

An Exploration of Unorthodox Worldviews that Predict Vaccine Scepticism and Use of Complementary and Alternative Medicine

by

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Abstract

There are many people who choose alternative or unorthodox healthcare options that are not based on the best available evidence for efficacy and effectiveness. There has been a rejection of vaccination by sections of the population leading to suboptimal rates of vaccination, and increased rates of infectious diseases such as measles. Complementary and alternative medicines (CAMs) are also increasingly popular, despite the scarcity of clinical evidence for the efficacy and safety of many of these therapies. The goal of this thesis is to explore unorthodox worldviews that predict vaccine scepticism and use of CAM in order to inform the future development of persuasive strategies to encourage participation in vaccination programs, and evidence-based healthcare. In this thesis the underpinnings of vaccine scepticism and CAM use have been explored through the different traditions of individual differences (inclusive of personality, attitudes, and beliefs), socio-demographics, and emotional reactions. Four studies were undertaken to achieve this goal including (1) the development of a standardised measure of CAM utilisation using data from an archived population survey of Australian adults; (2) an investigation of explanatory factors, including personality (openness to experience), cognitive style, and a range of unorthodox beliefs, for the relationship between CAM use and vaccination scepticism, using an archived population survey of Australian adults; (3) an examination of associations between geographic or area-level socio-demographic factors and uptake of vaccination among 5-year old children throughout Australia, using a public health focused ecological methodology, and (4) conducting an online priming experiment, to assess whether increasing the salience of concepts of contamination and purity will produce changes in reactions to a range of health interventions, including vaccination and CAM. Following are the key findings. The first study developed a brief,

summative questionnaire measure of CAM utilisation called the R-I-CAM-Q, to address a gap in previous research which was lacking a psychometrically sound, and quantitative measure of CAM utilisation. The main findings of the second study, a cross-sectional survey, were that positive attitudes to CAMs, rather than use of CAMs, best predict vaccination attitudes; and that negative attitudes to vaccination and positive attitudes to CAMs both correlate with the presumed antecedents of magical beliefs about health. The geographic/area-based study revealed that communities with lower rates of vaccination had relatively less disadvantage, and had relatively greater education and occupational status, suggesting that privilege puts people at risk. The priming experiment showed no experimental effect of priming for contamination or purity/naturalness. Nevertheless, higher levels of sensitivity to disgust were associated with lower ratings of the effectiveness of MMR vaccination, tetanus injection, antibiotics, and surgery. These studies identify the psychological, social, cultural, and emotional characteristics of those who have unorthodox health beliefs and behaviours. Knowledge that can directly inform the future development of tailored and persuasive health promotion strategies and campaigns which encourage evidence-based healthcare choices, particularly uptake of vaccination.

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Abbreviations

ABS	Australian Bureau of Statistics
ASGS	The Australian Statistical Geography Standard
CAM	Complementary and Alternative Medicine
EBM	Evidenced-based Medicine
HHB	Holistic Health Beliefs
I-CAM-Q	International Complementary and Alternative Medicine Questionnaire
MHB	Magical Health Beliefs
NCAAM	National Center for Complementary and Alternative Medicine
MFH	Magical Food and Health
NICM	National Institute of Complementary Medicine
MMR	Measles, Mumps, Rubella
NAPS	Nencki Affective Picture System
NIP	National Immunisation Program
OASIS	Open Affective Standardized Image Set
R-I-CAM-Q	Revised International Complementary and Alternative Medicine Questionnaire
SEIFA	Socio-Economic Indexes for Areas
TGA	Therapeutic Goods Association
WHO	World Health Organization

Chapter 1. Introduction to Unorthodox Worldviews that Predict Vaccine

Scepticism and use of CAM

There has been a rise in anti-science and science-sceptical movements in the last few decades, in a broad range of areas including vaccinations, genetically modified crops, gene editing, air pollution, synthetic chemicals, and climate change (Hotez, 2020). It is becoming increasingly common for individuals to reject the advice of medical experts and to choose alternative or unorthodox healthcare options that are not based on the best available evidence for efficacy and effectiveness (Čavojová & Ersoy, 2020; Hornsey, 2020; Soveri, Karlsson, Mäki, et al., 2020). This is clearly the case in regard to the safe, evidence-based, and demonstrably effective vaccination programs run in Australia and other parts of the world. There has been a rejection of vaccinations by sections of the population; leading to suboptimal rates of vaccination in some local areas of Australia (Dawson & Apte, 2015), and consequent increased rates of serious infections such as measles (Najjar et al., 2014; Wood et al., 2015). Complementary and alternative medicines (CAMs) are increasingly popular (Cant & Sharma, 2004; Coulter & Willis, 2004; Coulter & Willis, 2007; World Health Organization, 2019), despite the scarcity of clinical evidence for the efficacy and safety of many of these therapies (AMA, 2012). This is important as there are direct and indirect health risks associated with CAM (Wardle & Adams, 2014), such as herbal interactions with conventional medicines, and harm that occurs because patients may delay or stop using proven conventional medicine in favour of a CAM that has no evidence of efficacy (Braun et al., 2014).

