and Malaysia (63%) (Afifa, 2024; US Department of State, 2022). Both countries have democratic constitutions in which national elections are used to elect national leaders (Presidents for Indonesia, and Prime Ministers for Malaysia) and members of the parliament. However, in Indonesia, the President holds two positions as the head of the state and the head of government, whilst in Malaysia, the head of the state is his Majesty the King as the Paramount ruler, and the Prime Minister is the chief of government. Malaysia has a parliamentary system, while Indonesia does not.

Studies have shown that East Asian countries, including Indonesia and Malaysia, are countries where the citizens adopt authoritarian culture orientations, more so in the case of Malaysia (S. Kim & Baniamin, 2022; Ma & Yang, 2014). Authoritarian culture orientations are values that originated from the concept of authoritarian personality, a disposition towards unquestioning obedience and respect (Adorno et al., 1950; Altemeyer, 1998; Duckitt, 2015). Authoritarian cultures are not limited to political settings, but can occur anywhere, for instance in the relations between students and teachers in schools, the psychological distance between employees and supervisors in the workplace or in the conditions where social hierarchies are applied, separating males and females or children and parents. Some studies have been conducted to support this argument in Indonesia (Amemiya et al., 2023) and Malaysia (Hutchings, 2000). The key characteristics of authoritarian culture can be traced from several characteristics, such as deference to authority, unquestioning obedience, and reliance on authorities.

Authoritarian culture orientations may influence how people evaluate institutions and express their trust (Pernia, 2022). Studies concerning authoritarian culture orientation and institutional trust have been conducted in several contexts, such as politics (Zhai, 2019); organisational (Jiang et al., 2019) and educational settings (Parlar et al., 2022). People with authoritarian values tend to be prone to negative evaluations of others and have low levels of trust in others. Authoritarian values encourage people to obey authorities and restrict the autonomy and independence of group members to share their thoughts. Related to these findings, we propose:

> Hypothesis 1: The levels of trust in scientists will be lower in Malaysian compared to Indonesian participants because Malaysia has a higher level of authoritarian culture

orientations. This should be evident in the comparison of four elements of trust in scientists: integrity, benevolence, openness, and benevolence.

3.1.2 Confirmation bias: Between conspiracy theories and mistrust

Descriptive models of decision making have considered beliefs as the primary element that influences people to form satisfying decisions aside from maximising utilities or seeking profits (Tang et al., 2018). According to Usó-Doménech and Nescolarde-Selva (2016), beliefs can be seen as an integrated process in which one specific belief may exist due to the presence of other beliefs. Thus, people apply a set of beliefs to generate meaning towards social realities. For example, to decide the best candidate in an election, some people can rely on their political ideology (e.g., liberal or conservative) (Van Lange et al., 2012), or consider the perceived competence of the candidates (Castelli et al., 2009) or drawn on populist narratives (Araújo & Prior, 2021). Additionally, some people may accept misinformation if it is consistent or reinforces prior beliefs.

An example of confirmation bias can be seen from the act of expressive responding. Expressive responding is a condition when someone consciously applies misleading information to express and strengthen their previous existing beliefs (Berinsky, 2018; Fahey, 2022). Studies concerning expressive responding have been conducted mostly in the field of political science and voting behaviour. For example a study by Schaffner and Luks (2018) demonstrated evidence of expressive responding in how people responded to aerial photographs comparing the inauguration of Obama and Trump in the US. Most Trump voters who participated in this study choose the wrong photograph as having the greatest number of audiences, even though the reality was obviously the reverse. Moreover, Trump voters with higher education (i.e., at least college degree) were especially likely to choose the wrong

photo compared to low education voters. This evidence indicates that respond to aerial photographs is an expression of their allegiance to particular groups.

Distinct motivation in reasoning can also lead to the biased evaluation of evidence. This results from the conflict between two goals of information processing, (1) accuracy goals, an intention to seek for a valid explanation and (2) directional goals, the desire to process information to reinforce the existing beliefs (Kunda, 1990). When someone relies on motivation to seek accuracy, they are likely to use more complex information processing methods to avoid errors and hasty reasonings. However, complex information processing is not free from bias. Studies shows that dilution effect - the influence of non-relevant information in decision making–can emerge from complex information processing because when people apply this method, they will entertain more alternative hypotheses to arrive at particular conclusions (Tetlock & Boettger, 1989). On the contrary, directional goals require simpler information processing in terms of memory search and decision making. Applying directional goals can drive individuals to experience the illusion of objectivity, not realising that information processing is biased by only accessing relevant knowledge to form a conclusion (Pyszczynski & Greenberg, 1987).

The essence of motivated reasoning theories exposes the conception that bias can occur at any time without even can be noticed. The primary reason of confirmation bias is strengthening previous values and beliefs, not finding the information that is possible to counter those. A few of studies in this field have shown when people apply directional goals, they can experience bias when making self-evaluation of themselves (Sanitioso et al., 1990), others (Berscheid et al., 1976), and social events (Gilovich, 1983). To support these propositions, many studies apply experimental designs to manipulate directional goals among

groups. For example, a study conducted by (Kunda & Sanitioso, 1989) demonstrated that extraverted participants tend to view themselves as less extraversion when introversion is introduced as the personality that related to perceived academic success.

We presume that these biases can also occur when people use anti-vaccine conspiracy theories to make sense of their attitudes. Anti-vaccine movements reflecting anti-vaccine conspiracy theories developed during the COVID-19 pandemic in various countries, including the US (Mettler et al., 2022), Europe (Zsiros, 2022), and South-East Asian countries, including Indonesia (Intan, 2021) and Malaysia (Rahim, 2020). Also, vaccine conspiracy theories may predict vaccine hesitancy in Indonesia (Wirawan et al., 2021) and Malaysia (K. W. Lee et al., 2022), similar to the results from Western population (Jolley & Douglas, 2014; Milošević Đorđević et al., 2021). An example of proposition endorsed by those is that "scientists cover up the dangers of vaccination". They were encouraged by a small number of scientists who argued that COVID-19 vaccines were not completely tested and might be harmful (Stecklow & Macaskill, 2021). As the consequences, this argument also conveys multiple meanings, conspiracy theories and mistrust to scientists.

In our second hypothesis, we intend to test whether endorsing anti-vaccine conspiracy beliefs reflects confirmation bias of mistrust to scientists. We argue that the proposition of "scientists cover up the danger of the vaccines" is not fully reflecting conspiracy theories but can be the alternative expression of mistrust to scientists. Specifically, individuals utilise conspiracy propositions to express their negative views toward scientists, but not believing the true proposition of conspiracy theories. We apply four dimensions of trust in scientists (i.e., integrity, competence, benevolence, openness) as moderator variables and vaccine attitudes as the outcome variable to test our hypotheses:

Hypothesis 2a: An association between anti-vaccine conspiracy beliefs and vaccine attitudes will be found stronger in individuals who mistrust to scientists. Thus, the four dimensions of trust in scientists will moderate the association between conspiracy beliefs and vaccine attitudes.

Hypotheses 2b: Anti-vaccine conspiracy theories reflect the unmotivated understanding of reality, in which case there will be a direct association between anti-vaccine conspiracy beliefs and vaccine attitudes.

Different from anti-vaccine conspiracy beliefs as specific conspiracy theories, general conspiracy beliefs may convey different meanings. It has been consistently observed that someone who believes in one conspiracy theory is highly likely to believe in many others (Brotherton et al., 2013b). In one famous study, it was even found that people disposed to conspiracy theories may believe in several that are contradictory, for example that Princess Diana faked her own death and was killed by the British security services (Wood et al., 2012), although this may be accounted for by the common factor of distrusting official accounts of events. These findings have led researchers to argue that there is a general mindset associated with conspiracy beliefs, sometimes called a 'conspiracy mentality' which can be measured by attitudinal scales (Bruder et al., 2013). A study by Imhoff et al. (2022) compared the correlations between general conspiracy beliefs and various content-specific conspiracy theories in three studies, finding that these correlation were stable even though the content-specific conspiracy theories were different between studies. Based on these empirical assumptions, we argue the third hypotheses as:

Hypotheses 3: Those with general conspiracy beliefs will perceive that secret agreement lie behind the vaccine development, leading them to avoid vaccinations.

3.2 Method

3.2.1 Participants and data collection

Participants were recruited from the Trust in Science (TISP) Many Labs project, a global assessment initiative led by the team from Harvard University in collaboration with 239 researchers from 167 institutions across universities and research centres worldwide (Mede et al., 2024). The project aims to measure trust in scientists and science-related populism in global contexts with representative samples from 68 countries. The Indonesia and Malaysia teams included additional instruments on general conspiracy beliefs (Lantian et al., 2016), vaccine conspiracy beliefs (Jolley & Douglas, 2014) and vaccine attitudes (Di Martino et al., 2020).

Ethical clearance was granted by Harvard University (No: IRB22-1046) for the core instruments and by Sunan Kalijaga Islamic State University (No: B 292a/Un.02/L3/TL/01/2023) for the additional surveys conducted in Indonesia and Malaysia. Data collection was carried out by Bilendi & Respondi (B&R), a UK based market research institution appointed by the TISP core team as the official project partner. The survey was prepared in Qualtrics and integrated with Maximiles. The data collection took place from November 2022 to August 2023, involving approximately 71.922 participants from 68 countriesAmong the 1,031 Indonesian and 1,081 Malaysian participants who passed the attention check questions, we ultimately selected 929 Indonesian and 997 Malaysian participants who met the minimum completion time criteria.

3.2.2 Data quality measures

All measurement tools were translated into Indonesian before the data collection process. This same language was applied for the Malaysian sample due to linguistic similarities between Malay and Indonesia. To ensure data quality, we included attention check questions and set a minimum completion time. The TISP core team developed two attention check questions: An open-ended question ("*Please write the number 213 in the column box*") and close-ended question ("*To show us that you are still paying attention, please select strongly disagree*"). The TISP Many Labs underwent a soft launch, conducted by the core team with 400 participants, who completed the survey in 14 minutes without additional questions.
To determine the minimum completion time for the Indonesian and Malaysian samples, we applied the first quartile (Q1) from the median completion time for the full version survey (16 minutes). Those who fall below the Q1 will be excluded from the analysis, and we also removed duplicate participants by using participant IDs.

3.2.3 Open science practices

To follow the principle of open science and reproducibility, raw data and materials are publicly accessible on the OSF webpage: https://osf.io/5c3qd/?view_only=771b391647f342afb71fc2af02950842. To ensure data confidentiality, raw data has been anonymised to prevent the identification of individual participants when other scholars re-analyse the data.

3.2.4 Measurements

3.2.4.1 Recording demographic variables

Demographic variables were recorded using open-ended and close-ended questions in the survey. The demographic variables measured in this study included age, gender, and

educational background. We used this information, particularly education background, to identify the characteristics of samples in Indonesia and Malaysia as education was addressed as the significant predictor of conspiracy beliefs (van Prooijen, 2017). Moreover, educational background was included as a random intercept in the regression analysis to account for potential random effects.

3.2.4.2 Anti-vaccine conspiracy beliefs

To measure anti-vaccine conspiracy beliefs, we used a single item from anti-vaccine conspiracy beliefs scale (VCBS). VCBS have been widely used in various studies, including studies by Jolley and Douglas (2017) and Cookson et al., (2021). The validity of the scale has been confirmed by Shapiro et al. (2016) through an internal consistency test, indicating good reliability ($\alpha = 0.77$ to 0.82). Construct validity was supported by a significant correlation with the Conspiracy Mentality Questionnaire (CMQ) developed by Bruder et al. (2013) with $r = .44$; $p < .001$.

Single item of the total eight items was used to minimise respondent-fatigue, high drop-out rates, and participants disengagement. The original version of the item was: "*Pharmaceutical companies, scientists and academic work together to cover up the dangers of vaccines*". Related to construct validity, Shapiro found acceptable value of factor loadings for the item used in this study ($\beta = .85$; $p < .05$). The item was re-written into a shorter version with an adjustment related to survey length into: "*Scientists work together to cover up the dangers of vaccines*". Likert scales were applied to record the response from participants from 1 (strongly disagree) to 5 (strongly agree).

3.2.4.3 General conspiracy beliefs

General conspiracy beliefs were measured with a single-item question developed by Lantian et al. (2016). This item was psychometrically examined by assessing the correlation with Generic Conspiracy Beliefs (GCB) (Brotherton et al., 2013b); Belief in Conspiracy Theories Inventory (BCTI) (Swami et al., 2010) and Conspiracy Mentality Questionnaire (CMQ) (Bruder et al., 2013). Also, studies revealed positive correlations between this single item and GCB (r = .50; p < .001); BCTI (r = .50; p < .001) and CMQ (r = .41; p < .001). This single item applied a scenario as a stimulus for participants to express their views on conspiracy theories:

"Some political and social events are debated. It is suggested that the official version of these events could be an attempt to hide the truth to the public. This official version could mask the facts that these events have been planned and secretly prepared by a covert alliance of powerful individuals or organisations. What do you think?"

After viewing the scenario, participants must respond the statement of: "*I think that the official version of the events given by the authorities very often hides the truth*" with Likert scales from 1 (completely false) to 9 (completely true).

3.2.4.4 Trust in scientists with four dimensions

Trust in scientists was measured as a potential moderating variable in this study. The scale was developed by the TISP core team based on the four dimensions: Openness, competence, integrity, and benevolence following the framework from Besley et al. (2021). Four dimensions of trust in scientists were validated using confirmatory factor analysis, generating a good model fit (RMSEA = .04; SRMR = .03; AIC = 1673.91). The survey consisted of 12

items with each dimension assessed using three statements. Each statement measured a specific characteristic of scientists with 5-point Likert scales. For example, benevolence was measured with: "*How considerate or inconsiderate are most scientists of others' interest*?" Participants responded on a scale from (1) *very inconsiderate* to (5) *very inconsiderate*. Response options differed for items measuring openness, one of those items was: "*How open are most scientists to feedback?*" Participants responded to this question with scales from (1) *not open* to (5) *very open*.

3.2.4.5 Vaccine attitudes

We selected two items from the original 12-item scale to assess vaccine attitudes in this study, based on the study by Di Martino et al. (2020). The survey was part of *HProImmune* study conducted by the Health Programme of the European Union, focusing on immunizations and developing health materials for healthcare professionals (HProImmune, 2024). One item was positively framed (i.e., *I believe vaccines are important in reducing or eliminating serious diseases*) and the other one was negatively framed (i.e., *I think vaccinations do more harm than good*), serving as a control mechanism to ensure response quality. Likert scales were used to capture participant's response from (1) strongly disagree to (7) strongly agree.

3.2.5 Statistical analysis

The analysis consisted of three essential parts: Descriptive statistics, inter-correlation matrices and hypothesis testing. Descriptive statistics using mean, and percentage were used to compare our study variables, including demographic and key variables in the two countries. Comparative analysis using independent *t*-test was applied to identify significant differences between study variables. To identify correlation among study variables, we

applied inter-correlation matrices with Pearson correlation. Beyond correlation, we also performed a factor analysis to assess the robustness of the model based on participant's responses in two countries. To test the primary hypotheses, we applied interaction analysis with mixed-effect regression. Trust in scientists were categorised into three dimensions: Low, average, and high categories by comparing the mean and standard deviation. We utilised *dplyr* package (Wickham et al., 2019), *Hmisc* package (Harrell & Dupont, 2023), and *lme4* package (Bates et al., 2014) in R to analyse our research data.

3.3 Results

3.3.1 Factor analysis and invariance measurement testing

Participants in this study were from two different countries with distinct historical and cultural backgrounds. As the consequences, there is a possibility that our scales were perceived differently by the two groups. To assess whether our scales conveyed equivalent meanings in two groups, we performed multiple groups confirmatory factor analysis (MGCFA) and invariance testing measurement for trust in scientists. The historical and cultural differences between the two countries may create different perceptions of trust in scientists. We evaluated model fit with three models: (1) configural models, no constraints for factor loadings, (2) metric models, with constraints in factor loadings to be equivalent across groups, and (3) scalar invariance models, with constraints in intercepts to be equal across groups. We followed the standard criteria proposed by Chen (2007) and Putnick and Bornstein (2016), suggesting these thresholds: △Confirmatory Factor Analysis (△CFI) of -0.01, a △Root Mean Square Approximation (△RMSEA) of 0.015, and a △Standardised Root Mean Square Residual (△SRMR) of 0.030.

MGFCA demonstrated a good model fit based on the configural model (RMSEA = .070; SRMR = .026; CFI = .967; TLI = .955), the metric model (RMSEA = .070; SRMR = .037; CFI = .965; TLI = .955), and the scalar invariance model (RMSEA = .081; SRMR = .049; CFI = .949; TLI = .940). According to Hu and Bentler (1999), fit indices values between .08 and .10 indicate marginal model fit, while values between .05 and .08 reflect acceptable model fit. For SRMR, CFI and TLI, we addressed the same criteria from Hu and Bentler where values below .08 indicating good fit for SRMR; values ≥ .95 indicating acceptable fit for CFI, and above .95 reflects a good fit for TLI.

3.3.2 Descriptive analysis in two countries

In total, 929 Indonesian and 997 Malaysian participants involved in this study after we excluded duplicate participants and those categorised as "speedy". Findings in Table 1 showed that Indonesian and Malaysian exhibited similar patterns related to educational background, with most participants having higher education backgrounds but differs in terms of age and gender. Education is essential in conspiracy studies due to the evidence that those with low education tend to have negative correlation with powerlessness and belief in simple solutions, which are strong predictors of conspiracy beliefs (van Prooijen, 2017). In this study, educational background was classified to four categories: Primary education (e.g., elementary schools), secondary education (e.g., junior high school and senior high school), higher education (e.g., vocational, undergraduate degree or postgraduate) and did not attend schools. The age range of education levels is identical in Indonesia and Malaysia, with elementary schools beginning at 6-year-old and high school starting at 12-year-old.

Table 3. 1

Description of demographic variables for Indonesian and Malaysian samples

	Indonesia (n = 929)	**Malaysia (n = 997)**
Age	35.07 (15.87)	41.82 (13.57)
Gender (%)		
Male	48.81 %	48.04 %
Female	50.32 %	45.74 %
Prefer to self-describe	0.75 %	2.01 %
Prefer not to say	0.11 %	4.21 %
Educational background (%)		
Primary education	0 %	0.40 %
Secondary education	21.09 %	22.07 %
Higher education	78.10 %	77.43 %
Did not attend school	0 %	0.10 %

Related to our key variables, general conspiracy beliefs and vaccine attitudes were significantly higher among Indonesians, however anti-vaccine conspiracy beliefs were higher among Malaysians. Regarding vaccine attitudes, Indonesian participants were more willing to obtain vaccinations compared to Malaysians. Related to trust in scientists, integrity was perceived as the most important dimension and openness considered less essential.

Table 3. 2

Description of study variables for Indonesian and Malaysian samples

	Indonesia (n = 929)	**Malaysia (n = 997)**	***t*-test**
General conspiracy	5.77 (2.19)	5.43 (1.69)	3.73***
Anti-vaccine conspiracy	2.64 (4.93)	3.10 (1.07)	-2.72**
Vaccine attitudes	10.56 (2.78)	9.92 (2.43)	5.26***
Trust in scientists			
Competence	12.52 (5.06)	11.49 (2.09)	5.90**
Integrity	12.74 (5.42)	12.18 (2.44)	2.94**
Benevolence	10.87 (9.20)	10.60 (2.16)	.86
Openness	10.77 (2.61)	10.25 (2.21)	4.74**

Note:

** Significant at 95% CI*

*** Significant at 99% CI*

**** Significant at 99.99% CI*

3.3.3 Inter-correlation matrix

Results in Table 3 showed that anti-vaccine conspiracy beliefs and general conspiracy beliefs were negatively correlated with vaccine attitudes in the two countries. These findings confirmed the previous existing studies, demonstrating a significant correlation between conspiracy beliefs and vaccine attitudes. Specifically, increases in conspiracy beliefs are associated with greater vaccine hesitancy (Jolley et al., 2022; Jolley & Douglas, 2014; Sallam et al., 2022; T. Winter et al., 2022).

Regarding to the correlation between dimensions of trust in scientists with conspiracy beliefs, different patterns were found in the two countries. Two dimensions: Competence and integrity, were found significantly associated with general conspiracy and anti-vaccine conspiracy beliefs in Indonesians. Whereas for Malaysians, we found three dimensions (i.e., integrity, benevolence, and openness) correlated with general conspiracy and all dimensions

with anti-vaccine conspiracy beliefs. Also, Indonesians treated each dimension of trust as separate dimensions whereas Malaysians viewed each dimension as more identical (see Table 3).

Table 3. 3

Inter-correlation matrix of study variables for Indonesian and Malaysian samples

	1	2	3	4	5	6	7
Indonesia (n = 929)							
1.General conspiracy							
2.Vacc conspiracy	.51***						
3.Vacc attitudes	-.39***	-.51***					
4.Competence	-.04	-.03	.05				
5.Integrity	-.12**	-.10**	.11***	.09**			
6.Benevolence	-.03	-.05	.01	.02	.29***		
7.Openness	-.16***	-.13***	.16***	.16***	.36***	.16***	
Malaysia (n = 997)							
1.General conspiracy							
2.Vacc conspiracy	.24***						
3.Vacc attitudes	-.19***	-.40***					
4.Competence	-.04	-.12***	.27***				
5.Integrity	-.12***	-.17***	.27***	.68***			
6.Benevolence	-.16***	-.13***	.26***	.67***	.77***		
7.Openness	-.13***	-.14***	.26***	.64***	.75***	.80***	

Note: Missing values are not calculated in the correlation

** Significant at 95 % CI*

*** Significant at 99 % CI*

**** Significant at 99.99*

3.3.4 Anti-vaccine conspiracy beliefs as the reflection of mistrust to scientists

To test our key hypotheses, we applied moderation analysis with mixed-effect regression with trust in scientists included as the potential moderating variable and educational background as the random slope. The normality test demonstrated that general conspiracy beliefs ($W = .94$; $p < .01$); anti-vaccine conspiracy beliefs ($W = .91$; $p < .01$) and the four dimensions of trust in scientists: Competence ($W = .93$; $p < .01$), integrity ($W = .95$; $p < .01$), benevolence ($W = .96$; $p < .01$) and openness ($W = .97$; $p < .01$) classified as non-normal distribution with varying means and standard deviations. Also, moderation analysis required each predictor to have a low correlation with other predictors, as high correlation coefficient can inflate standard errors (SE). To reduce the effect of inflated SE, we applied centring methods, a statistical method converting raw scores into centred scores to minimise errors in statistical computations (Kraemer & Blasey, 2004) based on the results of variance inflation test (VIF) in each model.

Explanatory analysis to test hypotheses 2a and 2b was conducted separately for each country due to different social and political backgrounds. Table 4 showed several regression coefficients of anti-vaccine conspiracy beliefs and four dimensions of trust in scientists included as predictors. Benevolence and openness were two elements of trust that significantly moderated the correlation between anti-vaccine conspiracy beliefs and vaccine attitudes. The significant effect of openness was observed in two countries, whereas benevolence was observed only in Malaysian samples. This finding suggested that correlation between anti-vaccine conspiracy theories and vaccine attitudes was stronger in those who mistrust to scientists.

Table 3. 4

Interaction analysis between trust in scientists and vaccine conspiracy beliefs in two countries

	Indonesia (n = 929)		Malaysia (n = 997)	
	β	SE	β	SE
Model 1a – 1b				
(Intercept)	10.29	.26	10	.24
AVC	-1.12***	.06	-.83***	.06
CM	.02	.01	.26***	.03
AVC*CM	.01	.01	.00	.02
Model 2a – 2b				
(Intercept)	10.31	.27	9.94	.24
AVC	-1.13***	.06	-.81***	.07
IT	.01	.01	.20***	.12
AVC*IT	.03	.01	.02	.10
Model 3a – 3b				
(Intercept)	10.31	.26	9.92	.24
AVC	-1.13***	.06	-.83***	.06
BV	-.00	.00	.22***	.03
AVC*BV	.01	.01	.05*	.02
Model 4a – 4b				
(Intercept)	10.29	.27	9.93	.24
AVC	-1.12***	.06	-.82***	.06
ON	.10***	.03	.21***	.03
AVC*ON	.06**	.02	.05*	.02

Note. AVC = anti-vaccine conspiracy; CM = competence; IT = integrity; BV = benevolence; ON = openness

Centring method applied for the models with high variance inflation due to multicollinearity issues

Missing values were not calculated in the regression analysis

** Significant at 95% CI*

*** Significant at 99% CI*

**** Significant at 99.99% CI*

From the findings described in Table 4, three regression equations can be established by considering predictors and significant interactions between them to predict vaccine attitudes.

The equations below describe the formula predicting vaccine attitudes from the interaction between vaccine conspiracy theories and trust in scientists. The notation of X represents anti-vaccine conspiracy beliefs, Y^1 represents benevolence (only for Malaysia) and Y^2 represents openness values (for Indonesia and Malaysia).

$$\textbf{Vacc\_attitudes } (Y_{Malay}) = 9.92 + (-.83*X) + (.22*Y^1) + (.05*X*Y^1) + €$$

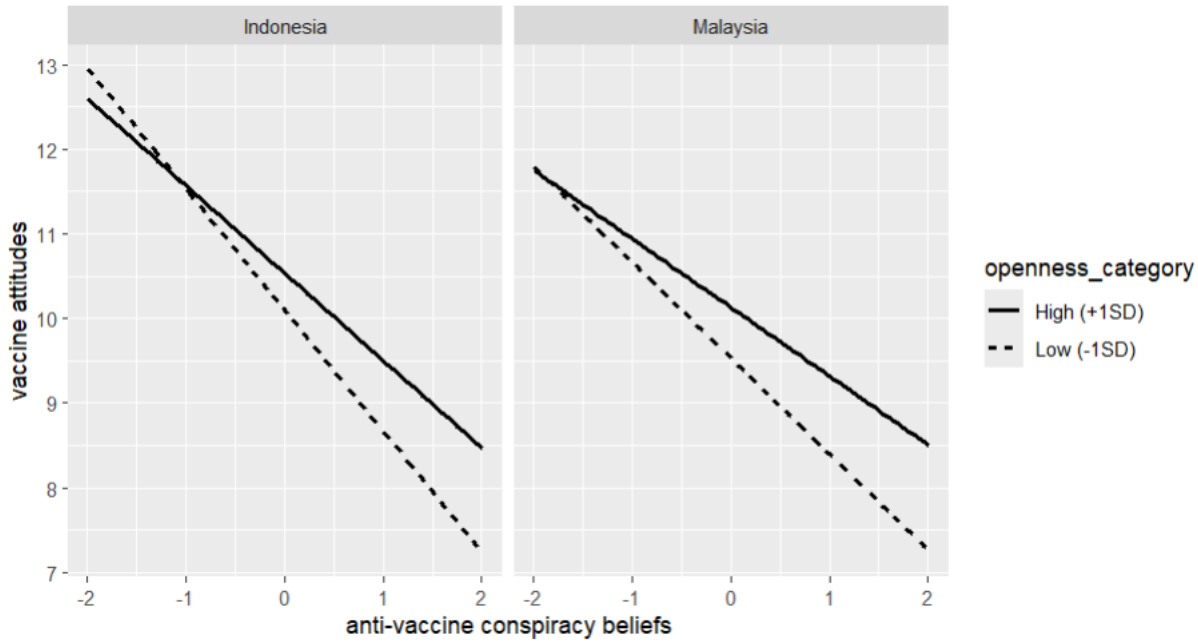
$$\textbf{Vacc\_attitudes } (Y_{Malay}) = 9.93 + (-.82*X) + (.21*Y^2) + (.05*X*Y^2) + €$$

$$\textbf{Vacc\_attitudes } (Y_{Indo}) = 10.29 + (-1.12*X) + (.10*Y^2) + (.06*X*Y^2) + €$$

Figure 3. 1

Openness moderates the strength of the correlation between vaccine conspiracy beliefs and vaccine attitudes for Indonesians (n = 929) and Malaysians (n = 997)

Note: Centring method applied to replace the scores of predictors



To test hypothesis 3, we replicated the previous analysis in Model 1 to Model 4, replacing anti-vaccine conspiracy beliefs with general conspiracy beliefs. Table 5 shows different results compared to the previous analysis, showing no significant interactions between trust in scientists and general conspiracy in two countries. These findings suggest that the

symptom of confirmation bias occurred in content-specific conspiracy beliefs, but not in general conspiracy beliefs.

Table 3. 5

Interaction analysis between trust in scientists and general conspiracy beliefs in two countries

	Indonesia (n = 929)		**Malaysia (n = 997)**	
	β	SE	β	SE
Model 5a – 5b				
(Intercept)	10.46	.31	9.86	.29
GC	-.48***	.03	-.28***	.04
CM	.02	.01	.29***	.03
GC*CM	.00	.00	-.02	.01
Model 6a – 6b				
(Intercept)	10.48	.32	9.79	.29
GC	-.48***	.03	-.25***	.04
IT	.02	.01	.24***	.03
GC*I	.00	.00	-.01	.01
Model 7a – 7b				
(Intercept)	10.48	.31	9.75	.29
GC	-.49***	.04	-.23***	.04
BV	.00	.00	.26***	.03
GC*BV	.00	.00	-.02	.01
Model 8a – 8b				
(Intercept)	10.47	.32	9.77	.29
GC	-.48***	.04	-.24***	.04
ON	.09**	.03	.25***	.03
GC*ON	.02	.01	-.01	.01

Note. GC = general conspiracy; CM = competence; IT = integrity; BV = benevolence; ON = openness

Centring method applied for the models with high variance inflation due to multicollinearity issues

Missing values were not calculated in the regression analysis

** Significant at 95% CI*

*** Significant at 99% CI*

**** Significant at 99.99% CI*

3.4 Discussion

3.4.1 Authoritarian culture and trust in scientists

This study shows different degrees of trust in scientists among Indonesian and Malaysian. This difference can be contributed by multiple factors, including authoritarian culture orientations, with Malaysia exhibiting higher levels than Indonesia. Authoritarian culture promotes a perspective of unquestioning obedience, leading to institutional mistrust (Pernia, 2022). Although scientists are not directly involved with politicians, some of them may contribute to providing insight and solution to the government, including vaccinations. This involvement may influence public opinion to consider some scientists as a member of governments. Thus, public can experience confirmation bias when evaluating scientists and governments at the same time.

3.4.2 Confirmation bias and vaccine conspiracy beliefs

This study showed that openness moderated the correlation between vaccine conspiracy beliefs and vaccine attitudes in the two countries. From this finding, we suggest that vaccine conspiracy theories reflect mistrust bias, utilising conspiracy theories to reinforce mistrust to scientists, not believing the true proposition of vaccine conspiracy. Thus, endorsing content-specific conspiracy theories, in this case, vaccine conspiracy theories does not perpetually align with conspiracy proposition. This study showed that vaccine conspiracy theories can be applied to reinforce the existing claim of mistrust in scientists. Additionally, it shows evidence that content-specific conspiracy theory can be classified as misinformation.

This also support the evidence from Imhoff, Bertlich, et al. (2022b), explaining that content-specific conspiracy is not the same with conspiracy mentality.

Different from vaccine conspiracy beliefs, general conspiracy beliefs that reflect intention to believe in various conspiracy theories have different characteristics. Including this variable as the key predictor did not stimulate a significant interaction with trust in scientists. General conspiracy beliefs reflect the true belief of conspiracy ideation, predicting vaccine hesitancy. This variable reflects the general likelihood to believe in various conspiracy ideation, even though those are contradictory (Brotherton et al., 2013b; Swami et al., 2011).

This study provides a novel contribution in the field of conspiracy studies. Exploring the distinct characteristics between specific and general view of conspiracy theories may support scholars and practitioners to assess more effective treatments to foster resistance to conspiracy theories. For example, misinformation can be mitigated with debunking, exposing individuals to correct information. However, altering conspiracy mindsets require more longitudinal approaches. Brand and Stafford (2022) proposed the idea of engaging individuals in a dialogue to change minds which can be the alternative for interventions to general conspiracy beliefs.

3.5 Limitations

Like any other empirical studies, this study also has a few limitations that should be considered in the next follow-up study. First, this is not an experimental study that can establish causation where most of the studies concerning bias involve experimental treatments to generate different conditions of biases. Second, a single item to assess anti-vaccine conspiracy beliefs can be one element that may confound statistical outcomes. The item applied in this study only focuses on the aspects of scientists covering up the dangers of the vaccine. We did not apply other items in the full instrument that might be relevant with

anti-vaccine conspiracy theories (e.g., *immunizations allow governments to track and control people* or *tiny devices are placed in vaccines to track people*) where those items might convey different mistrust elements. Third, unequal sample size between high and low trust dimensions might influence the model where only openness shown as the significant moderator. Lastly, follow-up studies in other countries (e.g., western population) might be needed to test our core hypotheses where different cultural backgrounds are possible to influence the results.

3.6 Conclusion

Based on the findings from this study, we confirmed to accept hypothesis 1, 2b and 3. Overall findings show distinct levels of trust between Indonesia and Malaysia, which authoritarian orientation can be one of contributors determining this result. Related to our primary hypotheses, although this study is not experimental to confirm causal relationship, we argue that individuals endorse vaccine conspiracy theories as a desire to reinforce their existing attitudes, mistrust to scientists, but not of general conspiracy beliefs. Additionally, analysing two variables, vaccine conspiracy beliefs and general conspiracy beliefs with the same model can provide comprehensive evidence in comparing two distinct characteristics.

Chapter 4

Social events moderate the association between conspiracy mentality and vaccine intentions: Evidence from longitudinal panel data during COVID-19 pandemic in the UK

Study 1 (Chapter 2) and study 2 (Chapter 3) explored the correlation between conspiracy beliefs and vaccine intentions with cross-sectional survey data. In this study, I explore again the correlation with longitudinal data, expecting to provide more comprehensive and robust findings about the correlation. I used the data from C19PRC longitudinal survey project to support my analysis and answer my primary hypothesis. Panel survey data allow me to capture different social events that may influence the likelihood to rely on conspiracy theories when evaluating vaccines.

Contributions: I designed the study and then approved by Tom Stafford and Richard Bentall as my primary supervisors. I used the data from COVID-19 Psychological Research Consortium (C19PRC) study for my analysis. I wrote the Chapter and Tom Stafford and Richard Bentall Provided feedback on the draft. All authors approved the final manuscript before submission to the journal.

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Abstract

Social events may provide important cues that influence the sense of reality, including the perception that conspiracy theories are plausible. Using longitudinal panel data collected in the UK from March 2020 to December 2021, this study aims to identify whether social events influenced the strength of the association between conspiracy mentality and vaccine intentions during the COVID-19 pandemic. Consistent with previous research, the conspiracy mentality was a significant predictor of vaccine intentions across three-time points, but also that conspiracy mentality measured in March 2020 predicted that participants were more hesitant to the vaccines in December 2020. The primary finding was that different social events moderated the strength of the correlation between conspiracy mentality and vaccine intentions within similar participants. Conspiracy mentality became more vital to evaluate COVID-19 vaccines in December 2020, when the vaccination program was about to commence.

Keywords: conspiracy mentality, COVID-19, vaccines, social, events

4.1 Introduction

Many studies have shown negative correlations between conspiracy beliefs and vaccine intention (Eberhardt & Ling, 2021; Hartman et al., 2021; Jolley & Douglas, 2014; Milošević Đorđević et al., 2021; Murphy et al., 2021; Ruiz & Bell, 2021). Some studies have suggested that the perceived dangers of vaccines (Jolley & Douglas, 2014) and poor vaccine knowledge (Milošević Đorđević et al., 2021) mediate this relationship. People who rely on conspiracy theories may perceive that the vaccine is the outcome of secret agreements or produced by malicious actors to control the human population. However, most studies examining the relationship between conspiracy beliefs and vaccine intentions have relied on cross-sectional data. Several studies that have utilised longitudinal data to test the relationship between conspiracy beliefs and vaccine intention, have not considered the different social events that occurred at each time point (Coelho et al., 2022a; van Prooijen & Böhm, 2023).

Social events can be cues that affect decision-making, and it seems likely that they could affect the way that existing beliefs about conspiracies influence the way that people evaluate vaccines. Sociologists have argued that, in addition to the rationality of decision-makers, environmental cues and social elements should be considered when understanding decision-making processes (Tang et al., 2018). Two theories have been used to understand the importance of environmental cues and ecological factors: social judgement theory (Brehmer, 1976; Hammond et al., 1975b) and ecological rational theory (Gigerenzer, 2008; Gigerenzer & Selten, 2001). Social judgement theory assumes that the outcome of a decision is influenced by how well decision-makers can perceive relevant social factors, how consistently they utilise the data and their ability to understand the world. Different individuals will therefore make different decisions even though they are exposed to the same

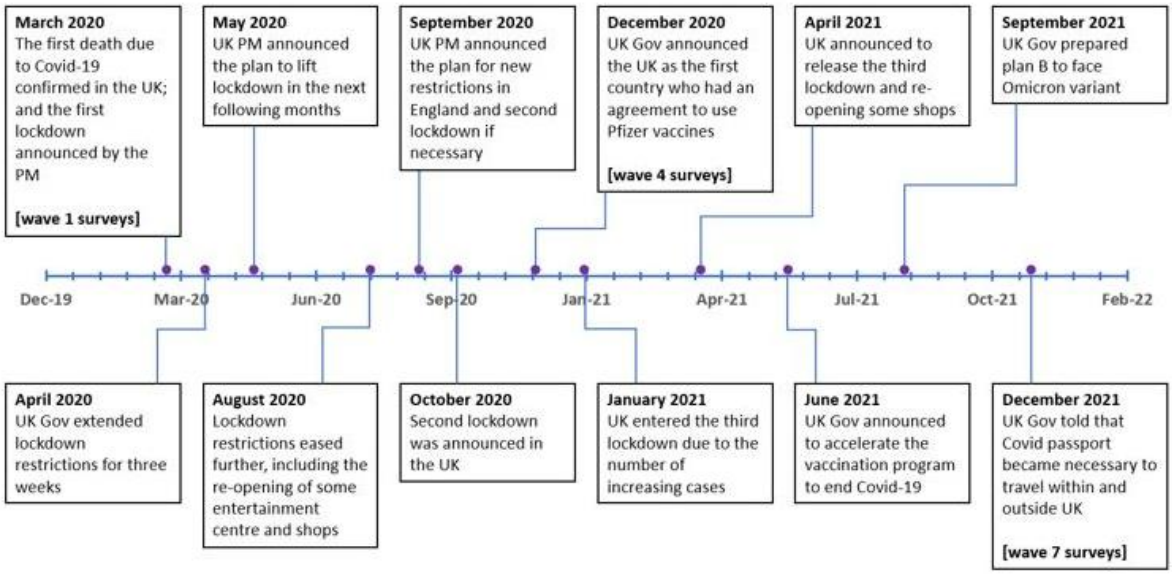
situation because they have different abilities in selecting and integrating social cues. Evidence in support of social judgement theory can be found in an experimental study investigating the effect of online comments in social media and public opinion polls (Lee & Chun, 2016). It was found that negative comments were considered acceptable only when participants had similar prior attitudes, but not when participants had positive attitudes. Hence, prior attitudes became the antecedent of how participants interpreted and responded to the environmental cues.

Unlike social judgement theory, which highlights the importance of deliberative processes in managing environmental cues for decision-making, ecological rational theory proposes that, under some conditions, people act quickly without employing analytic processes that involve probabilities. This allows rapid decision-making through the activation of mental shortcuts, known as heuristics (Gigerenzer, 2008). The concept of heuristics has been applied to several fields, including in politics (Petersen, 2015) and economics (Grandori, 2010). Political ideologies (left vs right or liberal vs conservative) may function as availability heuristics, they affect the availability of information in memory that may be activated when evaluating vaccines during COVID-19 pandemic. Hence, conservative people in the US tend to have a more negative evaluation of COVID-19 vaccines than liberals because they are more sensitive to messages about medical health risks (Howard, 2022). Political ideology and party affiliation have thereby become a rule of thumb in decision making that can lead to poor decisions, even for health care workers who have appropriate knowledge on health issues (Toth-Manikowski et al., 2022).

The COVID-19 pandemic was a fast-evolving global emergency, with impacts on the lives of people that changed rapidly, and sometimes unpredictably over time. For example, in the UK, the first lockdown was introduced with little warning on March 23rd, 2020 (Sparrow et al., 2020; Stewart et al., 2020), before being relaxed on June 23rd, 2020 (UK Gov, 2020). However, new restrictions were introduced again as the second lockdown on October 31st, 2020 (Otte et al., 2020). Rapid progress in the development of COVID-19 vaccines that was widely reported in the national media resulted in the first AstraZeneca vaccines and quickly becoming available on January 4th, 2021 and becoming rapidly accessible for the UK adults population (NHS, 2021).

Figure 4. 1

Timeline of COVID-19 events in the UK



These rapidly occurring events during the pandemic required UK citizens to quickly adapt to emerging situations. Figure 1 maps some related COVID-19 events that might influence psychological conditions and how judgements should be made by them. All reported events

were taken from the following sources: Institute for Government (Institute for Government, 2022); BBC news (https://www.bbc.co.uk/news/uk) and The Guardian newspaper (https://www.theguardian.com/uk). Under some conditions, there were no opportunities for them to generate deliberative decisions and they therefore had to rely on ecological rationality. We assume that, in these circumstances, people created mental shortcuts to manage the situation and generate judgements, including relying on conspiracy theories. We also hypothesise that different social events convey different meanings depending on pre-existing conspiracy mindsets and would affect hesitancy toward acceptance of the vaccine. Thence, the strength of the correlation between conspiracy beliefs and vaccine attitudes would be expected to vary following different social events.

To test our hypotheses, we applied mixed-effect regression analysis by including random components (i.e., random slopes and random intercepts). Random components are those that are assumed to be sampled from a wider universe of possible values, whereas fixed components are those that have definite values. For example, if, say, researchers intended to investigate how conspiracy beliefs and other factors predict individual political participation in Europe or Asia, political trust and economic conditions within each continent could be included as predictors and considered random factors (had different people sampled in each continent their values would be different) that vary to influence the fixed coefficient predicting political participation from conspiracy beliefs; whether or not the participants were in Europe or Asia would be considered a fixed factor. By taking into account random factors in the analysis, standard errors can be reduced, and a more accurate estimate of the regression coefficients can be obtained. In the current longitudinal analyses, PID will be included as random intercept and dummy coding for waves as random slopes.

4.2 Method

4.2.1 Participants and data collection

The data was taken from the COVID-19 Psychological research consortium (C19PRC) project (https://www.sheffield.ac.uk/psychology-consortium-COVID19) a longitudinal survey designed primarily for mental health surveillance initiated by University of Sheffield, Ulster University, University of College London, The University of Liverpool, and Royal Holloway University of London (McBride et al., 2021, 2022). The project aims to assess the psychological impacts of the COVID-19 pandemic in a representative quota sample of UK population stratified by age, sex, and household income. The project has been granted ethical clearance from University of Sheffield (Ref: 033759) and the sample was recruited and assessed online by the survey company, Qualtrics. Eight waves of data collection have been completed at the time of writing, but this study only utilises data collected in three waves where the core variables, conspiracy mentality and vaccine intentions were available (wave 1 collected in March 2020, wave 4 in November to December 2020, and wave 7 in December 2021).

In each wave, participants who completed previous waves were invited to take part, with participants missing at follow-up replaced with new participants required to meet the sampling quotas in each wave. The total participants at wave 1 was 2008 after we removed participants who answered option (4) which is "not applicable" (n = 17) in the vaccine intention question (i.e., "*If a new vaccine were to be developed that could prevent COVID-19, would you accept it for yourself?*"). These consisted of 51.74% females, with the mean age of 45.52 (SD = 15.91). Of these, 1262 were carried through to wave 4 which, with replacement participants (n = 2605), consisted of 51.48% females with a mean age of 48.36 (SD = 16.13). At wave 7, 740 participants from wave 1 and wave 4 remained in the sample, and

replacements were recruited (n = 665). In total with replacement participants (n = 1405), wave 7 data consisted of 49.96% females with the mean age of 48.844 (SD = 15.10). Only participants who contributed to all three waves (n = 740) were involved to test our hypotheses, consisting of 48.37% females with mean age of 52.30 (SD = 14.74).

4.2.2 Data quality measures

To ensure the quality of the data, the C19PRC core team eliminated participants who did not complete the surveys in full; have a technical issue with the informed consent; those who were not English-speaking adults; those with short completion times and any suspected duplicate respondents, those who join the survey more than one time with identical ID (McBride et al., 2021). Also, eliminating speedy participants is conducted to reduce errors in the analysis. The minimum time allowed was set as 11 minutes and 11 seconds for wave 1 surveys. Similar principles also applied for wave 4 for which the core team conducted a pilot study (n = 100) to identify the minimum time which is half of the median time from the pilot study (McBride et al., 2022).No papers have been published using wave 7 data prior to this one, however the C19PRC team applied the similar parameters as in wave 1 and wave 4 to ensure the quality of the data.

4.2.3 Open science practices

To follow the best practice of open science, all materials, including measurement scales, codebook, user guide and measure information for wave 1 and wave 4 surveys have been uploaded to an open science webpage at https://osf.io/v2zur/. The technical report for wave 7 already uploaded in the webpage, but the full data is still being managed at the time of writing. Raw data for explanatory analysis also have been anonymised to ensure confidentiality for all participants based in compliance with general data protection regulation

(GDPR). All personal data is restricted to members of the research team (McBride et al., 2021).

4.2.4 Measures

4.2.4.1 Recording time points and identification number

Dummy coding with three categories was used to indicate data from the three-time points (i.e., wave 1, wave 4, and wave 7). These categories allow us to map and identify numerical data in each wave. To provide participants ID, Qualtrics recorded those with unique numbers called PID. These unique numbers were used to identify similar participants across the three waves.

4.2.4.2 Self-report instruments

The C19PRC utilised the conspiracy mentality scale (CMS); (Bruder et al., 2013). CMS is a self-report instrument with five items measuring the likelihood of believing in conspiracy theories. To note, CMS does not address content-specific conspiracy theories (e.g., anti-vaccine conspiracy theories or COVID-19 conspiracy theories) that are related to COVID-19 vaccines, yet they assess the likelihood to engage in conspiracist ideation. Each item is rated using a Likert scale ranging from 1 (certainly not - 0%) to 11 (certainly 100%). The validity of the scale had been assessed by Bruder et al. (2013) using samples from five countries, the US, UK, and Ireland, Germany, and Turkey. Exploratory factor analysis suggested that five items in CMS were explained by one factor that explained 60.6% of the variance with all factor loadings larger than 0.71. An example item is "*I think that, many very important things happen in the world, which the public is never informed about*".

Vaccine intentions were measured at each wave using one question developed by the C9PRC core team. At wave 1, no vaccines had been developed, and the question used was "*If a new*

vaccine were to be developed that could prevent COVID-19, would you accept it for yourself?" By wave 2, multiple COVID-19 vaccines had been developed and the question asked was "*Multiple vaccines for COVID-19 have now been developed. Will you take a vaccine for COVID-19 when it becomes available to you?*". By wave 7, the vaccination program was well under way and booster vaccines had been available and were easy to obtain, so the question asked was "*Have you been fully vaccinated against COVID-19 (i.e. have you received all jabs/shots)?*". Questions at each time point were constructed differently following those conditions. The outcome of the measurements was categorical variables where participants were given several options to respond to the question, (1) yes; (2) maybe; (3) no. The option of (4) not applicable was only available at wave 1.

4.2.5 Statistical analysis

We conducted descriptive and explanatory analysis from the longitudinal data collected at the three time points. A Sankey diagram was used to visualise the movement of vaccine intentions across time. We excluded participants who answered (4) or "not applicable" in responding to the vaccine intention question because this option was only available at wave 1. Intercorrelation matrices were constructed to identify inter-correlations among study variables. Three correlational methods are used, the Spearman rank test to identify the correlation between vaccine intentions as ordinal scales (Zar, 2014), point biserial correlations to assess correlations between continuous and categorical variables (Gupta, 1960) and Pearson correlations when both variables were continuous (Bishara & Hittner, 2012). We applied mixed-effect regression analysis to test our hypotheses. The scores derived from the CMS were transformed into standardised Z scores to obtain standardised coefficients. All the computations were conducted using *R studio* with the {ggsankey} package for descriptive analysis (Sjoberg, 2022) and {lme4} package for mixed-effect regressions (Bates et al., 2014).

4.3 Results

4.3.1 Attrition analysis

Attrition analysis was conducted to assess how loss of participants in the longitudinal study influenced the internal validity of the findings. We followed the approach of Oleksy et al. (2022) and McBride et al., (2021) to compare socio-demographic variables (i.e., age, gender, and educational background) between participants who completed all waves (n = 740) and incomplete participants (n = 1268) using wave 1 as the first stage. We then conducted logistic regression to assess the effect of demographic variables and conspiracy mentality in predicting the status of being complete or incomplete responders, dummy coding categorised participants at wave 1 into incomplete responders (participants who did not complete the survey in all three waves: 0) and complete responders (1). Comparison analysis with *t-test* (*t*) and *Mann-Whitney U test* (Z) demonstrated that two groups were different in terms of age ($t(2006) = -12.09$, $p < .05$) and gender ($Z = -2.84$, $p < .05$), but not for educational background ($Z = -1.24$, $p > .05$). The levels of conspiracy mentality were also significantly different ($t(2006) = 2.36$, $p < .05$, $d = .10$) between complete responders ($M = 34.51$; SD = 9.67) and incomplete responders ($M = 35.47$; SD = 8.81). However, the effect size (*d*) was categorised as a small effect because, even though conspiracy mentality differed significantly between the groups, the difference in mean scores and variances were small (Lakens, 2013)

In the second stage, we applied logistic regression to assess whether being complete or incomplete responders can be predicted through demographic variables and conspiracy mentality. Two demographic variables, age ($\beta = .56$; $p < .01$) and gender ($\beta = -.27$; $p < .01$) were significant predictors of the number of time points participants responded to, but educational background was not significant ($\beta = -.03$; $p > .05$). Conspiracy mentality also significantly predicted the status of being complete or incomplete responders ($\beta = -.10$; $p <$

.05). Overall, the analyses indicate that the differences between complete and incomplete responders were small, and the main findings of our study are likely robust.

4.3.2 The overview of participants

There were 159 participants who did not provide the full informed consent and were eliminated; 35 participants completed the survey from outside the UK or under 18-year-old (n = 6) also removed from the survey; 77 participants who categorised as speedy and 64 potential duplicate participants were removed in wave 1 surveys (McBride et al., 2021). In wave 4, two phases of data collection were employed. Phase 1 data collection focused on recontacting participants from wave 1 (March 2020) with n = 1796 and wave 3 (August 2020), whilst phase 2 recruited replacement participants with n = 2071. For over 62.8% (n = 1271) participants were successfully recontacted from the previous waves and 3073 participants collected in phase 2. From this, the C19PRC core team removed 344 participants who did not complete the surveys in full; 185 participants who were not English-speaking adults and those who were too quick in completing the surveys (n = 50) (Butter et al., 2024; McBride et al., 2022).

Of the 740 participants who joined the survey in all three waves and included in our primary analysis, the majority were from England (85%), followed by Scotland (8.78%), Wales (4.05%) and Northern Ireland (2.16%). Related to ethnicity, the survey classified eleven ethnic groups, which can be seen in the supplementary materials. Most participants were white British (91.49%), with the rest white non-British (3.24%), Indian (2.03%) and other ethnic groups (1.49%). In terms of educational background measured in wave 1 (n = 740), 3.24% of participants had no qualification, followed by 19.19% with GCSE-level qualifications, 18.11% with A-levels, 9.86% having a technical qualification, 29.46% with an

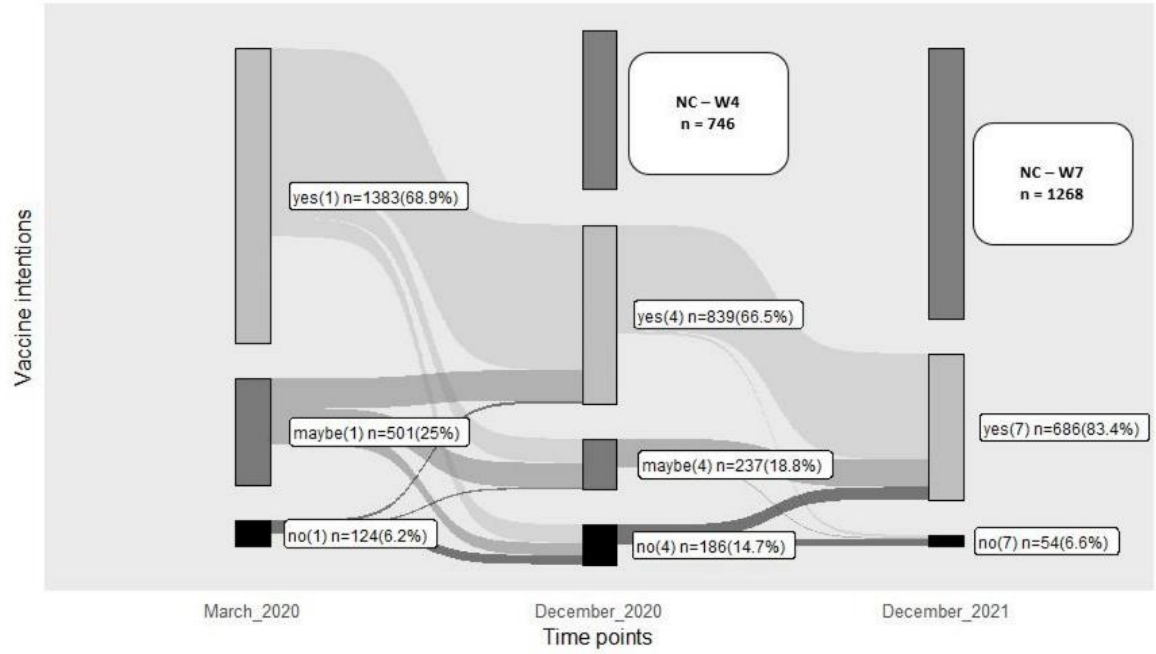
undergraduate degree, 5% with a diploma, and 13.51% with postgraduate degree; 1.62% mentioned other qualifications.

4.3.3 Tracking the movement of vaccine intentions

We show the movement of participants responding to vaccine intention questions with a Sankey diagram (Figure 2). New participants in wave 4 and wave 7 were not considered in our flow analysis. Also, 746 participants in wave 1 (NC-W4) were not considered in the analysis because they decided to leave the survey in wave 4 and there were 1268 participants in wave 1 (NC-W7) who were not involved in wave 7. It has previously been reported that vaccine hesitancy ("maybe") and vaccine refusers ("no") were more prevalent at time 4 but no statistical analysis has previously been reported for time 7 (Hyland, Vallières, Shevlin, et al., 2021).

Figure 4. 2

The movement of vaccine intentions from identical participants at three-time points (March 2020 to December 2021)



4.3.4 Intercorrelation among study variables across times

There was a significant negative correlation between conspiracy mentality and vaccine intentions at each of the three-time points, with the largest correlation coefficient at wave 4. Table 1 shows the correlations across times between conspiracy mentality and vaccine intentions at the three waves. Although vaccine intentions at wave 1 correlated with those at the 4th wave, no correlation was found between vaccine intentions at wave 1 and vaccine intentions at wave 7. The negative correlations between conspiracy mentality and vaccine intentions confirmed similar findings reported in previous studies that used C19PRC data (Hartman et al., 2021; Murphy et al., 2021). However, no previous studies tested the inter-correlations across waves.

Table 4. 1

Inter-correlation matrix between conspiracy mentality and vaccine intentions among three-time points

	1	2	3	4	5	6
1.Vaccine intentions (W1)	1					
2.Vaccine intentions (W4)	.37**	1				
3.Vaccine intentions (W7)	.16***	.33***	1			
4.Conspiracy mentality (W1)	-.08*	-.22***	-.13***	1		
5.Conspiracy mentality (W4)	-.05	-.21***	-.14***	.62***	1	
6.Conspiracy mentality (W7)	-.06	-.18***	-.09*	.59***	.69**	1

** Significant at 95% CI*

*** Significant at 99% CI*

**** Significant at 99.99% CI*

4.3.5 The cross-lagged effects of conspiracy mentality

We conducted two regression models to assess how previous conspiracy mentality influenced vaccine evaluations at a particular wave. Model 1a calculates the effects of conspiracy mentality and vaccine intentions at wave 1 as predictors of vaccine intentions at wave 4. Model 1b and Model 1c replicate the previous model with similar predictors at wave 1 and wave 4, respectively predicting vaccine intentions at wave 7 (see Table 2). All models included PID as the random intercept. PID represents categories that reflect individual differences in term of conspiracy mentality and vaccine intentions.

Table 4. 2

Logistic regression for cross-analysis between conspiracy mentality and vaccine intentions at wave 1, wave 4 and wave 7

	Vacc intentions (W4)			Vacc intentions (W7)		
	β	**OR**	**SE**	**β**	**OR**	**SE**
Model 1a - 1b						
(Intercept)	-1.46	.23***	.26	1.14	3.15***	.31
Vacc intentions (W1)	2.88	17.99***	.31	2	7.40***	.40
Consp mentality (W1)	-.50	.60***	.09	-.45	.64**	.15
Model 1c						
(Intercept)				.82	2.28***	.22
Vacc intentions (W4)				3.11	22.61***	.38
Consp mentality (W4)				-.32	.72*	.16

Note: Model 1a shows wave 1 predictors of vaccine hesitancy at wave 4; model 1b shows the same wave 1 variables as predictors of hesitancy at waves 7, and 7 model c shows the wave 4 predictors of hesitancy at wave 7 with n=740 for similar participants joined in three waves

** Significant at 95% CI*

*** Significant at 99% CI*

**** Significant at 99.99% CI*

Models 1a and 1b show that levels of vaccine acceptance at wave 4 and wave 7 can be predicted by the previous levels of vaccine intentions and conspiracy mentality in wave 1, and not only by conspiracy mentality at the same wave. Similar results are shown by Model 1c where conspiracy mentality and vaccine intentions at wave 4 significantly predicted the level of vaccine intentions at wave 7. An equation can be constructed to predict vaccine intentions in wave 4 (Y^4) and two equations for vaccine intentions in wave 7 (Y^7) from the two models. Equations below describe the formula to predict vaccine intentions based on the previous levels of vaccine intention (X), the level of conspiracy mentality (Z) and random errors (ϵ). There is no variance contribution from the random intercepts to our fixed predictors in the models.

$$\textbf{Vac\_intentions W4 } (Y^4) = -1.46 + (2.88*X^1) + (-.50*Z^1) + \epsilon$$

$$\textbf{Vacc\_intentions W7 } (Y^7) = 1.14 + (2*X^1) + (-.45*Z^1) + \epsilon$$

$$\textbf{Vac\_intentions W7 } (Y^7) = .82 + (3.11*X^4) + (-.32*Z^4) + \epsilon$$

4.3.6 Moderation analysis

We applied moderation analysis to (1) compare the strength of the correlations between our study variables at three-time points and (2) identify effects of time points that reflect different social events influencing the strength of the correlation. PID was included as the random intercept, and dummy coding for waves as the random slope. By including PID, we could control the magnitude of individual factors that may influence vaccine intentions apart from conspiracy mentality (e.g., risk perception, vaccine knowledge and *needle-phobic*). Table 3 illustrates the regression coefficients of time points, conspiracy mentality and the interaction between fixed predictors. Results show time points are significant predictors of vaccine intentions, reflecting the increase of vaccine acceptance over time from March 2020 to December 2021, whereas conspiracy mentality reduced vaccine acceptance at all time points.

Table 3. 3

Logistic regression with random effects describing the interaction between time points and conspiracy mentality

	β	OR	SE	Confidence interval	Random effects
Model 2					$\sigma^2 = 3.29$
(Intercept)	.73	2.08***	.08	1.74 - 2.47	$\tau_{00} = .50$
Time points	2.05	7.82***	.26	4.66 - 13.14	$\tau_{11} = .80$
Consp mentality	-.17	.84*	.08	.71 - .98	
Time*Consp mentality	-.32	.72*	.15	.53 - .98	

Note: n=740 for similar participants joined in three waves

Marginal R^2 /Conditional R^2= .203/ NA

** Significant at 95% CI*

*** Significant at 99% CI*

**** Significant at 99.99% CI*

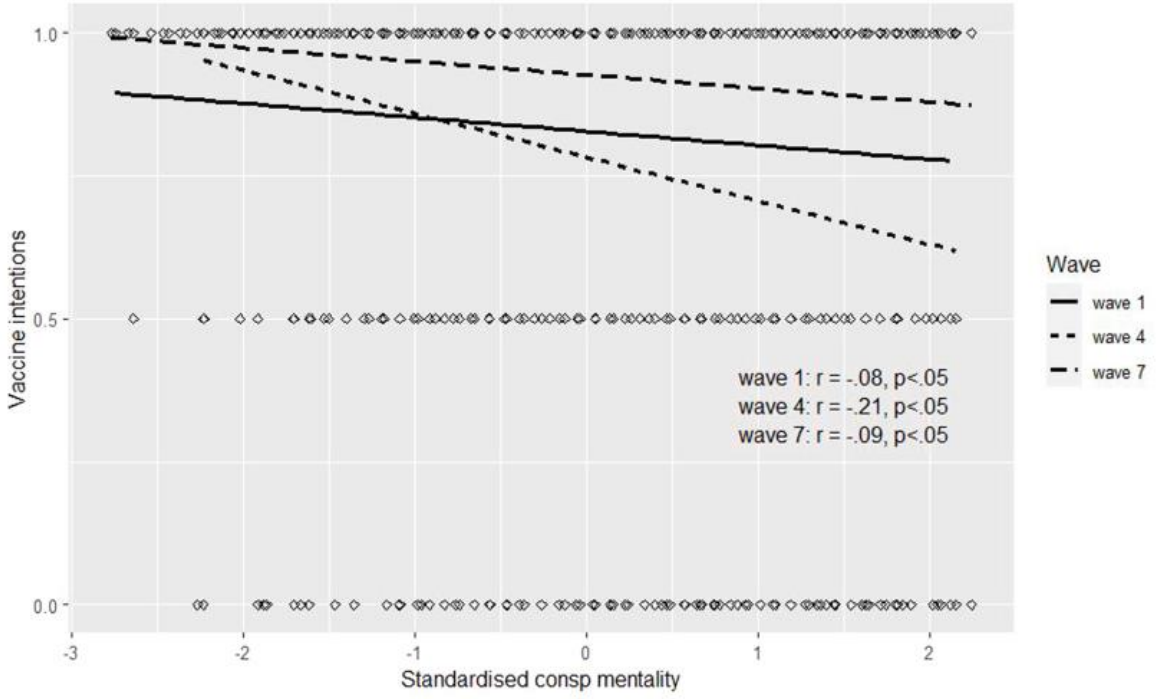
The analysis also revealed that time points, reflecting various social events during the pandemic, moderated the strength of the correlation between conspiracy mentality and vaccine intentions, where the strongest correlation occurred at wave 4 (see Table 1). The strongest effect of conspiracy mentality led to the lowest vaccine intentions at wave 4, whereas the highest vaccine acceptance occurred at wave 7 (see Figure 2). Supporting analysis also revealed a significant difference ($F(2,737) = 76.67$; $p < .05$) in conspiracy mentality across the three waves but the highest levels of conspiracy mentality occurred at wave 1 ($M = 34.95$; SD = 9.30), followed by wave 7 ($M = 32.62$; SD = 9.99) with the lowest conspiracy mentality at wave 4 ($M = 30.89$; SD = 11.08). Hence, the increased effects of conspiracy mentality at wave 4 is not in line with changes in conspiracy mentality over time. Further explorations of this result will be discussed in the discussion section. Using Model 2, the levels of vaccine intentions can be predicted by fixed predictors, the interaction between time points (X), conspiracy mentality (Z), and random errors (ϵ):

$$\text{Vac\_intentions (Y)} = .73 + (2.05*X) + (-.17*Z) + (-.32*X*Z) + \epsilon$$

Figure 3. 3

Linear model describing the strength of the correlation between conspiracy mentality and vaccine intentions at three-time points

Note: Vaccine intentions described with dummy coding where 0 = no; 0,5 = maybe and 1 = yes



4.4 Discussion

4.4.1 Longitudinal analysis of conspiracy mentality and vaccine intentions

This study captures three important pieces of evidence by using longitudinal data. First, the percentage of people expressing positive vaccine intentions varied across 22 months and, in general, vaccine acceptance increased over time during the pandemic from March 2020 to December 2021. However, there was an increase in vaccine hesitancy and vaccine refusals in December 2020, measured at wave 4. Second, the levels of conspiracy mentality in participants were mainly stable across the three-time points but, nevertheless, the magnitude of their impact on vaccine intentions was different at the three-time points. Third, vaccine

intentions at each follow-up time point were influenced by conspiracy mentality and vaccine intentions at the previous time point. These findings confirmed previous longitudinal analysis showing that conspiracy mentality has a longitudinal effect influencing vaccine hesitancy (Coelho et al., 2022a; van Prooijen & Böhm, 2023) but add to previous findings by showing that this effect is contingent on social contexts. This observation has implications for future pandemics, and the design of strategies for monitoring vaccine perceptions and identifying the effectiveness of public health communication strategies, facilitating effective interventions to encourage people to get vaccinated.

4.4.2 Social events influence the correlation between conspiracy mentality and vaccine intentions

The findings from this study reveal the different strengths of correlation within similar participants at three-time points. In December 2020, conspiracy theories became more important to people when evaluating vaccine efficacy even though the mean levels of conspiracy mentality at this point was the lowest in the period of study. We expect that different social events influenced the strength of the correlation by encouraging participants to be ecologically adaptive to situational factors.

Events occurred during March 2020 and December 2020 that caused UK citizens to draw more on conspiracy theories when evaluating the vaccine. Rapid changes of lockdown policies may have led to feelings of uncertainty that prompt more reliance on conspiracy theories (Pertwee et al., 2022). At the time, there were also some public criticisms of the UK's rapid approval of COVID-19 vaccines, including by the Chief Medical Advisor to the US President, Dr Anthony Fauci, who later retracted his remarks (Henley, 2020). Conflicting arguments between scientific advisors and the UK government regarding the decision to restrict social movements during Christmas in December 2020 was another event that may

have encouraged people to be more influenced by conspiracy theories (Shead & Ellyatt, 2020; Stewart et al., 2020).

4.5 Limitations

Despite the empirical insights provided by the data, this study has limitations. First, our attrition analysis revealed the significant differences between complete and incomplete responders, such that incomplete responders may have had different vaccine intentions and levels of conspiracy mentality. Second, measures of vaccine intentions only relied on single items with categorical options. MacDonald (2015) has argued that measures of vaccine intentions or vaccine hesitancy should assess three dimensions of complacency, confidence, and convenience. Third, the study could only utilise the data from three-time points from seven waves of data collection.

4.6 Conclusion

Specific social events experienced during the pandemic period may have bolstered the plausibility of vaccine conspiracy theories, particularly in the case of those with high conspiracy mentality. This effect likely generated different correlational strengths between conspiracy mentality and vaccine intentions in the same participants at the three time points. Despite public communications by health service providers intended to clarify the fact that COVID-19 vaccine was safe, these attempts to contrast *myth vs fact* may not always have been effective, as previous research has shown that these efforts can lead to backfire effects (Pluviano et al., 2019). The findings from this study offer a fresh perspective for understanding the impact of a conspiracy mindset. Rather than focusing on how conspiracists perceive reality, and attempting to change the way they think, a more effective approach to

reducing vaccine hesitancy may be to focus on creating supportive social environments for people who are considering whether or not to be vaccinated (Brewer et al., 2017).

Chapter 5

Re-examining the effect of inoculation messages on vaccine conspiracy attitudes: A conceptual replication of Banas et al (2023)

From study 1 to study 3, we observed significant correlations between three types of conspiracy beliefs, general conspiracy, vaccine conspiracy and conspiracy mentality with vaccine intentions. Those mean, individuals who endorse and believe in conspiracy theories may have greater likelihood to avoid vaccinations. In study 4 (Chapter 5), I focus on the strategy to generate resistance to vaccine conspiracy theories by replicating Banas et al. (2023) study.

Contributions: I designed the study and approved by Tom Stafford and Richard Bentall as my primary supervisors. This was a conceptual replication study with conspiracy mentality as the auxiliary variable. I recruited participants and analysed the data. I wrote the chapter. Tom Stafford and Richard Bentall provided feedback on the draft. I was supported by Beasiswa Pendidikan Indonesia Kemendikbudristek – LPDP & Balai Pembiayaan Pendidikan Tinggi (BPPT) Kemdikbudristek, providing research grant for this study.

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Abstract

This is the second study to attempt replication of Banas et al (2023) on inoculation messages. The original experiment demonstrated that inoculation messages could foster resistance to anti-vaccine conspiracy theories without significantly affecting motivational threat. However, using the same materials, Bessarabova and Banas (2024) reported significant effects on both variables. To re-investigate the effect of the inoculation scripts, we conducted a conceptual replication experiment in the UK. Our analysis found that the logic-based inoculation presented stronger factual content than fact-based and baseline scripts. Also, we failed to replicate the original findings: The inoculation treatment did not generate significant effects on motivational threat and MMR vaccine conspiracy attitudes. A few possible reasons are discussed in this study.

Keywords: Inoculation, communication, vaccine, conspiracy, mentality

5.1 Introduction

Vaccine conspiracy attitudes have been identified as one of the predictors of vaccine hesitancy (Jolley & Douglas, 2014; Milošević Đorđević et al., 2021; van Prooijen & Böhm, 2023). A few interventions have shown effective to reduce the likelihood to believe in conspiracy theories, such as priming analytical thinking task (Swami et al., 2014); debunking (Stojanov, 2015); narrative persuasion (Nera et al., 2018); pseudoscience class (Dyer & Hall, 2019), and inoculation messages (Banas et al., 2023; Banas & Miller, 2013). Among these, a recent systematic review found inoculation as the treatment with the strongest effect size with Cohen's *d* from *d* = .58 up to *d* = 1.31 (O'Mahony et al., 2023). Inoculation messages apply weakened counter arguments to stimulate resistance against future persuasive attempts (Banas & Rains, 2010; Compton, 2024). Unlike debunking that emphasizes more on direct refutational to counter fake news (e.g., the idea of vaccines cause autism is wrong, vaccines are safe), inoculation offers alternative view to pre-emptively challenge existing beliefs (e.g., *some people might argue that … is true, but they can be wrong because …*).

To specifically counter vaccine conspiracy theories, Banas et al. (2023) have demonstrated an application of inoculation theory to confer resistance against such beliefs. In their experiment, they applied fact-based and logic-based inoculation scripts to build resistance to conspiracy movie clip, Vaxxed. The inoculation treatments were administered prior to participants viewing Vaxxed: From Cover-up to Catastrophe, a vaccine conspiracy documentary movie. Each type of inoculation employed different approach in presenting forewarning and refutational content focusing on the director, producer and the main star of the movie, Andrew Wakefield. The fact-based script emphasized that Wakefield promoted false evidence to support a link between vaccine and autism, while the logic-based script highlighted logical fallacies presented in the movie clip. Both inoculation treatments

generated significant effects relative to control condition, however they were not significant to each other, $t(97) = .44$, $p > .05$.

Although Banas's study revealed significant findings, several factors motivated us to replicate their experiment. First, the study did not measure inoculation perception of the fact-based and logic-based scripts. Without these measures, it is unclear whether the two types of inoculation truly encourage participants to rely on factual evidence (fact-based) or logical reasoning (logic-based) when resisting from conspiracy persuasion. Second, the original experiment reported small effect size, $\eta^2p = .03$, on the impact of inoculation treatments, which based on the benchmarks from Richardson (2011), indicating only 3% of the variance in MMR conspiracy attitudes was explained by the treatment. Small effect size can be contributed from multiple factors, such as low statistical power, measurement error or high variability within group. In addition, this condition may generate another consequence, failures in replicating the original finding. Replication failures have been observed in various influential frameworks in psychology, including priming (Harris et al., 2013) and nudging (Roozenbeek et al., 2021).

Third, the inoculation treatments in the original experiment did not generate significant effects on motivational threat, served as a manipulation check variable. However, when the same inoculation materials were used by Bessarabova and Banas (2024), significant effects were found for both variables. Motivational threat reflects a psychological awareness to prompt individuals to defend their attitudes against upcoming persuasive messages (Banas & Richards, 2017). Unlike traditional threat which emphasize emotional reactions (e.g., fear) and physical safety of recipients, motivational threat is more cognitively oriented in responding to forewarning and refutational content, two essential elements of inoculation.

Motivational threat has stronger correlation with inoculation process and weaker correlation with fear, distinguishing it from traditional threat. Banas and Richard (2017) also provide empirical claims showing motivational threat as a mediating variable linking inoculation to reduce conspiratorial attitudes. Notably, Bessarabova and Banas (2024) observed larger effect sizes when inoculation treatment successfully influenced motivational threat.

To replicate the original study, we followed the same procedure and measured the similar key variables. The independent variable was the similar inoculation treatments, while the dependent variables were motivational threat and anti-vaccine conspiracy attitude. Two covariates also measured in this study: Involvement to the issue and pre-treatment anti-vaccine conspiracy attitudes. As an auxiliary measure, we assess inoculation perception after participants read either inoculation scripts or baseline (sushi) scripts, leading us to formulate hypothesis:

H1: Fact-based inoculation scripts will be perceived presenting stronger factual evidence than logic-based inoculation and baseline scripts.

The first hypothesis leads to our second hypothesis with two research questions focusing on the different effects of fact-based and logic-based inoculation scripts and how the treatments foster cross-protection effects.

H2: Inoculation treatment will reduce MMR vaccine conspiracy attitudes by first influencing motivational threat.

RQ1: How do the effects of logic-based inoculation treatments compare to fact-based inoculation treatments in their ability to confer resistance to conspiracy theories?

RQ2: Do inoculation treatments provide cross-protection effects to other specific conspiracy theories?

5.2 Method

We attempted to replicate Banas et al. (2023) study in 2024 by contacting John Banas requesting the original stimuli, an excerpt of Vaxxed and the baseline verbatim script about history of sushi. However, we did not receive a response from John Banas related to our request. As the second attempt, we contacted Elena Bessarabova in 2025 after completing the data collection. She responded in a helpful gesture to address our queries. A 40-minute excerpt of Vaxxed was obtained from a conspiracy community in Facebook. For the baseline condition, we applied similar approaches, by presenting participants with a page about the history of sushi taken from open-source article: https://www.sushisushi.co.uk/blogs/news/the-ancient-history-of-sushi.

5.2.1 Open science and pre-registered hypothesis

The hypotheses for this study were pre-registered prior to data collection at the School of Psychology, University of Sheffield. The pre-registration documents include study information, research design, sampling plan, study variable and the analysis plan-they are available at https://osf.io/f5zxd. Also, all study materials, including measurements, raw data and the inoculation materials are publicly accessible at https://osf.io/tfyvk/ to support reproducibility practices. The raw data have been anonymised to ensure confidentiality in compliance with the General Data Protection Regulation (GDPR), and no personal information uploaded to the OSF webpage.

5.2.2 Participants and data collection

We recruited 183 participants residing in the UK, exceeding the minimum sample size of n = 53 for each group, as determined by the power analysis based on a moderate effect size. Participants were recruited to join the study at University of Sheffield, Sheffield, UK between October and November 2024. Data collection was conducted in person at the university's computer laboratory, with four to five sessions every day from Monday to Friday. Interested participants can select their preferred schedule from a shared calendar set up with Calendly. In each session we could accommodate maximum 6 participants and lasted approximately 55 minutes. The first author served as the experimenter, providing assistance and responding to any queries before, during and after the sessions.

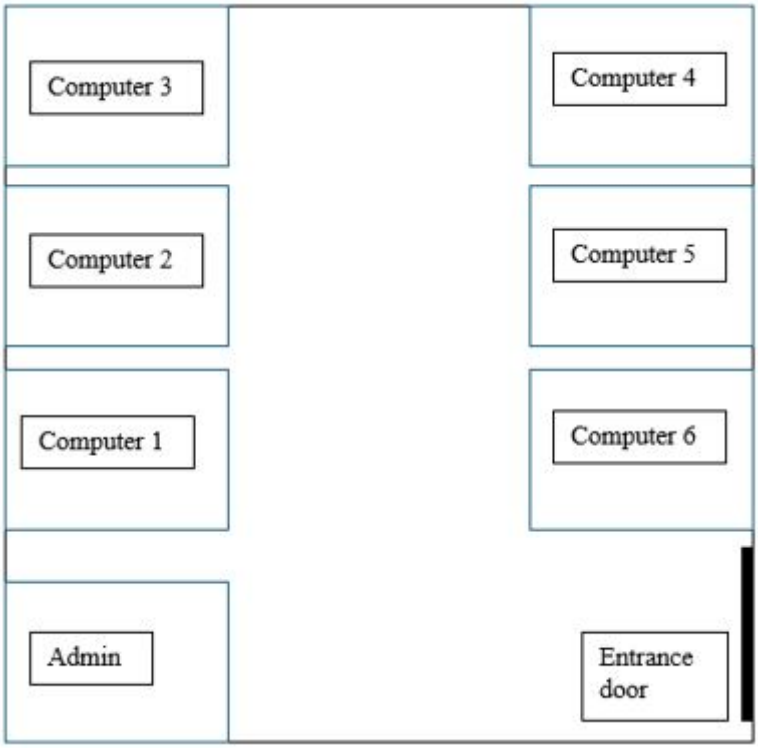


Fig 5.1. *Map of computer laboratory at School of Psychology, University of Sheffield used for the experiment.*

This study was advertised through multiple channels, including the university mailing list (i.e., MyAnnouncement), Facebook community, Instagram, and a few WhatsApp groups. The advertisement provided information about participant characteristics, overview of the study, study location and contact person. Participants were informed that the study would be about vaccine perception, and they could receive a £10 Amazon voucher upon completion. To note, the advertisement did not explicitly mention vaccine conspiracy theories. Interested participants could fill a Google form, where they could provide email address and phone number (optional). Recorded personal data was used solely to distribute the financial incentives. After completing the form, participants received a calendar invitation from the researcher, allowing them to select a preferred session time and date. We also recruited level-1 undergraduate students at the School of Psychology, University of Sheffield via online research participation system (SONA). Those who participated the study in full were granted with four academic credits.

In total, 176 eligible participants passed the attention check and were included in the final analysis. Following the procedures in Banas et al. (2023) and Bessarabova and Banas (2024), participants who strongly endorsed vaccine conspiracy beliefs, measured in phase 1 (n = 5) were excluded, consistent with the aim of the treatment as prevention strategies. Majority of participants were students with a mean age of 25.95 (SD = 8.36; age range = 18 – 56 years). Most of them held postgraduate degree (43.09 %), followed by undergraduate (32.59%) and A-level (23.20%). Over 71.82% of participants were females, and all of them lived in England. This study has been granted ethical clearance from University of Sheffield in September 2024 (Ref: 059761).

5.2.3 Data quality measures

To ensure data quality, we relied on several criteria. Participants were removed from the analysis if they (a) scored high on phase 1 vaccine conspiracy attitudes (above the median threshold of 30), (b) failed attention check items, or (c) had prior exposure to conspiracy-related movie, particularly the movie Vaxxed: From cover-up to catastrophe. To minimise potential bias that could arise from asking about one movie, participants were also asked about their experience with three conspiracy-related movies. The primary screening question was: "*Have you watched a documentary movie named "Vaxxed: From Cover-up to Catastrophe*"? Two attention check questions employed in this study were: "*Some people are not aware of their responses while doing the survey. Please show us that you are still paying attention here by choosing "Yes" in the option*" asked in phase 1 and "*please enter 323 into the box below*" asked in phase 3. Participants who failed these checks, reported prior viewing of Vaxxed, and had a technical issue with the informed consent were excluded from the analysis.

5.2.4 Experimental procedure

This study followed the procedure from Banas et al. (2023), incorporating two experimental groups and one baseline group. Prior starting the experiment, the experimenter provided a brief introduction of the study, which included the layout of the room, estimated duration, and the use of computer. We used Qualtrics to randomise participants, present the stimuli and measure the study variables. In the first phase, participants completed an informed consent which addressed the study's objectives, duration, open access data, funding information, and mechanism to raise complaints. Following this, participants answered a series of demographic questions (i.e., age, gender, educational background, and place to live), a single

item measuring anti-vaccine conspiracy beliefs, a brief measure of involvement in vaccine-related issues and three questions assessing vaccine-related documentary movies.

Moving to phase 2, participants were randomly assigned to one of three conditions using Qualtrics: A fact-based inoculation group, a logic-based inoculation group, or a baseline group (received the history of sushi script). To ensure all participants engaged with the assigned script, an 80-second (1.34 minutes) time lock was set up before the "Next" button became visible, preventing premature advancement. Following this, participants completed two scales to assess inoculation perceptions and motivational threat.

In phase 3, participants viewed a 40-minute excerpt from a conspiracy movie *Vaxxed: From cover-up to catastrophe,* from the total runtime of 1.5 hours. A control mechanism was implemented, requiring participants to remain on the clip for the full 40 minutes before the "Next" button appeared. After watching the clip, they completed questionnaires measuring MMR vaccine conspiracy attitudes and other specific conspiracy beliefs (i.e., Agenda 21 conspiracy, chemtrails conspiracy, FEMA conspiracy and Illuminati). At the end of the session, participants were presented with a complete debriefing page describing the true aim of the study, empirical evidence supporting the safety of MMR vaccines, and a link to access general practitioners (GP) via National Health Service (NHS) website.

5.2.5 Inoculation stimulus

Participants assigned to experimental conditions received identical inoculation scripts which applied in Banas et al. (2023) and Bessarabova and Banas (2024). The inoculation scripts began with forewarning as an introduction, informing participants that they would view a movie describing about the alleged adverse effects of the MMR vaccine. The forewarning in

the script was designed to stimulate a sense of motivational threat, prompting participants to critically evaluate the claims made by the actors and the efficacy and safety of MMR vaccines. The forewarning statement applied in both logic-based and fact-based scripts are: "*The film attempts to persuade you that the director, producer, and star of the movie, Andrew Wakefield, has discovered a link behind the measles, mumps, rubella vaccination (MMR) and autism*".

To counter the claim that MMR vaccines cause autism, the inoculation scripts contained a refutational preemption. Based on the prior studies, logic-based and fact-based inoculation applied distinct approaches in building refutation arguments (Banas et al., 2023; Banas & Miller, 2013). Logic-based inoculation encourages participants to engage in analytical thinking to identify flaws, while fact-based inoculation presents factual evidence to resist misinformation. A short version of the logic-based refutational preemption can be tracked from these statements: "*Aside from the credibility of Andrew Wakefield, think about how outlandish the conspiracy theory really is. They claim that the Centre for Disease Control has conspired with pharmaceutical companies to harm children for profit, and that medical researchers from around the world are just going along with it?*" and for the fact-based: "*Vaxxed attempts to support the fraud conspiracy through William Thompson, a CDC scientist who was critical of a 2004 study that failed to establish any link between the MMR vaccine and autism. There are two problems with this segment of the film. One, as the conspiracy grew, William Thompson also came forward with a public statement to make "absolutely clear" that he believes vaccines save lives and that he would never advise a parent not to vaccinate*". For the baseline condition, participants read a neutral script about the history of sushi.

Logic-based and fact-based inoculation scripts have been previously applied to counter 9/11 conspiracy theories (Banas & Miller, 2013). This study showed consistent results in how participants perceived each treatment. The fact-based inoculation script was perceived presenting stronger factual evidence than logic-based, $F(1, 90) = 11.50$, $p = .001$, $\eta 2 = .11$. On the contrary, the logic-based script was perceived as providing stronger logical reasoning, $F(1, 90) = 5.80$; $p < .05$, $\eta 2 = .06$. Overall, the fact-based script showed to be more effective in building resistance to 9/11 conspiracy theories, ($F(1, 115) = 5.23$, $p = .02$, $\eta 2 = .04$).

5.2.6 Scales to measure study variables

In phase 1, we measured anti-vaccine conspiracy theories using a single item which participants responded to the statement, "*vaccinations cause autism*" on a 9-point bipolar scale (1 = strongly unfavourable to 9 = strongly favourable). Involvement with vaccination issues was assessed by asking participants to rate their interest in two topics: (1) "*Vaccines cause autism"* and (2) *"vaccines cause injury and death*" also with 9-point bipolar scales (e.g., 1 = strongly irrelevant to 9 = strongly relevant). Following these, prior experiences in watching vaccine conspiracy-related movies were assessed with a question: *Have you watched a documentary movie named Vaxxed: From cover-up to catastrophe?* with two response options coded as "Yes" or "No".

In phase 2, we employed four manipulation check items administered after participants finished reading the scripts. These items assessed two dimensions: Logic-based (i.e., *I can sense the logical analysis provided by the author in the page* and *the page stimulates my critical thinking to counter vaccine misinformation*) and fact-based (i.e., *The message mainly relies on evidence to refute vaccine misinformation* and *concrete data are shown to provide empirical explanation in the page*) inoculation perceptions. All items used Likert scale from 1

(strongly disagree) to 7 (strongly agree). Two logic-based items emphasized relevant keywords, such as "logical analysis" and "critical thinking", while in fact-based items, we used "evidence" and "concrete data" as the keywords. These measures were adapted from Banas and Miller (2013) to assess inoculation perception related to 9/11 conspiracy theories. To assess motivational threat, we used Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Those items were: "*I want to defend my current attitudes from attack*" and "*I feel motivated to think about why I hold the beliefs I do about vaccinations cause autism*".

In phase 3, we measured MMR vaccine conspiracy attitudes and four specific conspiracy theories: Agenda 21, Chemtrails, FEMA and Illuminati. We prompted participants with a specific proposition: "*MMR vaccines cause autism"* which they could respond to this using bipolar scale ranging from 1 (e.g., wrong) to 9 (e.g., wise). Participants also evaluated four specific conspiracy theories. Example of these items are: "*Agenda 21 as the conclusion from UN conference on Environment & Development will support totalitarian world government* " and "*Illuminati is a shadow group that consist of doctors, politicians, actors and musicians where they have a purpose to control the world"*.

5.2.7 Statistical analysis

As the first step of our analyses, we conducted a principal component analysis (PCA) to convert raw scores into component scores, weighted proportionally to the principal component score. The transformation was employed to reduce dimensionality and mitigate potential multicollinearity issues in the dataset. The new scores were standardized with the approximate range from -3 to +3, with mean = 0 and SD = 1. Following this, we performed a correlation matrix with the converted scores to examine associations among study variables. Two correlational methods were employed in this phase: Point-biserial correlation to identify

correlation between categorical (inoculation) and continuous variables (study variables) and Pearson correlation for both continuous variables.

We applied analysis of variance (ANOVA) to test the first hypothesis, examining difference of inoculation perception among sub-groups. To test the primary hypothesis and answer two research questions (RQ1 and RQ2), we performed two separate multivariate analyses of covariance (MANCOVA). The first MANCOVA included motivational threat and anti-vaccine conspiracy attitudes as the dependent variables, while in the second MANCOVA, we replaced the dependent variables with four specific conspiracy theories (i.e., Agenda 21, Chemtrails, FEMA and Illuminati).

5.3 Result

5.3.1 Inoculation perception

Inoculation perception was measured using four attitudinal scale items consisting of two dimensions: Logic-based and fact-based perceptions. Table 1 shows the average of the raw scores and the standard deviation in the two dimensions among sub-groups calculated with raw scores from the dataset. Our scales revealed that the logic-based inoculation script was perceived as prompting more logical reasoning compared to the other two scripts, $F(2, 173) = 51.07$; $p < .05$. On the contrary, fact-based that should promote strongest empirical fact, did not demonstrate this as clearly, $F(2, 173) = 43.43$; $p < .05$.

Table 5. 1

Mean and SD for inoculation perception among three groups

	n	Mean fact-based perception (SD)	Mean logic-based perception (SD)
Fact-based group	66	10.09 (2.67)	11.18 (2.14)
Logic-based group	55	10.34 (2.66)	11.54 (2.20)
Sushi group	55	5.96 (3.08)	7.45 (2.78)

5.3.2 Correlation between study variables

We created two coding categories for inoculation: 0 for sushi group and 1 for logic-based and fact-based inoculation group, to perform point-biserial correlation. These categories were created based on the original's study finding that found no significant differences between the two inoculation types (Banas et al., 2023). The overall correlation between inoculation and all study variables showed identical pattern with the original study. Significant coefficients occurred between inoculation and P3 MMR vaccine conspiracy (r = -.15; $p < .05$), yet no significant correlation observed between inoculation and motivational threat (r = -.01; $p > .05$). Unlike the original study which observed significant correlation between motivational threat and P3 MMR vaccine conspiracy attitudes, our analysis did not replicate this pattern. We presumed this discrepancy to non-significant correlation between inoculation and motivational threat in our dataset.

Table 5. 2

Correlation among study variables with PCA scores

	1	2	3	4	5	6	7	8	9
1. Inoculation Treatment	1								
2. Involvement	.04	1							
3. Anti-vax Conspiracy Attitudes, P1	.07	-.24**	1						
4. Motivational Threat	-.01	-.10	.01	1					
5. Anti-vax Conspiracy Attitudes, P3	-.15*	-.18*	.29**	.01	1				
6. Agenda 21 Conspiracy Attitudes	.04	-.07	-.09	-.10	-.31**	1			
7. Chemtrails Conspiracy Attitudes	-.11	-.06	.36**	-.08	.44**	-.29**	1		
8. FEMA Conspiracy Attitudes	.04	.02	.20**	-.01	.35**	-.48**	.35**	1	
9. Illuminati Conspiracy Attitudes	-.09	-.09	.31**	.00	.42**	-.37**	.61**	.45**	1

Note. P1 describes the data collected in phase 1 and P3 collected in phase 3

Correlation analyses were conducted using component scores

***Significance at 99% confidence interval (CI)*

**Significance at 95% confidence interval (CI)*

5.3.3 Inoculation, motivational threat, and conspiracy attitude

The first MANCOVA found no significant multivariate effects for inoculation, Wilk's Λ = .97, $F(4, 340) = 1.30$; $p > .05$, nor for involvement to the issue, Wilk's Λ = .97; $F(2, 170)$ = 2.03; $p > .05$. Only the initial attitude on vaccine conspiracy found significant, Wilk's Λ = .90; $F(2, 170) = 8.47$; $p < .05$. This result was distinct from the original study which showed significant effect of involvement as one of the covariates.

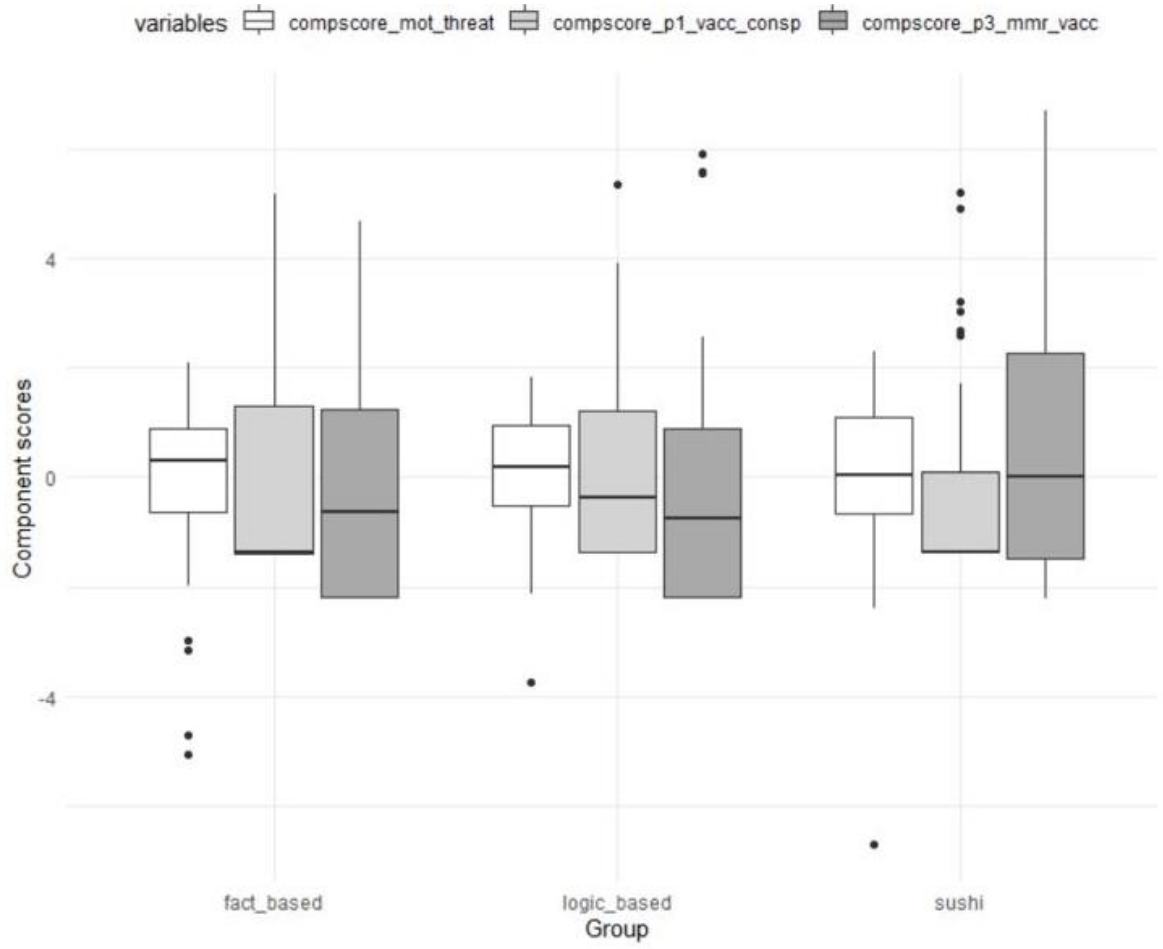
As a follow up analysis, we conducted separate ANCOVAs from the previous multivariate model. Our results showed no significant univariate effects of inoculation in affecting motivational threat, $F(2, 171) = .20$; $p > .05$. Both covariates —initial attitudes on vaccine conspiracy theories ($F(1, 171) = .02$; $p > .05$) and involvement to vaccination issues ($F(1, 171) = 1.80$; $p > .05$) —also generated non-significant results in influencing motivational threat. Related to MMR vaccine conspiracy attitudes assessed after participants being exposed with conspiracy movie Vaxxed, the inoculation treatments also provided non-

significant univariate effects, $F(2, 171) = 2.42$; $p = .09$. The covariate, initial vaccine conspiracy attitudes was found significant in predicting MMR vaccine conspiracy attitudes with $F(1, 171) = 17.02$; $p < .05$, whereas involvement was not, $F(1, 171) = 2.25$; $p > .05$. These results were contrasted with the original study, which showed significant effects of on MMR vaccine conspiracy attitudes. Perhaps, non-significant results of MMR vaccine conspiracy attitudes were due to the inoculation scripts fail to sufficiently motivate participants to defend their attitudes against the upcoming persuasive attacks. Figure 2 describes the median scores across all three subgroups, showing that the logic-based and fact-based conditions had numerically lower scores than baseline condition. However, overlapping interquartile ranges indicate that the differences among the three groups were not statistically significant.

To answer RQ1, we conducted a t-test to compare the effect of the two inoculation scripts: Logic-based and fact-based conditions, in influencing MMR vaccine conspiracy attitudes. Our results observed no significant difference in MMR vaccine conspiracy scores between logic-based and fact-based groups, $t(119) = .66$; $p > .05$. As illustrated in Figure 2, the median scores for both conditions were identical, with overlapping interquartile ranges.

Figure 5. 2

Boxplots comparing the levels of motivational threat (white) and vaccine conspiracy attitudes measured in phase 1 (light grey) and phase 3 (grey) among three sub-groups



Finally, to examine whether the inoculation treatments provide cross-protection effects in conferring resistance against four different types of conspiracy theories, we conducted second MANCOVA, replacing the dependent variables with Chemtrails, FEMA, Agenda 21 and Illuminati conspiracy attitudes. Initial vaccine conspiracy attitudes and involvement also entered as the covariates. We observed significant multivariate effects for initial attitudes, Wilk's $\Lambda = .82$; $F(4, 167) = 9.08$; $p < .05$ and MMR vaccine conspiracy attitudes measured in phase 3, Wilk's $\Lambda = .79$; $F(4, 167) = 10.98$; $p < .05$. However, multivariate effects of involvement Wilk's $\Lambda = .97$; $F(4, 167) = 1.21$; $p > .05$ and inoculation Wilk's $\Lambda = .95$; $F(8, 334) = 1.01$; $p > .05$ were not significant. Our univariate analysis also showed non-significant

inoculation effects in protecting participants from Chemtrails, $F(2, 170) = 1.51$, $p > .05$; FEMA, $F(2, 170) = .34$, $p > .05$; Agenda 21, $F(2, 170) = .95$, $p > .05$ and Illuminati, $F(2, 170) = .90$, $p > .05$ conspiracy theories. Consistent with the original study, our replication did not observe cross-protection effects of vaccine inoculation scripts on these conspiracy theories.

5.4 Discussion

Inoculation message is considered as an effective communication strategy to foster resistance against conspiracy theories, including vaccine conspiracy. Unlike debunking methods, inoculation presents weakened-counter arguments, stimulating motivational threat to refuse upcoming persuasive arguments (Compton, 2024; Pfau et al., 1990; Pfau & Burgoon, 1988). Banas et al. (2023) have demonstrated these effects those, engaging participants to read specific inoculation scripts, could reduce the likelihood to be influenced by conspiracy-related media. However, as mentioned earlier, their study had several limitations. First, the treatment failed to generate significant effects on motivational threat, but when the same materials were applied again by Bessarabova and Banas (2024) study, they yielded significant effects. Second, the original study reported small effect size. Third, no scales provided to measure inoculation perception of logic-based and fact-based. Our study aimed to re-check the hypothesis and the strength of the treatment with conceptual replication design.

In overall, we found no significant effects of Banas's inoculation scripts on motivational threat and MMR vaccine conspiracy attitudes, indicating failures to replicate the original experiment. Several potential factors may account for this non-significant result. First, our study observed an incongruent perception for the two inoculation scripts, logic-based and fact-based, developed by Banas. The fact-based inoculation script did not emphasize strong

evidence, yet relying more to logical reasoning. While Banas and Miller (2013) demonstrated that presenting participants with logic-based and fact-based inoculation generated distinct effects on 9/11 conspiracy attitudes, the original study showed no significant impacts. Yet, this incongruent may introduce confusion, potentially weakening the inoculation effect.

Second, our study was conducted by recruiting UK participants, who may not be familiar with important entities in the movie, such as Centre for Disease Control (CDC), a US government agency portrayed as conspiring with pharmaceutical industries to cover up the danger of MMR vaccines. While UK participants shared a similar language, their social and cultural contexts may differ, potentially shaping their perceptions of institutional trust and reducing their conspiratorial attitudes. To note, Milošević Đorđević et al. (2021) mentioned subjective and objective knowledge serve as important mediating variables in explaining the effect of vaccine conspiracy theories on vaccine attitudes. Perhaps, cultural differences played a role as the factor that influence them to defend their attitudes, not the inoculation treatments that exposed before viewing the clip. This possibility could also apply to participants in the baseline condition, who may have relied on cultural attitudes while watching the clip.

The original study highlighted the need to refine motivational threat scales. This scale was constructed and published in 2017 by Banas and Richards (2017), to refine the previous conventional threat scales. This study demonstrated that motivational threat was less strongly correlated with fear than conventional threat and served as a significant mediator between inoculation and conspiratorial attitudes. A subsequent replication study by Bessarabova and Banas (2024) employed similar motivational threat scales and reported significant outcomes. Thus, we do not view the idea to refine the scale as a necessary action. Rather, we still

consider motivational threat as the valid scale to assess the strength of inoculation. The scale can capture psychological awareness stimulated after presenting participants with the weakened counterargument, explaining the cognitive response to defend current attitudes from upcoming persuasive attacks. Instead of refining the scale, we propose including pilot testing to initially check the effect of the treatment prior applying those in the main experiment and detect potential problems in early stage.

We also found another study that reported identical results with the original experiment, no significant effects on motivational threat, yet the inoculation treatment successfully stimulated less reactance to persuasive health messages (Richards & Banas, 2015). In explaining non-significant results, they argued, perhaps, motivational threat does not serve as an assessment of induction, but rather of psychological states that aroused by the message variation. However, we have distinct perspective about this. We argue that motivational threat remains promising as the manipulation check, capable of indicating the strength of the inoculation message in fostering resistance against persuasive arguments. In experimental designs, manipulation checks could support researchers to indicate the true effect of the treatment and control the validity of the study (Fiedler et al., 2021). They help to maintain the logical premise of H: delta Y → delta X, where the shift of the dependent variable (delta Y) occurred due to the shift of the independent variable (delta Y), not by other variables. In our case, motivational threat scales may offer an insight whether the defending attitudes against conspiracy theories are generated from the inoculation treatment itself, rather than from the prior attitude or cultural perceptions. Even though Hauser et al. (2018) warned that manipulation check could disrupt the effect of independent variables through hypothesis guessing or specific emotional reactance, this limitation can be anticipated with pilot testing. Perhaps, the placement of motivational threat as manipulation checks influenced participants

becoming more attentive to vaccine issues, including in the baseline group, and subsequently affecting their attitudes to response upcoming persuasive information. Pilot studies would allow researchers to decide the most effective placement of the manipulation check (e.g., before or after the dependent variable) and make adjustment to the procedure.

Although the primary result of this study was contradictory with the original experiment, the findings related to cross-protection shared similar results, non-significant outcomes. To generate cross-protection effects, participants must apply the logical reasoning, acquired through logic-based inoculation, to response other conspiracy theories. We argued that non-significant effects did not occur due to both logic-based and fact-based failed to generate medium or strong effects. Another plausible reason to explain this may be content contamination and surplus meaning from specific conspiracy theories (Imhoff et al., 2022). This means, endorsement of vaccine conspiracy theories may reflect diverse meanings, such as misinformation, institutional mistrust, in-group identity or feeling of apathetic, rather than directly reflecting conspiracy mindsets. While specific conspiracy theories can be identified as a symptom of conspiracy mentality, these two variables are distinct. Specific conspiracy theories are related to low cognitive stability and defensive ingroup identity while conspiracy mentality may not. Our results provided supporting evidence that inoculation should be designed with context-specific approach to generate significant effects.

5.5 Conclusion

Although we failed to replicate Banas et al. (2023), this study provided a valuable contribution to inoculation theories and reflects empirical insights for designing future studies. In addition, we could not test our auxiliary hypothesis as preregistered due to non-

significant outcomes of the inoculation treatment. First, our study highlighted the potential influence of social and cultural perceptions as the factors that influence responses from participants, in our case, when participants viewed the conspiracy movie clip exposing US contexts. This suggests that social and cultural perception may moderate the effect of inoculation treatments. Second, our study underlines the importance of pilot studies prior to the main experiment. Pilot studies enable researchers to assess some key aspects of the study, identify potential challenges in measuring variables and determine the optimal timing and placement of manipulation checks.

Chapter 6

General discussion and conclusion

This Chapter summarise all results from all studies and provide general discussion related to lesson learned and empirical contribution from those. I also include potential future research plan that can be conducted to further elaborate the association between vaccine conspiracy theories and vaccine hesitancy.

Contributions: I wrote the Chapter. Tom Stafford and Richard Bentall as my primary supervisors provided feedback on the draft.

This chapter reflects the main research aims, how they can be addressed by the projects, key findings from our studies, implications of the studies, and general limitations of the study. I also review the main findings achieved from four individual projects, starting from study 1 to study 4. This chapter attempts to synthesize the empirical contribution from every study and summarise those into practical implications. Some limitations of the study are also addressed in this chapter as an insight to improve future research.

6.1 Research aims and overview of the findings

The aim of this thesis was to explore the association between conspiracy theories and vaccine intentions and identify potential communication strategies to stimulate resistance to vaccine conspiracy theories. Even though numerous studies have identified significant correlations between the two variables, most of them rely on cross-sectional designs which limit causal inferences. In this thesis, I utilised multi-method approaches investigating the association between study variables, such as experimental and longitudinal analyses. Experimental designs allow scholars to obtain more robust evidence by establishing causal inference, while longitudinal designs are capable of tracing the alteration of conspiracy and vaccine attitudes from similar participants over time under different conditions. The final study in this thesis also re-examined the effect of inoculation messages as the potential strategy to foster resistance to vaccine conspiracy theories.

Many studies across countries have identified conspiracy beliefs as a significant predictor of vaccine hesitancy (L. Chen et al., 2021; Jolley & Douglas, 2014; Milošević Đorđević et al., 2021), demonstrating that increases in conspiracy theories is associated with greater vaccine

hesitancy. Propositions offered by anti-vaccine conspiracists are not always harmful, they can be unique and stimulate excitement, showing the vaccine-related stakeholders as conspirators. For example, the proposition of "*Bill Gates invented a tiny chip within the COVID-19 vaccine*" is less harmful compared to "*COVID-19 vaccines cause injury and death*". Most conspiracy theories, including vaccine conspiracy, propose simplistic attributional arguments, explaining the potential causes of unresolved societal events. Although no specific pattern is proposed by the theory, some people endorse them due to their unsophistication. Also, the epistemic motive, the desire to seek for any possible causal inference, is a potential factor explaining why some groups rely on conspiracy theories (Douglas et al., 2017).

According to WHO, vaccine hesitancy was identified as one of the major public health issues worldwide (World Health Organization, 2019). Multiple factors, including mistrust, fear, and accessibility contribute as the factors influencing people to avoid vaccinations. Vaccine conspiracy theories play a role as a factor that is most associated with vaccine mistrust. Studies in this field have applied several frameworks to investigate why individuals endorse conspiracy theories to evaluate vaccines. A rabbit hole hypothesis, one of those frameworks, was introduced by Sutton and Douglas (2022), offering a concept that many conspiracy theories presented as appealing arguments rather than harmful. By perceiving those, people can be attracted to the proposition and not fully aware about the confirmation bias. In the case of vaccine conspiracy, this phenomenon can occur in societies and alter individuals to evaluate vaccines negatively.

This thesis explores three types of conspiracy beliefs–vaccine conspiracy beliefs, general conspiracy beliefs and conspiracy mentality–in predicting vaccine hesitancy. Study 1 aimed

to provide empirical evidence on the nature of anti-vaccine conspiracy beliefs using expressive responding frameworks throughout experiments. We manipulated the degree of institutional trust among participants with two distinct vignettes. Significant interactions were expected to occur between institutional trust and vaccine conspiracy beliefs, demonstrating that vaccine conspiracy beliefs were the symptom of low trust and influenced vaccine attitudes. Data collection was conducted in 2022 during the COVID-19 pandemic. Unfortunately, we could not test the hypotheses due to non-significant effects of our treatments. Despite this limitation, we found a negative correlation ($r = .80$; $p < .05$) between anti-vaccine conspiracy and vaccine intentions, indicating that increases in conspiracy theories was associated with higher vaccine hesitancy.

In study 2, we elaborated the correlation between conspiracy mentality and vaccine intentions with longitudinal panel data. We used the data from the C19PRC project initiated by the University of Sheffield, in collaboration with Ulster University, University of Liverpool, University College London and Royal Holloway University of London. The project consisted of eight waves data collection starting from March 2020 to May 2022. For this study, we utilised the data in three waves: Wave 1 (March 2020), wave 4 (December 2020), and wave 7 (December 2021). The project provided panel data involving similar participants across three waves. This study identified two key findings: (1) prior vaccine attitudes significantly predicted conspiracy mentality and (2) the strength of the association between conspiracy mentality and vaccine intentions varied across different conditions. The strongest association emerged in December 2020, indicating the initial rollout of COVID-19 vaccination programs. During this moment, the UK public faced a realistic decision–whether to accept or refuse COVID-19 vaccines–despite ongoing debates about vaccine safety. These findings suggested

that the effect of conspiracy mentality could be more severe, even though the degree of conspiracy mentality remained stable over time.

Study 3 was conducted to re-test the study 2 hypotheses with non-experimental methods. Building from the data from the TISP Many Labs project–a large-scale survey involving 68 countries and 71,922 participants–we analysed the data from Indonesia and Malaysia to test the similar hypotheses. From this analysis, we observed significant interactions between anti-vaccine conspiracy beliefs and two dimensions of trust in scientists: Openness and benevolence. The correlation between these variables was stronger in low trust groups. On the contrary, no significant interaction occurred when we replaced the predictor to general conspiracy beliefs. Although causal inferences could not be established through this analysis, this study indicated the symptom of confirmation bias within vaccine conspiracy beliefs, but not for general conspiracy. From these, we propose that general conspiracy beliefs reflect the true commitment of conspiracy theories, whereas anti-vaccine conspiracy theories may emerge in response to misinformation.

Study 1 to 3 attempted to elaborate the association between conspiracy beliefs and vaccine hesitancy, identifying several factors that may influence the strength of the correlation. In study 4, we re-examined the effect of inoculation messages as a promising communication strategy to foster resistance to conspiracy theories. Inoculation messaging is a communication strategy, providing threat and refutational preemption as the weakened counter arguments, to enhance resistance against persuasion (Banas & Richards, 2017; J. Compton, 2024). The aim of this replication was to build a stronger empirical claim on inoculation messages and how this strategy can be improved to counter conspiracy theories. Findings from this study

showed no significant effects of inoculation messaging on MMR vaccine conspiracy attitudes. Although the findings were distinct from the original study, this study generated a novel contribution where motivation threat was the key variable in activating the sense of countering the opposing arguments.

In general, four research projects in this thesis provided some novel findings. First, conspiracy mindset and vaccine conspiracy theory can become more important in certain time periods to evaluate vaccinations, particularly when people encounter crises. Second, evidence from study 1 to 3 support the presumption of conspiracy theories as mental shortcuts, when they are available, individuals can apply those to make sense of social realities, particularly when no objective information provided. Conspiracy theories provide a simple solution and a few of conspiratorial arguments, they can be classified as appealing rather than harmful (van Prooijen, 2022). Third, vaccine conspiracy theories may appear due to misinformation, not always a reflection of conspiracy mindsets. Individuals can endorse vaccine conspiracy theories without believing the true proposition of conspiracy theories.

Taken together, results from these studies provide empirical evidence in elaborating the association between conspiracy theories and vaccine hesitancy and replicating the effect of inoculation treatment to foster resistance against vaccine conspiracy theories. This evidence may support scholars, practitioners, and policymakers to comprehensively identify the characteristics of vaccine conspiracy theories and how this belief influences vaccine hesitancy. Aside from the empirical chapters, insights from the theoretical chapter (literature review) can also respond to the question on why some individuals endorse conspiracy theories.

6.2 Anti-vaccine conspiracy theories and confirmation bias

A study conducted by van Prooijen and Böhm (2023) examined the correlation between conspiracy beliefs and vaccine attitudes using longitudinal data, showing that prior vaccine attitudes significantly predicted vaccine conspiracy beliefs at later time points. These findings may support our proposition on vaccine conspiracy beliefs as an attitude to justify their existing beliefs on vaccine refusals and are not representing the true commitment of conspiracy theories, can be named as confirmation bias, a tendency to apply specific attitudes to reinforce our pre-existing beliefs (Nickerson, 1998). Until now, studies addressing the argument behind conspiracy theories remain limited, whereas understanding this can contribute to the efficacy of psychological treatment aiming to reduce conspiracy beliefs.

Although study 1 did not generate a significant finding, study 3 supported our presumption of vaccine conspiracy beliefs as confirmation bias. Using the data from the TISP survey project, focusing on two countries, we observed the symptom of confirmation bias within vaccine conspiracy beliefs. Interestingly, significant interactions between conspiracy beliefs and trust in scientists only occurred in vaccine conspiracy. When we replaced the key predictor with general conspiracy beliefs, no significant interaction resulted in the analyses. This model demonstrated that the correlation between vaccine conspiracy beliefs and vaccine attitudes was stronger in the low trust groups compared to the high trust group. From this, vaccine conspiracy beliefs can be considered as a response to misinformation, while general conspiracy reflects the true belief of conspiracy theories.

The genuine belief of conspiracy theories and a response to misinformation share different commitments to specific issues. Misinformation can occur due to absence of correct

information, while genuine belief reflects the specific expectation of social objects. Related to psychological stability, misinformation can be classified as more short term expectations, whereas genuine beliefs reflect more long term commitments. However, misinformation is possible to shift into beliefs when individuals are committed to repeat the identical information over time. This argument is supported by the study from (Stafford & Vaci, 2022), investigating how chess players acquire specific skill sets over time. By analysing big data from numerous chess games, they addressed the importance of repetitions in improving skills and altering mindsets.

6.3 Perceived social events and conspiracy ideation

Social events can influence individuals to become more vulnerable to conspiracy theories. According to van Prooijen and Douglas (2017), although not every of them, most conspiracy theories were generated from societal crisis, a condition involving unpleasant emotion, social pressure, political disturbance and uncertainty. Historical events–such as the cold war, global warming, economic crisis, 9/11 tragedy, and COVID-19 pandemic–may stimulate conspiratorial thinking. Social crises foster individuals to rely on intuition or low effort thinking to form decisions rather than using analytical thinking mechanisms to process information. Additionally, they can apply heuristics (mental shortcut) to support their intuition in perceiving social realities, and conspiracy theories can be categorised as the element to fit those. Conspiracy theories offer a simple proposition of the unquestioned social realities when valid explanations are unavailable to access.

Throughout the study 2, I provided evidence that different social events moderated the strength of the association between conspiracy mentality and vaccine intentions. Findings showed that the strongest correlation occurred in December 2020, the situation when the UK Government finally approved Pfizer COVID-19 vaccines for public use for the first time. Also, rapid changes in lockdown policies and widespread public criticism towards the vaccine, mentioning the uncompleted human testings, were some factors that possibly drove the public to rely on conspiracy theories in evaluating vaccine efficacy. In general, this study demonstrated that the effect of conspiracy ideation can be altered by how they perceive social realities, particularly uncertain situations.

Alteration of social events is an essential element that contributes to the association between conspiracy theories and vaccine hesitancy. Relying on conspiracy theories can be classified as a decision making that may be influenced by different social realities. According to descriptive decision theories, several social cues can be the potential factors affecting individuals to generate decisions (Bruch & Feinberg, 2017; Tang et al., 2018). However, it is challenging to capture these through cross-sectional designs. This study provides a finding from the longitudinal perspective on the correlation between those variables, showing that different social events influence individuals to be more prone to conspiracy theories.

6.4 Inoculation and vaccine conspiracy theories

Study 1 to 3 have explored the association between conspiracy beliefs and vaccine hesitancy, identifying novel contributions to conspiracy theories research. In study 4, we focused on investigating the potential communication strategy in stimulating resistance to conspiracy

theories. According to systematic review by (O'Mahony et al., 2023), inoculation was identified as the intervention with the strongest effect size compared to other treatments. Referring to these, study 4 replicated Banas et al (2023), applying fact-based and logic based inoculations to generate resistance to MMR vaccine conspiracy theories. Our study found that the inoculation scripts did not influence motivational threats and were unable to stimulate resistance to conspiracy theories.

Although our replication study provided non-significant results, this study provided two key insights: (1) Addressing the issue of replication crisis and (2) identifying motivational threat as the essential element in inoculation studies. Motivational threat is the key signal that should be activated by inoculation messages, promoting awareness of upcoming counter arguments. Although some inoculation studies ignored motivational threat to be significant (Banas et al., 2023; Richards & Banas, 2015), this study provided evidence when motivational threat was not significant, no significant effects could be generated from the treatment. We argue that motivational threats are psychological desire, encouraging people to focus on specific topics. According to motivated reasoning theory (Kunda, 1990), motivation is an essential component, determining the types of reasoning processes. Also, this replication study supports reproducibility and replicability practices by uploading all research materials in an open science platform, enabling other scholars to re-analyse the data.

6.5 Vaccine conspiracy theories in the UK and South-East Asian Countries

Our studies utilise samples from the UK, Indonesia and Malaysia, allowing us to generate a systematic comparison across continents. Indonesia and Malaysia are considered as authoritarian culture country, addressing deference to authority as the important entity in life (Ma & Yang, 2014), while UK is not. The term authority in authoritarian culture country can be reflected in many figures, including teacher, parent, manager, supervisor or government. In this case, conspiracy theories can be an instrument to reinforce autocracy and legitimate authoritarian culture (Papaioannou et al., 2023), including utilise vaccine conspiracy theories to reinforce deference to authority. Studies using samples from Western countries show significant correlation between content-specific conspiracy theories (Krouwel et al., 2017; T. Winter et al., 2022). This evidence shows conspiratorial arguments, including vaccine conspiracy may be used to reflect socio-political identities.

In Indonesia and Malaysia, the concept of two political spectrums may be perceived differently from UK politics, for example Indonesian politics are more closer with figures and charisma (Hughes-Freeland, 2007). However, we found similar correlation patterns between the UK and the South-East Asian countries, showing that conspiracy beliefs significantly predict vaccine hesitancy. This evidence also confirmed the previous studies exploring the association between the variables. In the study, we did not include political orientation and authoritarian personality as covariates in the analysis.

6.6 Limitations of the studies

6.6.1 Sampling method

All studies in this thesis utilised non-random convenience sampling methods to recruit participants. Although the sample size was statistically robust based on power analysis, using non-random sampling methods in research convey certain limitations. A key concern is the risk of bias, as the sample may not accurately represent the wider population. For example, beliefs in vaccine conspiracy may differ across the UK, Europe and Asia due to multiple social factors. Despite this limitation, this thesis utilised data from three different countries to provide a more comprehensive exploration and comparison between Western and Asian countries. This cross-cultural approach enables us to capture cultural variations in conspiracy beliefs and vaccine hesitancy across diverse socio-political situations.

6.6.2 Sample bias

As previously mentioned, the use of non-random sampling could lead to high risk of bias, often resulting in a skewed distribution. This issue is demographically shown in study 3 and study 4, where the majority of participants are females and most of them are university students. Recruiting students for conspiracy studies may contribute to a positively skewed distribution, illustrating that most participants tend to have low conspiracy beliefs due to higher engagement in analytical thinking.

6.6.3 Sample representativeness

Samples for the four studies were collected from three different countries, the UK, Indonesia and Malaysia with non-random sampling methods. Involving multiple countries allows us to generate a comprehensive comparison between the UK and South-East Asian countries, where the characteristics of conspiracy theories might be varied. However, the inability to apply random sampling techniques limited the equal selection of participants. This limitation

may cause representativeness problems in our studies, a condition where selected samples do not represent the characteristics of a larger population. For example, in study 4, the majority of participants were university students, categorising them as educated participants. This demographic imbalance may influence the generalisability of the findings as educated participants are associated with less conspiracy beliefs.

6.6.4 Experimental treatment

Two studies in this thesis applied experimental stimuli to generate distinct conditions between experimental and baseline groups. Unfortunately, our treatments in study 1 did not generate significant effects in manipulating institutional trust. This limitation occurred due to absence of pilot study prior to the main experiment. Therefore, our study 1 hypotheses could not be tested with the research data. Contrary to study 1, in study 4, we applied the similar treatment used in Banas et al. (2023) study. Although the treatment did not stimulate significant effects to the dependent variables, we identified a novel insight from this study.

6.7 Implications of the studies

The primary aim of the thesis is exploring the association between conspiracy beliefs and vaccine attitudes. Previous studies concerning this issue rely on cross-sectional survey designs to generate correlational results, yet several gaps remain unaddressed. This thesis offers multi-method approaches to elaborate the association between these variables through study 1 to 3. Additionally, this thesis also provides a replication of Banas et al. (2023) to build a stronger inoculation framework in countering vaccine conspiracy theories. In general, our studies can support scholars and practitioners who work in the field of conspiracy

theories as academic references, describing comprehensive exploration on decision making, conspiracy theories and vaccine hesitancy.

Study 1 and 3 provided comprehensive evidence of the characteristics of conspiracy beliefs that were associated with vaccine attitudes. Findings from these studies suggested that propositions of vaccine conspiracy theories may stem from two distinct sources: (1) conspiracy mindsets, the general likelihood to believe in conspiracy arguments and (2) a response to misinformation, the tendency to process false information without engaging in deliberative thinking. These two characteristics may require distinct interventions to mitigate the consequences. For example, conspiracy theories generated from misinformation can be countered with debunking, correcting false claims with the factual information (J. Lee et al., 2023). In contrast, mitigating conspiracy mindsets may require longer interventions, such as engaging in constructive dialogues with them (Brand & Stafford, 2022). Exploring these distinctions may be essential to map specific audiences when activating communication to counter conspiracy arguments.

Study 4 addressed the issue of replication crisis, a condition when no significant findings could not be identified when re-testing the similar treatments (S. F. Anderson & Maxwell, 2017; Maxwell et al., 2015). A research gap was identified in the original study where two inoculations, fact-based and logic-based did not significantly influence motivational threat as the manipulation check, but they generated significant effects on MMR vaccine conspiracy attitudes as the dependent variable. Contradictory to the original study, our replication studies found no significant effect of two inoculation messages in affecting MMR vaccine conspiracy attitudes. This study contributes in improving the validity of inoculation theories and

inoculation treatments, identifying potential errors, generalisability and scientific progress. Findings from this study suggested to consider motivational threat as the key mediating variable in inoculation studies.

6.8 Suggestion for the future research

Four studies in this thesis offer several recommendations to continue exploring the association between conspiracy theories and vaccine intentions in the future, including potential strategies to reduce the likelihood to believe in vaccine conspiracy. First, we suggest applying various research designs, such as longitudinal, experimental or combination between those methods in examining the association between the two variables. These methods can provide more robust exploration on conspiracy beliefs by establishing causal inferences and time series analyses. Most of empirical claims predicting vaccine hesitancy with conspiracy beliefs were generated with survey and correlational design. For the next study, I suggest applying vignette to generate narration of vaccine conspiracy theories and identify the causal link between study variables.

Second, confirmation bias and expressive responding are empirical frameworks that can be applied to study conspiracy theories with experimental designs while most conspiracy studies apply social psychology frameworks. A study conducted by Imhoff et al. (2022) shows that content-specific conspiracy theories, including vaccine conspiracy were correlated with low cognitive ability and defensive group identity, explaining that content-specific conspiracy beliefs are less stable compared to conspiracy mentality. They also argue about content-contamination where specific conspiracy theories may carry the surplus meaning, reinforcing

their previous existing beliefs. From this argument, I argue that individuals can endorse specific conspiracy theories with less believing in the true proposition of conspiracy theories. I suggest continuing this work using the framework of confirmation bias and expressive responding.

Third, future studies may include more variables that related to socio-political background, including political orientation, group identity and institutional trust, as the potential variables that may influence the effect of interventions to stimulate resistance to conspiracy theories. I view inoculation theory as the potential framework that can be applied to counter conspiracy misinformation and generate resistance to it. I have started this exploration by replicating Banas et al. (2023) study on inoculation messages, and future studies to improve the efficacy of inoculation message can be potential studies in the future. For example, comparing short and longer inoculation messages to confer resistance to conspiracy theories or applying emotions within the message.

These future research plans are promising studies and can be conducted, allowing scholars to explore empirical evidence by assessing potential factors associated with vaccine conspiracy theories and why vaccine conspiracy theories may occur. Throughout experimental design, we could establish the causal inference explaining the nature of vaccine conspiracy theories and testing promising communication strategies to foster resistance to it. Beyond experimental design, longitudinal data also allow us to trace attitudinal changes within participants, capture social events associated with those changes and compare those with different time points.

6.9 General conclusion

The key aims of this thesis were to provide empirical evidence exploring the association between conspiracy theories and vaccine hesitancy and identifying promising interventions to foster resistance to conspiracy theories. Findings in this thesis provide novel contributions in understanding the association from the lens of confirmation bias (study 1 and 3) and social decision theories (study 2). Study 3, building from study 1 hypotheses, provided evidence that the symptom of confirmation bias occurred in vaccine conspiracy theories and this interaction predicted the levels of vaccine attitudes. Whereas in study 2, we observed that distinct social events moderated the correlation between conspiracy mentality and vaccine intentions. The strongest correlation occurred in December 2020 when COVID-19 vaccination programs were about to commence. Some potential factors causing this were public criticism regarding the safety and the efficacy of the COVID-19 vaccine. Study 4 addressed the efficacy of inoculation messages as the potential strategy to foster resistance to vaccine conspiracy theories through replication studies. In conclusion, various types of conspiracy beliefs predict vaccine hesitancy with different coefficients, and inoculation developed by Banas et al. (2023) did not stimulate motivational threat and generate resistance to MMR vaccine conspiracy theories.

Vaccine hesitancy is a global public health issue that requires attention from various stakeholders. Various global issues including climate crisis and environmental damage can be potential factors causing new infectious diseases in the future beyond COVID-19. To prevent the spread of infectious diseases, particularly new diseases, vaccines are considered as the effective medical instrument. Thus, studies on factors related to vaccine hesitancy are essential not only for now and after COVID-19 pandemic, but also for the future. Issues

related to vaccine evaluation should be addressed not only by public health scholars, yet social scientists and psychologists play an important role in exploring the reason of vaccine hesitancy. Also, with psychological framework, we could design the effective intervention to shift mindsets related to vaccines.

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Appendix A

Supplementary files Chapter 2: "Anti-vaccine Conspiracy Theories: Genuine Response or Expressive Responding?"

Contents:

1. Demographic questions

Gender

What is your gender?

a. Male

b. Female

c. Other

d. Prefer not to say

Year – born

What year were you born?

Education

What is your educational level?

a. No qualifications

b. O-level/ GCSE similar

c. A level or similar

d. Technical qualification

e. Undergraduate degree

f. Diploma

g. Postgraduate degree

h. Other qualification

Place – live

Where do you live?

a. England

b. Scotland

c. Wales

d. Northern Ireland

2. Vignette for experimental studies

NHS vignette

The Covid-19 pandemic has had a lot of negative impacts on people in the UK. The most effective strategy to overcome this situation is through vaccination. However, some people are hesitant to get vaccinated for several reasons. For example, there are rumours that the Covid-19 vaccine is hazardous. Vaccination is fundamental to achieving herd-immunity and helping life return to normal. Therefore, the National Health Service (NHS) works very hard to guarantee the availability of the vaccine so that everyone can be vaccinated. Also, the NHS assures the safety of the vaccine and that it's safe for everyone, including the elderly, pregnant mothers, children, and others who have comorbidities.

UK Gov vignette

The Covid-19 pandemic has had a lot of negative impacts on people in the UK. The most effective strategy to overcome this situation is through vaccination. However, some people are hesitant to get vaccinated for several reasons. For example, there are rumours that the Covid-19 vaccine is hazardous. Vaccination is fundamental to achieving herd-immunity and helping life return to normal. Therefore, the UK Government works very hard to guarantee the availability of the vaccine so that everyone can be vaccinated. Also, the UK Government

assures the safety of the vaccine and that it's safe for everyone, including the elderly,

pregnant mothers, children and others who have comorbidities.

3. Vaccine conspiracy belief scales

Vaccine Conspiracy Beliefs Scale (VBS; Shapiro, Holding, Perez, Amsel & Rosberger, 2016) from 1 (strongly disagree) to 7 (strongly agree)

1.Vaccine safety data is often fabricated

2.Immunizing children is harmful, and this fact is covered up

3.Pharmaceutical companies cover up the dangers of vaccines

4.People are deceived about vaccine efficacy

5.Vaccine efficacy data is often fabricated

6.People are deceived about vaccine safety

7.The government is trying to cover up the link between vaccines and autism

4. Attitude and belief toward vaccinations

Attitude and belief toward vaccination (Di Martino et al., 2020) with the scale from 1 (totally disagree) to 5 (totally agree)

1. I believe vaccines are important for reducing or eliminating serious diseases

2. I believe vaccines are useful in certain situations, for example in developing countries

3. I believe in natural immunity acquired through disease than in vaccines

4. I think vaccinations do more harm than good

5. I'm afraid of the side effects of vaccinations

6. My religious beliefs are against vaccinations

7. I don't think I'm at risk of contracting any infectious disease

8. I'm afraid of getting sick after getting vaccinated

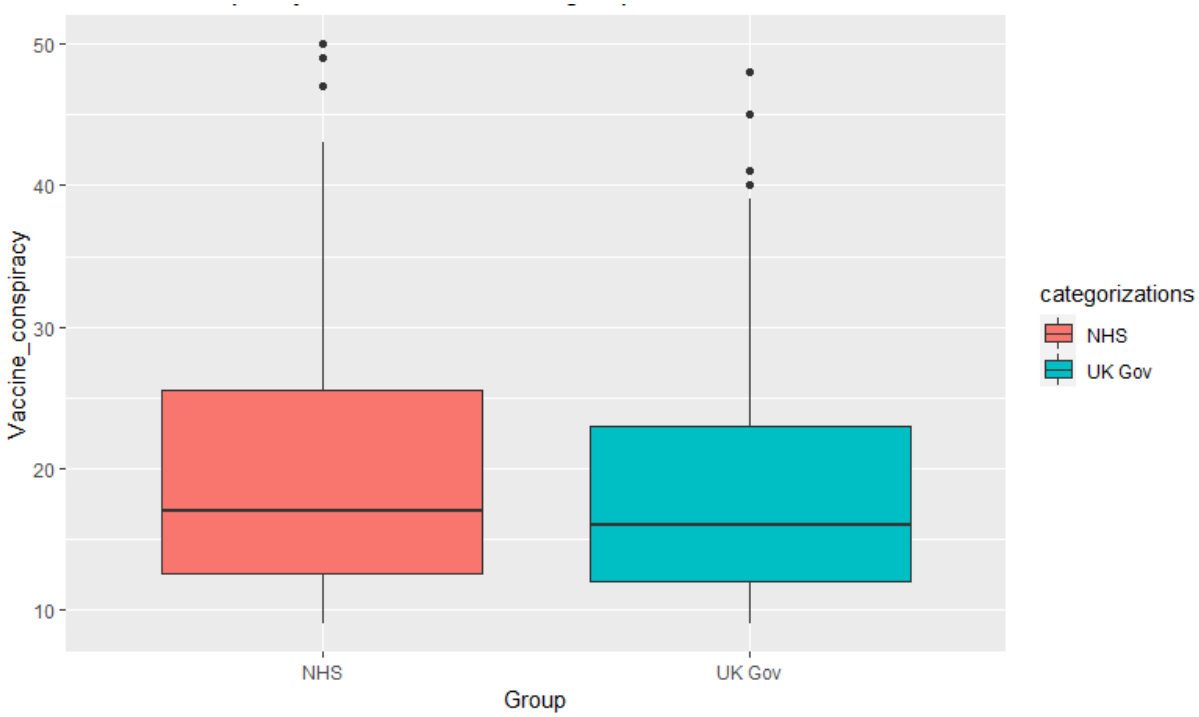
9. I believe I believe vaccines are not effective

10. I am wary of the long-term health effects of vaccinations

5. Comparison of vaccine conspiracy beliefs in two sub-groups

Figure S2.1

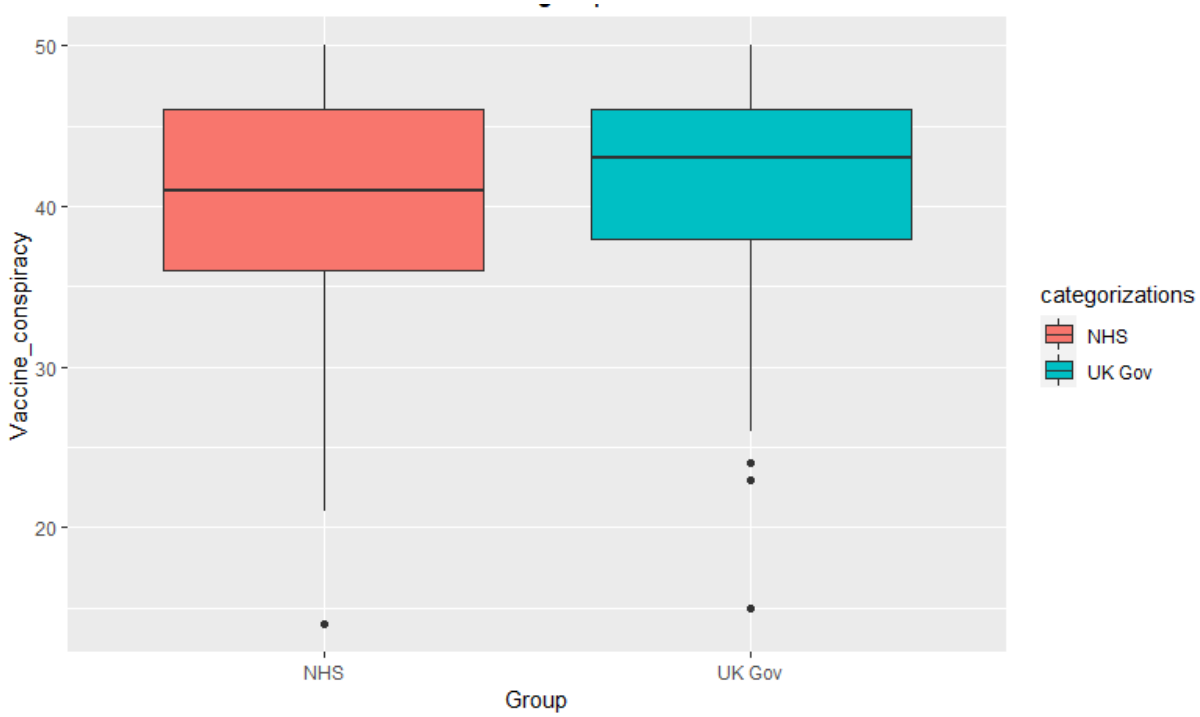
Comparison of vaccine conspiracy beliefs in NHS (n = 235) and UK Gov (n = 231) groups



6. Comparison of vaccine attitudes in two sub-groups

Figure S2.2

Comparison of vaccine attitudes in experimental (n = 235) and baseline (n = 231) groups



Appendix B

Supplementary files Chapter 3: "Anti-vaccine conspiracy beliefs are a reflection of mistrust of scientist, but not of general conspiracy beliefs: Testing the confirmation bias hypotheses using Indonesian and Malaysian samples"

Contents:

1. Demographic questions

Gender
What gender do you identify with?

a. Woman
b. Man
c. *Prefer to self-describe
d. Prefer not to say

Age
How old are you?
_____ year old

Educational background
What is your highest completed level of education?

a. Primary education
b. Secondary education (e.g., high school)
c. Higher education (e.g., university degree or higher education diploma)
d. Did not attend school

2. Anti-vaccine conspiracy belief scales

We apply a single item scale from Jolley and Douglas (2014):

Scientists work together to cover up the dangers of vaccines

1 (strongly disagree) ---------- 5 (strongly agree)

3. General conspiracy belief scales

"Some political and social events are debated. It is suggested that the official version of these events could be an attempt to hide the truth to the public. This official version could mask the facts that these events have been planned and secretly prepared by a covert alliance of powerful individuals or organisations. What do you think?"

"I think that the official version of the events given by the authorities very often hides the truth"

1 (completely false) ---------- 9 (completely true)

4. Trust in scientists with four dimensions

We are interested in your opinion about scientists in your country, including scientists working at universities, in government, at companies, and for non-profit organizations.

Competence

How expert or inexpert are most scientists?

How intelligent or unintelligent are most scientists?

How qualified or unqualified are most scientists when it comes to conducting high-quality research?

Integrity

How honest or dishonest are most scientists?

How ethical or unethical are most scientists?

How sincere or insincere are most scientists?

Benevolence

How concerned or not concerned are most scientists about people's wellbeing?

How eager or uneager are most scientists to improve others' lives?

How considerate or inconsiderate are most scientists of others' interests?

Openness

How open are most scientists to feedback?

How willing or unwilling are most scientists to be transparent?

How much or little attention do scientists pay to other's views?

5. Vaccine attitude scales

Please give your evaluation to these statements from 1 (strongly disagree) to 7 (strongly agree):

I believe vaccines are important for reducing or eliminating serious diseases.

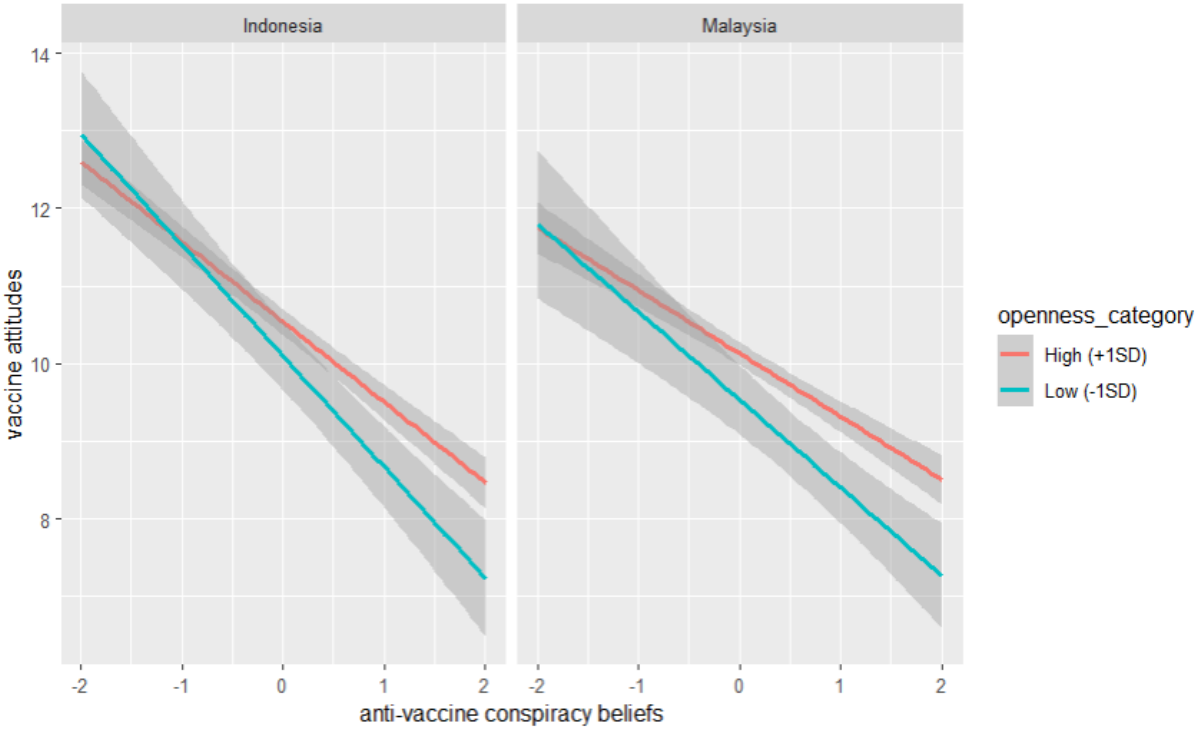
I think vaccinations do more harm than good.

6. Interaction between anti-vaccine conspiracy beliefs and vaccine intentions

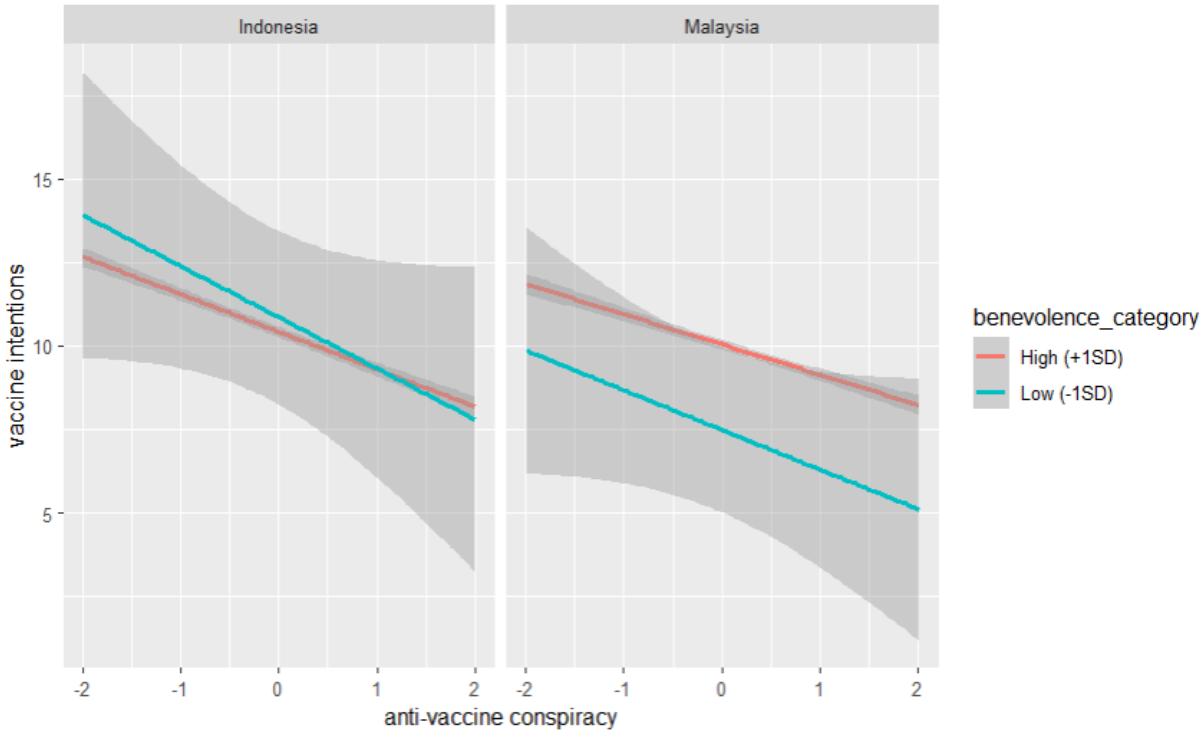
Figure S4.1

Interaction plots between anti-vaccine conspiracy beliefs and vaccine attitudes based on high and low trust groups with (A) openness; (B) benevolence; (C) integrity and (D) competence as moderators

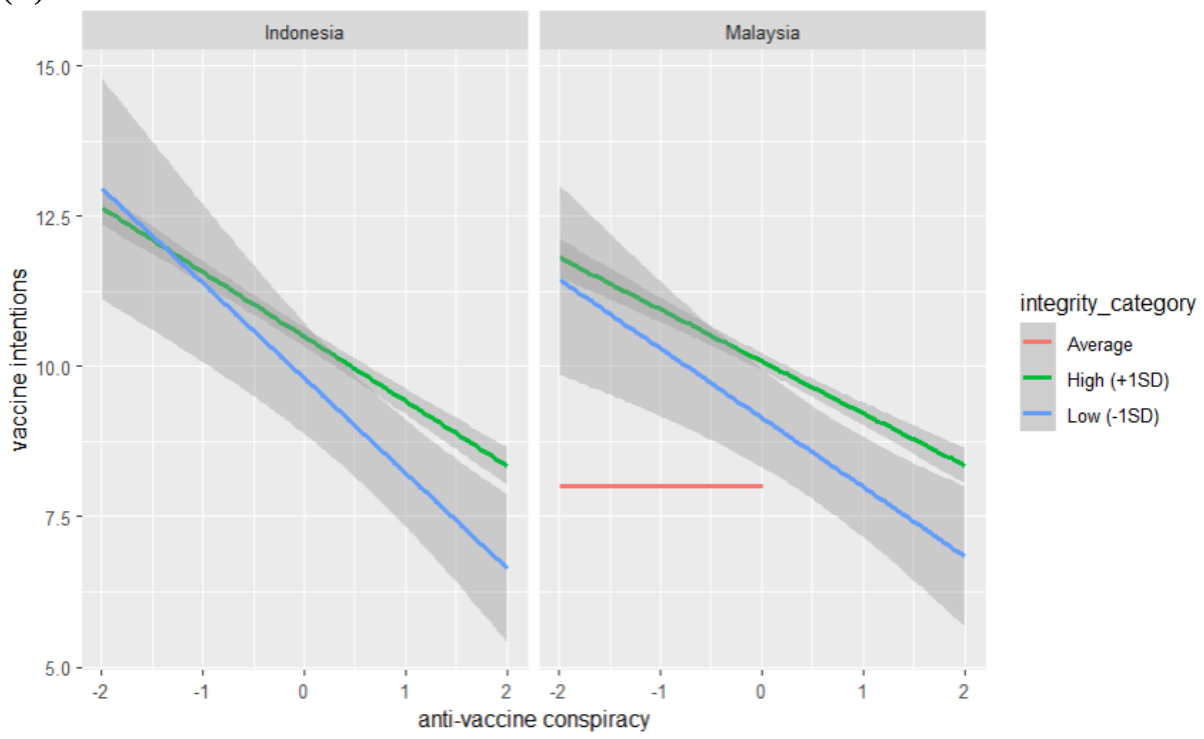
(A)



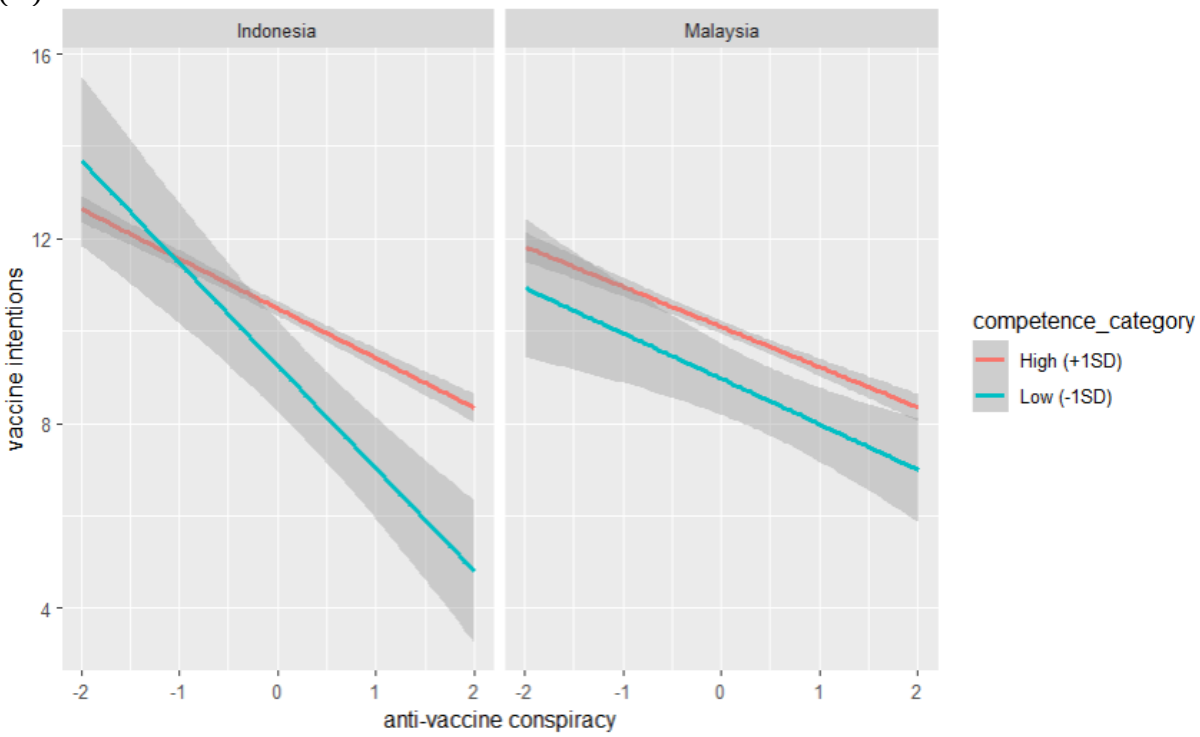
(B)


Indonesia
Malaysia
vaccine intentions
15
10
5
-2
-1
0
1
2
anti-vaccine conspiracy
benevolence_category
High (+1SD)
Low (-1SD)

(C)


Indonesia
Malaysia
vaccine intentions
15.0
12.5
10.0
7.5
5.0
-2
-1
0
1
2
anti-vaccine conspiracy
integrity_category
Average
High (+1SD)
Low (-1SD)

(D)

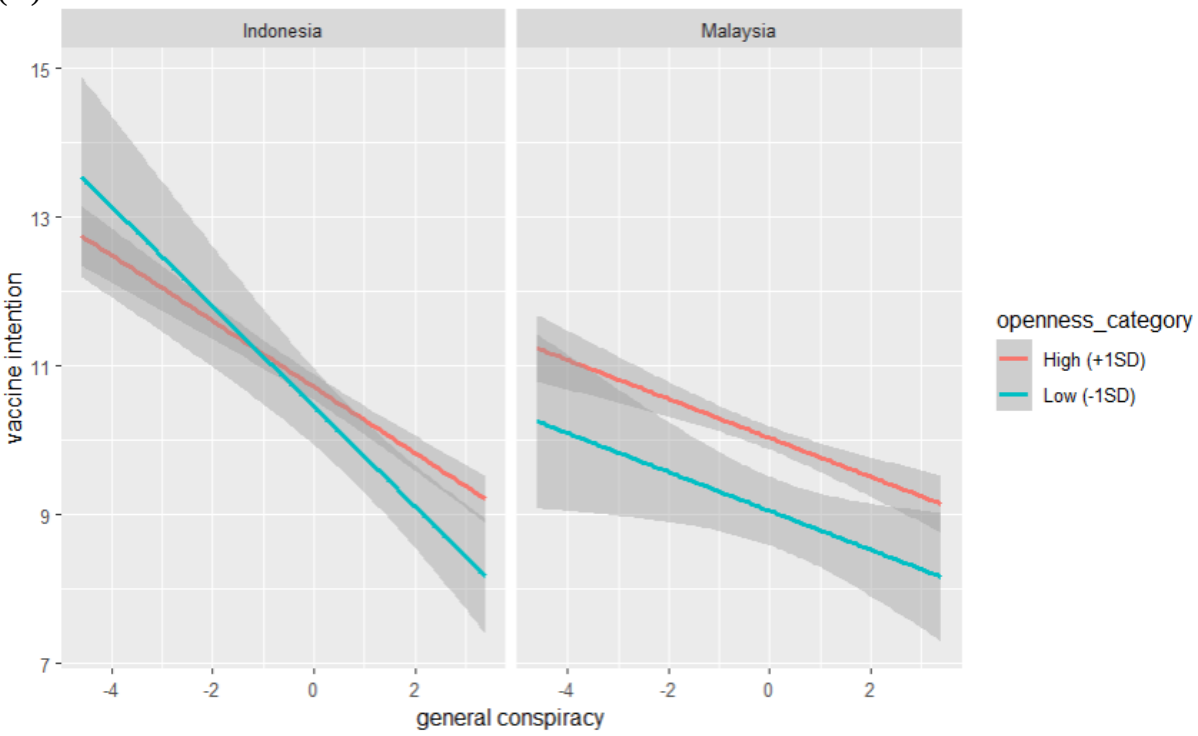

Indonesia
Malaysia
16
12
8
4
vaccine intentions
-2
-1
0
1
2
anti-vaccine conspiracy
competence_category
High (+1SD)
Low (-1SD)

7. Interaction between general conspiracy beliefs and vaccine intentions

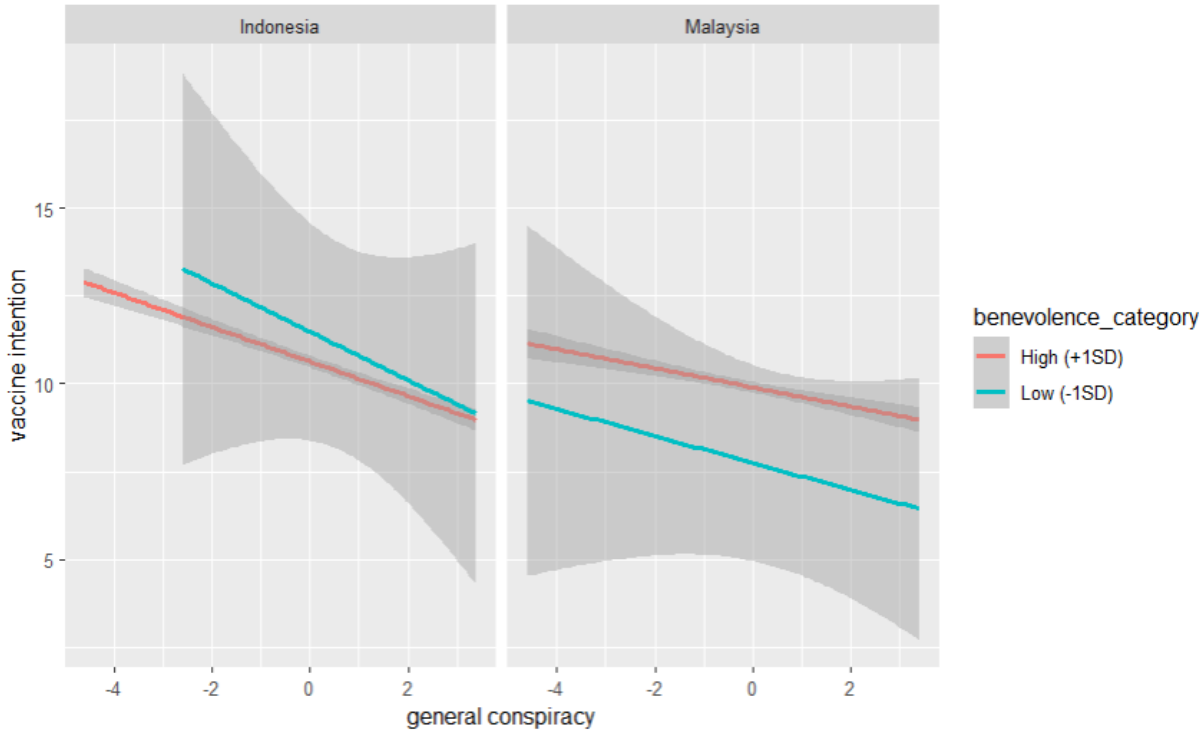
Figure S4.2

Interaction plots between general conspiracy beliefs and vaccine intentions based on high and low trust groups with (A) openness; (B) benevolence; (C) integrity and (D) competence as moderators

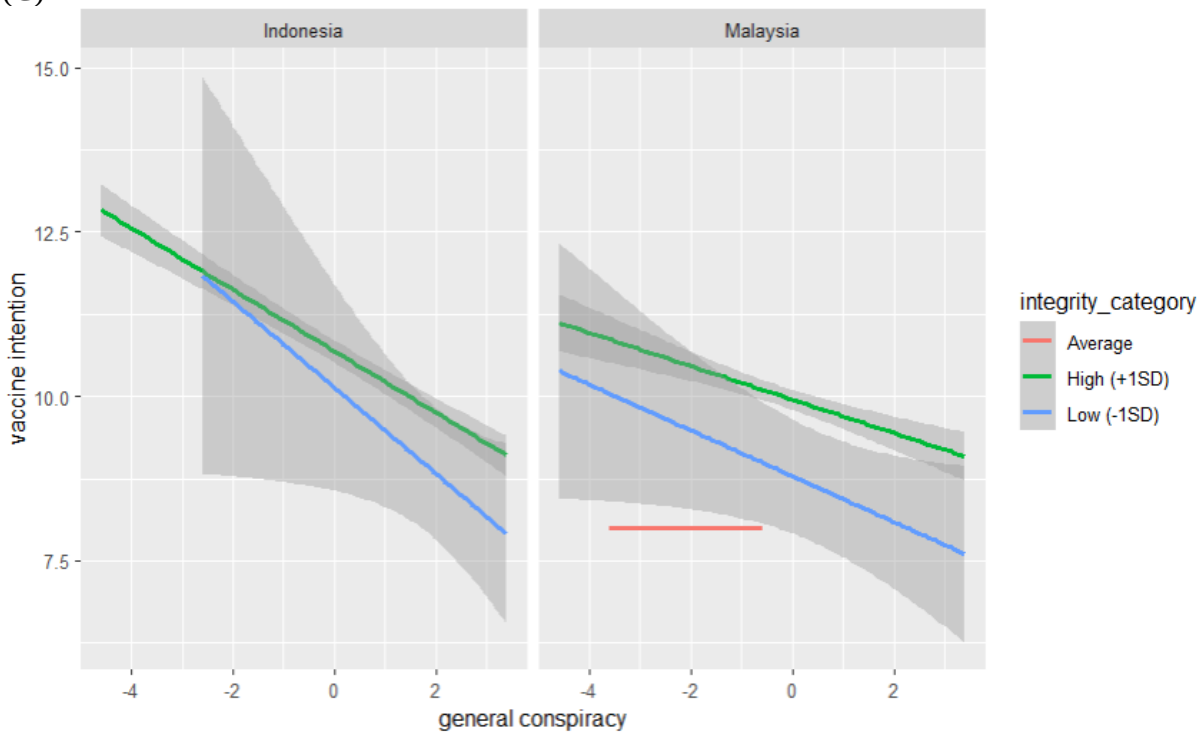
(A)



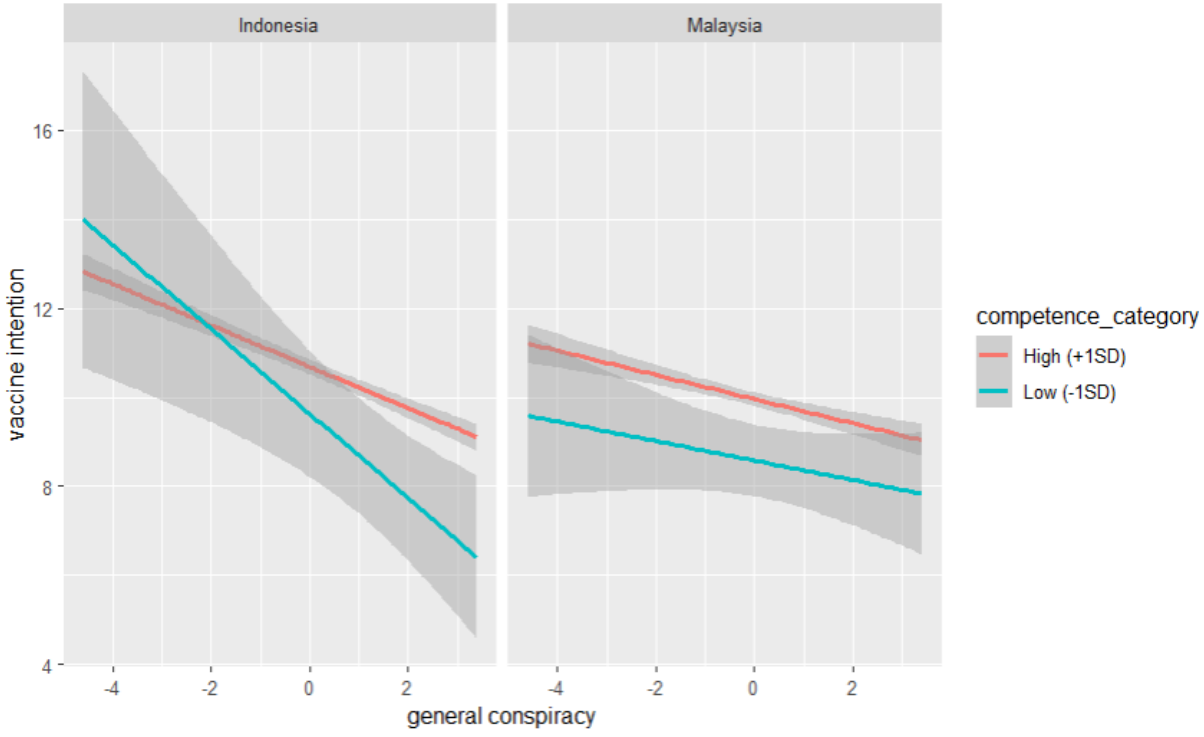
(B)


Indonesia
Malaysia
vaccine intention
15
10
5
-4
-2
0
2
general conspiracy
benevolence_category
High (+1SD)
Low (-1SD)

(C)


Indonesia
Malaysia
vaccine intention
15.0
12.5
10.0
7.5
-4
-2
0
2
general conspiracy
integrity_category
Average
High (+1SD)
Low (-1SD)

(D)


Indonesia
Malaysia
vaccine intention
16
12
8
4
-4
-2
0
2
general conspiracy
competence_category
High (+1SD)
Low (-1SD)

8. Descriptive statistics of study variables

Table S4.1

Mean (SD) of study variables based on high and low trust in scientists

	Indonesia (n = 929)		**Malaysia (n = 997)**	
	Low trust (SD)	**High trust (SD)**	**Low trust (SD)**	**High trust (SD)**
Competence	*n = 30*	*n = 899*	*n = 62*	*n = 935*
General conspiracy beliefs	6.60 (2.42)	5.74 (2.18)	5.78 (2.37)	5.41 (1.63)
Anti-vaccine conspiracy beliefs	3.25 (1.43)	2.85 (1.25)	3.42 (1.38)	3.08 (1.04)
Vaccine attitudes	8.67 (4.00)	10.62 (2.71)	8.54 (3.16)	10.01 (2.35)
Integrity	*n = 51*	*n = 878*	*n = 55*	*n = 940*
General conspiracy beliefs	7.52 (1.60)	5.67 (2.18)	6.03 (2.48)	5.40 (1.62)
Anti-vaccine conspiracy beliefs	3.58 (1.35)	2.83 (1.24)	3.43 (1.38)	3.08 (1.04)
Vaccine attitudes	8.80 (3.64)	10.66 (2.69)	8.63 (3.25)	10 (2.35)
Benevolence	*n = 11*	*n = 918*	*n = 10*	*n = 986*
General conspiracy beliefs	6.30 (2.16)	5.76 (2.19)	6 (3.52)	5.43 (1.66)
Anti-vaccine conspiracy beliefs	2.90 (1.52)	2.87 (1.26)	2.90 (1.79)	3.10 (1.06)
Vaccine attitudes	11 (4.08)	10.55 (2.77)	7.6 (3.83)	9.9 (2.40)
Openness	*n = 754*	*n = 175*	*n = 155*	*n = 841*
General conspiracy beliefs	6.41 (2.06)	5.62 (2.20)	5.77 (2.04)	5.37 (1.61)
Anti-vaccine conspiracy beliefs	3.09 (1.34)	2.81 (1.24)	3.46 (1.19)	3.03 (1.03)
Vaccine attitudes	9.92 (3.44)	10.70 (2.59)	9 (2.90)	10.09 (2.30)

Note. CM = competence; IT = integrity; BV = benevolence; ON = openness

Some participants who are categorised with average levels of trust are excluded from the table

9. CFA results for trust in scientists – Indonesia

Table S4.2

Factor loadings from confirmatory factor analysis for trust in scientist scales for Indonesian samples

	Indonesia (n = 929)			
	CM	**IT**	**BV**	**ON**
How expert or inexpert are most scientists?	.76			
How intelligent or unintelligent are most scientists?	.71			
How qualified or unqualified are most scientists when it comes to conducting high quality research?	.79			
How honest or dishonest are most scientists?		.70		
How ethical or unethical are most scientists?		.76		
How sincere or insincere are most scientists?		.80		
How concerned or not concerned are most scientists about people's wellbeing?			.82	
How eager or uneager are most scientists to improve others' lives?			.79	
How considerate or inconsiderate are most scientists of others' interest?			.82	
How open are most scientists to feedback?				.77
How willing or unwilling are most scientists to be transparent?				.78
How much or little attention do scientists pay to other's views?				.77

Note. CM = competence; IT = integrity; BV = benevolence; ON = openness

10. CFA results for trust in scientists – Malaysia

Table S4.3

Factor loadings from confirmatory factor analysis for trust in scientist scales for Malaysian samples

	Malaysia (n = 997)			
	CM	**IT**	**BV**	**ON**
How expert or inexpert are most scientists?	.69			
How intelligent or unintelligent are most scientists?	.80			
How qualified or unqualified are most scientists when it comes to conducting high quality research?	.80			
How honest or dishonest are most scientists?		.72		
How ethical or unethical are most scientists?		.80		
How sincere or insincere are most scientists?		.81		
How concerned or not concerned are most scientists about people's wellbeing?			.73	
How eager or uneager are most scientists to improve others' lives?			.73	
How considerate or inconsiderate are most scientists of others' interest?			.81	
How open are most scientists to feedback?				.73
How willing or unwilling are most scientists to be transparent?				.78
How much or little attention do scientists pay to other's views?				.79

Note. CM = competence; IT = integrity; BV = benevolence; ON = openness

11. Levene's test results comparing Indonesian and Malaysian samples

Table S4.4

Levene's test of homogeneity of variance for study variables comparing variance between Indonesian and Malaysian samples

	F	**df**	**p**
General conspiracy beliefs	73.66	1	<.01
Anti-vaccine conspiracy beliefs	29.70	1	<.01
Vaccine attitudes	35.16	1	<.01
Competence	.09	1	.75
Integrity	1.87	1	.17
Benevolence	6.55	1	<.05
Openness	24.76	1	<.01

Appendix C

Supplementary files Chapter 4: "Social events moderate the association between conspiracy mentality and vaccine intentions: Evidence from longitudinal panel data during COVID-19 pandemic in the UK"

Contents:

1. Demographic questions

Demographic Questions

C19PRC longitudinal data allow us to trace demographic variables to describe the characteristics of participants in each wave. We used five demographic variables to describe the characteristic of our participants.

Age

What is your age?

____year

Gender

What is your Gender?

1 = Male 2 = Female 3 = Transgender 4 = Prefer not to say 5 = Other

Ethnicity

What is your ethnicity?

1 = White British/ Irish

2 = White non-British/ Irish

3 = Indian

4 = Pakistani

5 = Chinese

6 = Afro-Caribbean

7 = African

8 = Arab

9 = Bangladeshi

10 = Other Asian

11 = Other ethnic group. Please specify ____

Educational background

What is your highest qualification?

1 = No qualifications 5 = Undergraduate degree

2 = O-level/GCSE similar 6 = Diploma

3 = A-level or similar 7 = Postgraduate degree

4 = Technical qualification 8 = Other qualification

Place to live

Where do you live?

1 = England 3 = Wales

2 = Scotland 4 = Northern Ireland

2. Conspiracy mentality scale

To measure conspiracy mentality, this study utilised Conspiracy Mentality Scale (Bruder et al., 2013) with five Likert scale items from 1 to 11. CMS is a unidimensional scale with one factor structure. Five items used in CMS are described below:

Please rate these statements from the scale of 1 (certainly not) to 11 (certainly 100%).

1. I think that – many very important things happen in the world, which the public is never informed about.

2. I think that – politicians usually do not tell us the true motives for their decisions.

3. I think that – government agencies closely monitor all citizens.

4. I think that – events which superficially seem to lack a connection are often the result of secret activities.

5. I think that – there are secret organisations that greatly influence political decisions.

3. Questions to assess vaccine intentions

The C19PRC core team developed one question at each wave to measure vaccine intentions based on different progress of vaccine development during the pandemic. Wave 1 when there is no vaccine available for Covid-19, wave 4 when the vaccine development was in progress and wave 7 when the mass vaccination programs has been underway. Three items are described below:

Wave 1 (March 2020)

If a new vaccine were to be developed that could prevent COVID-19, would you accept it for yourself?

1 = yes 2 = No 3 = Maybe 4 = Not applicable

Wave 4 (November to December 2020)

Multiple vaccines for COVID-19 have now been developed. Will you take a vaccine for COVID-19 when it becomes available to you?

1 = yes 2 = No 3 = Maybe

Wave 7 (December 2021)

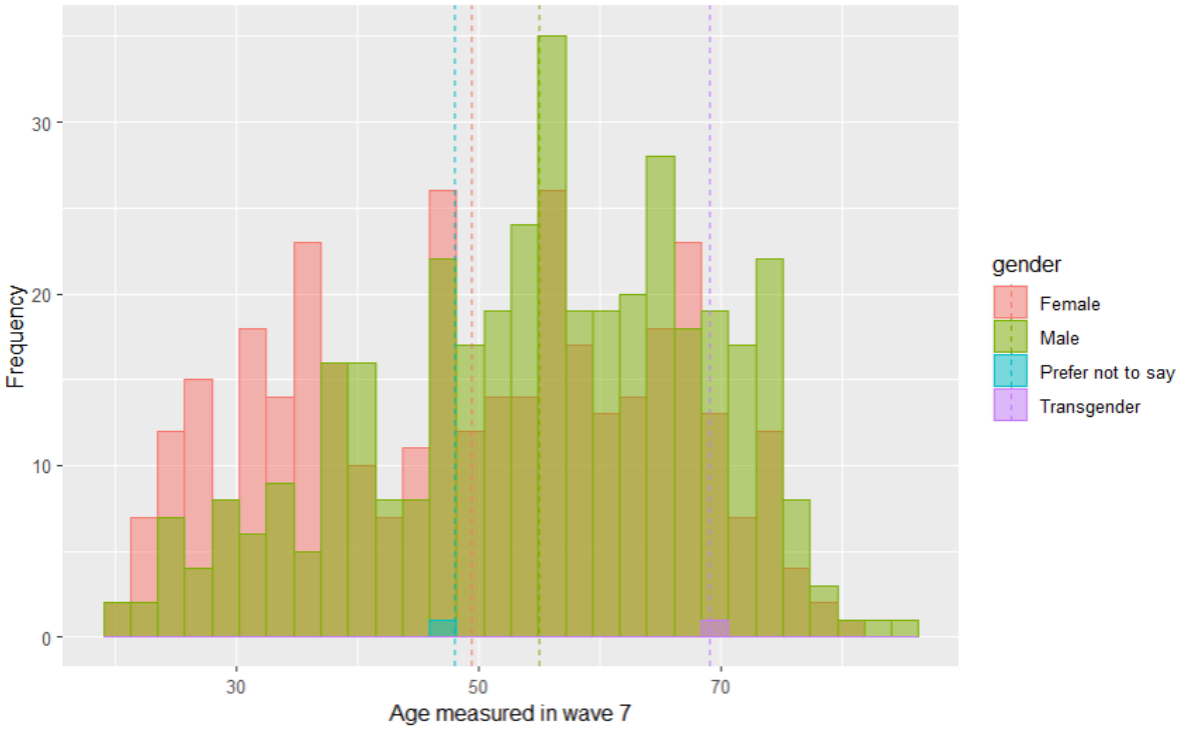
Have you been fully vaccinated against Covid-19 (i.e. have you received all jabs/shots)? Please note, we are not referring to 'booster' vaccinations in this question

1 = yes 2 = No

4. A histogram describing age by gender (measured in wave 7)

Figure S3.1

A histogram describing age by gender (measured in wave 7)



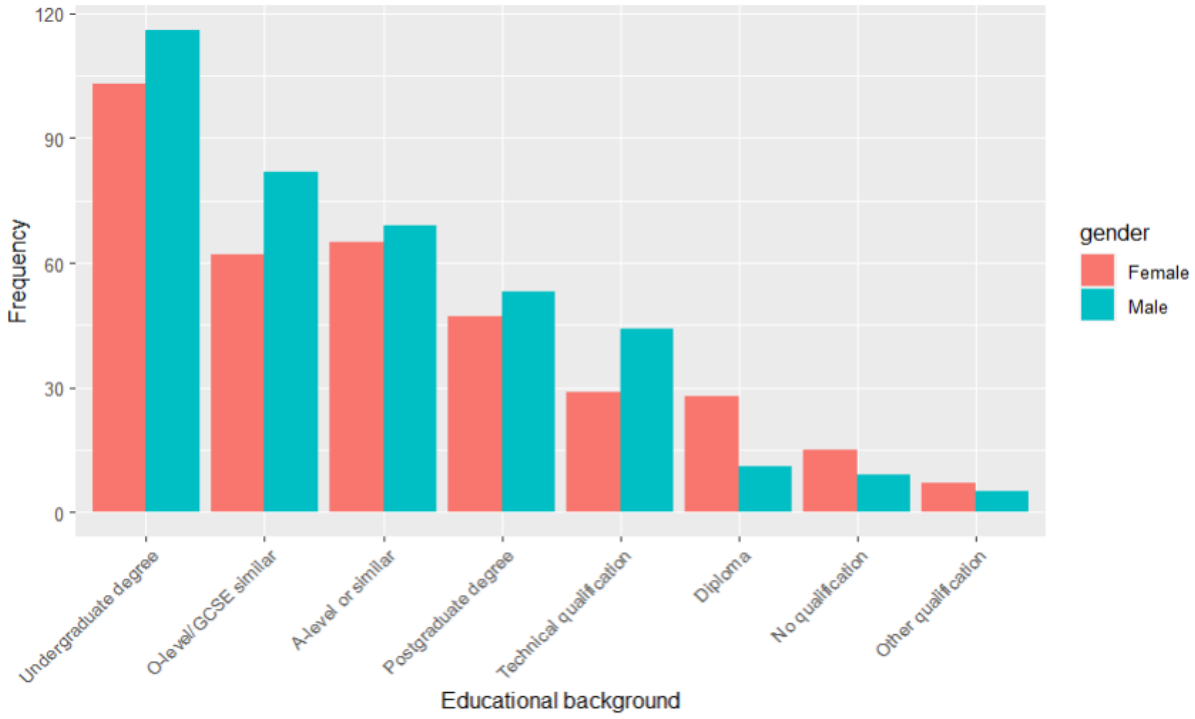
Note: Dashed lines represent the mean age in each gender category

n=740 in each wave

5. A histogram describing educational background (measured in wave 1)

Figure S3.2

A histogram describing educational background (measured in wave 1)



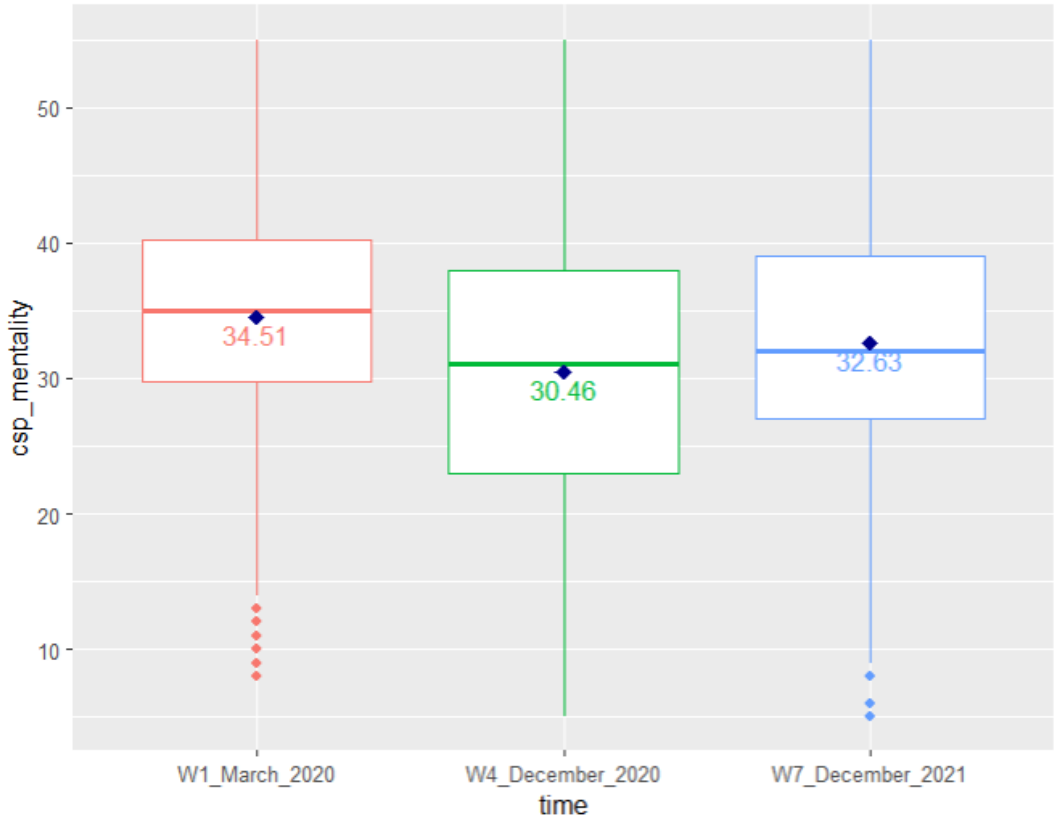
Note: The record was incomplete for wave 4, and no record for educational background measured in wave 7

n=740

6. Bar plot describing mean of conspiracy mentality in three waves

Figure S3.3

Bar plots describing mean of conspiracy mentality in three waves



7. Descriptive statistics of conspiracy mentality and vaccine intentions in each wave

Table S3.1

Descriptive statistics of conspiracy mentality and vaccine intentions in each wave

	Wave 1	**Wave 4**		**Wave 7**	
	(n = 2008)	Remaining participants (n = 1262)	Replacement participants (n = 2605)	Remaining participants (n = 740)	Replacement participants (n = 665)
Conspiracy mentality	M = 35.14 SD = 9.15	M = 30.89 SD = 11.08	M = 32.77 SD = 10.64	M = 32.62 SD = 9.99	M = 33.29 SD = 9.05
Vaccine intentions	yes = 68.87 % maybe = 24.95 % no = 6.18 %	yes = 66.48 % maybe = 18.78 % no = 14.74 %	yes = 64.95 % maybe = 20.54 % no = 14.51 %	yes = 92.70 % no = 7.30 %	yes = 86.77 % no = 13.23 %

Note. Total participants in wave 1 calculated after removing participants who answered (4)-not applicable in vaccine intention questions

Appendix D

Supplementary files Chapter 5: "Re-examining the effect of inoculation messages on anti-vaccine conspiracy attitudes: A conceptual replication of Banas et al (2023)"

Contents:

1. Demographic questions

Demographic questions

1. How old are you (please provide numbers)?

2. What is your gender?
- Male
- Female
- Other
- Prefer not to say

3. What is your educational level?
- No qualification
- O-level/ GCSE similar
- A level or similar
- Technical qualification
- Undergraduate degree
- Diploma
- Postgraduate degree
- Other qualification

4. Where do you live now?
- England
- Scotland
- Wales
- Northern Ireland

2. Experimental stimuli

Fact-based inoculation message:
The anti-vaccination film Vaxxed alleges a global conspiracy by doctors, governments, and pharmaceutical companies to poison and harm children through the MMR vaccine. The film presents a compelling case that may cause you to question the safety and effectiveness of vaccines; however, the film omits or distorts important facts that undermine its credibility. The film attempts to persuade you that the director, producer, and star of the movie, Andrew Wakefield, has discovered a link behind the measles, mumps, rubella vaccination (MMR) and autism. The film argues that there is fraud on the part of the Centers for Disease Control (CDC) to cover this up.

The first problem with the movie is that the link between vaccines and autism has been debunked — widely and repeatedly. The original study that raised the issue was published in 1998 in the journal the Lancet and involved 12 patients who, after receiving the MMR vaccine, suffered ill effects that appeared to be autism. While many researchers were skeptical of the finding, panicked parents in both Great Britain and the United States pushed vaccination rates down sharply. Outbreaks of the measles, mumps and rubella on both sides of the Atlantic soon followed.

In 2004, Sunday Times journalist Brian Deer reported serious ethical violations by the 1998 paper's lead author, gastroenterologist Andrew Wakefield. Deer accused Wakefield of having been paid by a law firm that had been planning to sue vaccine manufacturers and of subjecting some of the children to unnecessary, invasive procedures for the study. After the revelations, most of the researchers

named as co-authors in the study disavowed the findings and withdrew their names from the paper. In 2010, the Lancet's editors retracted the paper. Three months later, Britain's General Medical Council revoked Wakefield's medical license. In 2011, the British medical journal published a detailed investigation into the research, calling it an "elaborate fraud" by Wakefield and lamenting the harm it had caused and would continue to cause to public health.

Vaxxed attempts to support the fraud conspiracy through William Thompson, a CDC scientist who was critical of a 2004 study that failed to establish any link between the MMR vaccine and autism. There are two problems with this segment of the film. One, as the conspiracy grew, William Thompson also came forward with a public statement to make "absolutely clear" that he believes vaccines save lives and that he would never advise a parent not to vaccinate. Two, the movie neglected to mention all the studies that have been done throughout the world that have not shown a link between vaccines and autism. Dozens of top journals — including the New England Journal of Medicine, the Journal of Pediatric Infectious Diseases and the Journal of Autism and Developmental Disorders — have published papers that looked into a possible link and found none. This includes a massive study published in 2019 from involving 657,461 Danish children born between 1999 and 2010, which found no association between MMR and developing autism.

While experts still don't know what causes autism, it is thought to be a combination of genetic and environmental factors such as infections or exposure to certain chemicals that may lead to differences in the shape and structure of a child's brain. According to an estimate by the CDC published last year, 1 in 45 (or 2.24 percent) of children age 3 to 17 may have autism — a steep rise over the past few decades. Researchers have theorized that part of the rise could be attributable to a greater awareness of the condition. The CDC said the most recent jump from 2011 to 2014 may have a very mundane reason behind it: a change in the questionnaire the agency uses to track cases.

Again, let me repeat that there is absolutely no reliable scientific evidence that shows that any vaccine has any link to any part of the autism spectrum disorder. The only reason that we even spent one nanosecond thinking about this issue is because of Wakefield's fraud.

Logic-based inoculation message:
The anti-vaccination film Vaxxed alleges a global conspiracy by doctors, governments, and pharmaceutical companies to poison and harm children through the MMR vaccine. The film presents a compelling case that may cause you to question the safety and effectiveness of vaccines; however, the film, like all conspiracy theories, omits important facts and relies on faulty logic.
The film attempts to persuade you that the director, producer, and star of the movie, Andrew Wakefield, has discovered a link behind the measles, mumps, rubella vaccination (MMR) and autism. The film argues that there is fraud on the part of the Centers for Disease Control (CDC) to cover this up.

The first logical problem with the movie is that the key figure in the film, Andrew Wakefield, has no credibility. The man charging fraud against the CDC has been found guilty of fraudulent research himself. Wakefield's original study that raised the issue was published in 1998 in the journal the Lancet and involved 12 patients who, after receiving the MMR vaccine, suffered ill effects that appeared to be autism. While many researchers were skeptical of the finding, panicked parents in both Great Britain and the United States pushed vaccination rates down sharply. Outbreaks of the measles, mumps and rubella on both sides of the Atlantic soon followed.

In 2004, Sunday Times journalist Brian Deer reported serious ethical violations by the 1998 paper's lead author, gastroenterologist Andrew Wakefield. Deer accused Wakefield of having been paid by a law firm that had been planning to sue vaccine manufacturers and of subjecting some of the children to unnecessary, invasive procedures for the study. After the revelations, most of the researchers named as co-authors in the study disavowed the findings and withdrew their names from the paper. In 2010, the Lancet's editors retracted the paper. Three months later, Britain's General Medical Council revoked

Wakefield's medical license. In 2011, the British medical journal published a detailed investigation into the research, calling it an "elaborate fraud" by Wakefield and lamenting the harm it had caused and would continue to cause to public health.

Aside from the credibility of Andrew Wakefield, think about how outlandish the conspiracy theory really is. They claim that the Center for Disease Control has conspired with pharmaceutical companies to harm children for profit, and that medical researchers from around the world are just going along with it? Think about it: Dozens of top journals — including the New England Journal of Medicine, the Journal of Pediatric Infectious Diseases and the Journal of Autism and Developmental Disorders — have published papers that looked into a possible link and found none. This includes a massive study published in 2019 involving 657,461 Danish children born between 1999 and 2010, which found no association between MMR and developing autism. The coordination of the thousands of people, and without any credible dissenters or whistleblowers, defies logical explanation.

"It's perfectly natural when something important happens people want to have an explanation," says Dr. Karen Douglas, a leading social psychologist on conspiracies. "Often, the official explanation appears quite mundane to people and not particularly satisfying. "Conspiracy theories often emerge as a result of this need for an explanation that's proportional to the event itself." While experts still don't know what causes autism, it is thought to be a combination of genetic and environmental factors such as infections or exposure to certain chemicals that may lead to differences in the shape and structure of a child's brain.

This type of mundane explanation doesn't have a clear villain to blame, which is difficult to accept. What we do know is that people like Andrew Wakefield profit as they prey on the fears of well-meaning parents. As journalist Sarah Gill warned: "Don't be fooled — Wakefield's story is not the tale of a man wronged by powerful corporations or the medical establishment, which, in fact, closed ranks to protect him. It's the story of a physician who set out to cast doubt on vaccine safety before he'd even gathered the evidence, and he did so not for the public good, but for private gain."

The history of sushi
Taken from https://www.sushisushi.co.uk/blogs/news/the-ancient-history-of-sushi

While we think of sushi as a delicious pairing of rice and fish, in its original form, the rice was merely a means to an end. Fish was placed into cooked rice, which was allowed to ferment around the fish. This produced lactic acid bacilli that, in turn, slowed down the growth of bacteria in the fish, essentially becoming a pickling process. This allowed it to be shipped across the continent and remain edible for some time. Once the fish was sufficiently preserved, the fermented rice was discarded.

Japanese cuisine is closely connected to its folklore and oral tradition, and sushi is no different. One story tells of an old woman who was scared that thieves would steal her pots of rice from her. To keep them safe, she started hiding the pots in osprey nests. When she returned to collect them, she discovered that not only had the rice fermented, but that scraps of fish from the ospreys had fallen into the pots. She tasted this rice and fish mixture and found it so delicious that she began preserving fish in the same manner from then on.

As pleasant a story as that is, the truth is rather more prosaic, with the fermented fish product being imported to Japan from Chinese traders in the 7th century. It would be another two hundred years before the food really gained a foothold among the Japanese people. This coincided with the spread of Buddhism across the country. The Buddhist diet prohibited the eating of meat, but allowed its followers to consume fish and vegetables. As an island nation, fish was plentiful and soon became a staple part of Japanese cooking. Since preserved fish and rice was both delicious and convenient, it proved popular throughout the country. This was the first dish that might be recognised as modern sushi.

The first kind of sushi that we know of from this period was called funa-sushi, and it comes from the Lake Biwa region in what is today the Shinga prefecture of Japan. This is the country's largest freshwater lake, known for its golden carp, which locals called funa. These fish were packed into salted rice, weighed down and compacted to speed up the fermentation process. Even with these shortcuts, the process took as long as six months to complete, meaning the finished dish was only affordable by the upper classes.

The Sengoku period describes a period of time from the Ōnin War of 1467 to siege of Osaka in 1615, in which Japan was in a state of near-constant civil war and political upheaval. During this period – though presumably unrelated – cooks realised that the fermentation time of funa-sushi could be reduced to a single month by compressing the fish and rice mixture under greater weight. This allowed them to produce sushi more readily and in greater quantities, with the preserved fish dish being an important way to support troops during the various wars. It was also around this time that the cooks realised that the fish they utilised in their sushi did not need to be fully decomposed to taste good. As a result they began using fresher fish, creating a dish known as mama-nare zushi.

3. Initial attitudes on vaccine conspiracy scale

Some people might have different perceptions on vaccinations. Please provide your respond to the statement below using the scale consists of two opposite words in your screen. The closest your answer to the words on the left or right, the more you favour to those.

"Vaccinations cause autism"

Negative	1	2	3	4	5	6	7	8	9	Positive
Bad	1	2	3	4	5	6	7	8	9	Good
Unfavourable	1	2	3	4	5	6	7	8	9	Favourable
Unacceptable	1	2	3	4	5	6	7	8	9	Acceptable
Wrong	1	2	3	4	5	6	7	8	9	Right
Foolish	1	2	3	4	5	6	7	8	9	Wise

4. Personal involvement inventory

Some people might have different interest in specific issues.

Please rate your interest about "vaccines cause autism" and "vaccines cause injury and death" into these three opposite words below:

Unimportant	1	2	3	4	5	6	7	8	9	Important
Irrelevant	1	2	3	4	5	6	7	8	9	Relevant
Of no concern	1	2	3	4	5	6	7	8	9	Of concern to me

5. Inoculation perception scale

Based on the previous page that you have read, please indicate your response to these four questions (scale from 1 – strongly disagree to 7 - strongly agree):

1. The message mainly relies on evidence to refute vaccine misinformation

2. Concrete data are shown to provide empirical explanation in the page

3. I can sense the logical analysis provided by the author in the page

4. The page stimulates my critical thinking to counter vaccine misinformation

6. Motivation threat scale

From the scale 1 (strongly disagree) to 7 (strongly agree), please provide your response to these statements below:

1. I want to defend my current attitudes from attack

2. I feel motivated to think about why I hold the beliefs I do about “vaccinations cause autism”

3. I feel motivated to resist persuasive messages about alternative accounts of “vaccinations cause autism”

4. I want to counterargue conspiracy theories about “vaccinations cause autism”

7. MMR vaccine conspiracy belief scale

Some people might have different opinion after watching the clip.

Please provide your opinion related to the statement below using the scale consists of two opposite words in your screen. The closest your answer to the words on the left or right, the more you favour to those.

"MMR vaccines cause autism"

Negative	1	2	3	4	5	6	7	8	9	Positive
Bad	1	2	3	4	5	6	7	8	9	Good
Unfavourable	1	2	3	4	5	6	7	8	9	Favourable
Unacceptable	1	2	3	4	5	6	7	8	9	Acceptable
Wrong	1	2	3	4	5	6	7	8	9	Right
Foolish	1	2	3	4	5	6	7	8	9	Wise

8. Content-specific conspiracy theories scale

1. Agenda 21 as the conclusion from UN Conference on Environment & Development will support totalitarian world government (Agenda 21).

2. The Government or other parties spread toxic chemicals to the atmosphere from aircrafts as a way to control weather and human population (Chemtrails).

3. US Federal Emergency Management Agency is planning to build a concentration camp following the martial law in the US after a major disaster or crisis (FEMA).

4. Illuminati is a shadow group that consists of doctors, politicians, actors and musicians where they have a purpose to control the world (Illuminati).

Please indicate your response using scales below:

Negative	1	2	3	4	5	6	7	8	9	Positive
Bad	1	2	3	4	5	6	7	8	9	Good
Unfavourable	1	2	3	4	5	6	7	8	9	Favourable
Unacceptable	1	2	3	4	5	6	7	8	9	Acceptable
Wrong	1	2	3	4	5	6	7	8	9	Right
Foolish	1	2	3	4	5	6	7	8	9	Wise

9. Conspiracy mentality scale

Scales from:

1 = certainly not – 0%

2 = 10%

3 = 20%

4 = 30%

5 = 40%

6 = Undecided 50%

7 = 60%

8 = 70%

9 = 80%

10 = 90%

11 = certainly 100%

1.I think that many very important things happen in the world, which the public is never informed about.

2.I think that politicians usually do not tell us the true motives for their decisions.

3.I think that government agencies closely monitor all citizens.

4.I think that events which superficially seem to lack a connection are often the result of secret activities.

5.I think that there are secret organisations that greatly influence political decisions.

10. Conspiracy-related movies scale

1. There are many movies explaining about vaccine developments from many sources.

Have you watched a documentary movie named "Vaxxed: From Cover-up to Catastrophe"?

- Yes
- No

2. Have you watched a documentary movie called "Died Suddenly"?

- Yes
- No

3. Have you seen a documentary movie "Jabbed! Inside Britain's Vaccine Triumph"?

- Yes
- No

4. Some people are not aware of their responses while doing the survey. Please show to us that you are still paying attention here by choosing "Yes" in the option

- Yes
- No

11. Gender distribution of participants

Table S5.1

Gender distribution (n = 181)

Gender	n	%
Female	130	71.82
Male	49	27.07
Other	2	1.104

12. Educational background of participants

Table S5.2

Educational background (n =181)

Education	n	%
O-level/ GCSE similar	1	0.55
A-level/ similar	42	23.20
Diploma	1	0.55
Undergraduate	59	32.59
Postgraduate	78	43.09

Note. Specific qualifications in the UK can be seen in https://www.gov.uk/what-different-qualification-levels-mean/list-of-qualification-levels

13. Descriptive results of vaccine conspiracy in experimental and baseline groups#

Table S5.3

Descriptive statistics of vaccine conspiracy in experimental and baseline groups

Groups	n	Mean (P1)	SD (P1)	Mean (P3)	SD (P3)
Fact-based	67	10.7	6.69	17.8	10.9
Logic-based	57	10.6	7.18	17.1	12
Sushi	57	10.3	7.82	21.2	13

Note. Calculations were conducted based on raw score