What is meant by evidence-based? Evidence-based medicine (EBM) is an approach that finds evidence in a systematic way and uses that evidence to make clinical decisions (Burns, Rohrich, & Chung, 2011). The classification of evidence is central to

EBM and is hierarchical, from the highest level of evidence provided by randomised controlled experiments, followed by cohort or case-control studies that have been well designed, time series comparisons (or remarkable results from uncontrolled studies), to the lowest level of evidence being expert opinions. Using the highest level of evidence to solve clinical questions is important for all physicians (Burns, Rohrich, & Chung, 2011). Alternative or unorthodox healthcare options are not based on the highest level of evidence (Čavojová & Ersoy, 2020; Hornsey, 2020; Soveri, Karlsson, Mäki, et al., 2020), as delineated in the levels of evidence hierarchy of EBM. CAM is an unorthodox healthcare choice by definition: ‘a group of diverse medical and healthcare systems, practices, and products that are not presently considered to be part of conventional medicine’ (NCCAM, 2012).

There are many people who have little manifest interest in whether their healthcare choices are supported by scientific evidence and endorsed by authoritative experts, but rather select their healthcare based on other factors, such as their cultural worldview or the influence of their peer group (Bishop et al., 2007; Browne, 2018; Browne et al., 2015; Hornsey et al., 2018; Michaels et al., 2008; Thomson et al., 2014). To focus solely on peoples’ comprehension of science and data in relation to health care choices is to ignore one of the fundamental tenets of cognitive psychology, that people often employ motivated reasoning in relation to risk assessments and often process information in a biased manner. The provision of rational argument and supporting data is therefore not always an ideal or sufficient persuasive health promotion strategy with sceptics. Persuasion can benefit from the addition of strategies such as the right messenger, a message that can arouse the audience emotionally, and one which is congruent with audience worldviews (Cialdini, 1991).

This chapter provides a review of a range of concepts or factors that have been found to predict vaccine scepticism and CAM use. These underpinnings are explored in the different traditions of individual differences (inclusive of personality, attitudes, and beliefs), socio-demographics, and emotional reactions. The chapter begins with an overview of vaccine scepticism, including the anti-vaccination movement and vaccine hesitancy, and then the use of CAMs. This is followed by a look at cultural worldviews and risk perception, personality and sociocultural factors, emotional reactions, unorthodox beliefs, and unorthodox healthcare choices. Finally, a look at ways to encourage evidence-based healthcare choices.

1.1 Vaccination and CAM

A proliferation of scientific advances informs all aspects of how people live. However, recent decades have seen a backlash by significant sections of the population against scientific knowledge (Achenbach, 2015; Čavojová & Ersoy, 2020; Hornsey, 2020; Shulevitz, 2013). A number of scientific developments which have consensus support from scientists such as the benefits of vaccinations, fluoridation of water supplies, and the risks of human-induced climate change, are all facing vigorous opposition (Dubé et al., 2015; Dunlap, 2013; Martin, 1988). Public confidence in vaccinations and decision-making regarding whether to participate in immunisation programs is guided in part by scientific evidence, but also by socio-cultural, psychological, and political imperatives (Larson et al., 2011, 2014).

1.1.1 Rejecting Vaccination

This broader backlash against scientific advice includes an unwillingness by some people, including in developed countries, to accept the advice of medical doctors and public health officials regarding vaccinations. This is despite strong evidence that

vaccines work to eradicate disease and that there is minimal risk associated with their use. In fact, vaccination programs are one of the most cost-effective and successful health interventions to prevent illness and death from communicable diseases, and experts agree that the benefits of vaccines far outweigh the risks (Who, 2009). However, there is transnational organised opposition to vaccinations - an 'anti-vaccination movement' - which questions the safety, efficacy, and even the necessity for vaccinations (Blume, 2006). There has been opposition to vaccines ever since the first vaccine was introduced in the 19th century (Poland & Jacobson, 2011). Today the anti-vaccination movement is more coordinated and has greater reach due to the internet and social media (Chiou & Tucker, 2018; Hussain et al., 2018; Kata, 2012; Megget, 2020; Olpiński, 2012; Smith & Graham, 2019). Anti-vaccination activists disseminate a range of vaccine misinformation including that vaccines cause disorders such as autism; that the ingredients in vaccines are toxic and cause diseases and death; that vaccines are unnecessary and ineffective, and that the government and vaccine manufacturers are conspiring to harm people (Blume, 2006).

The internet has provided an effective medium for anti-vaccinationists to spread unreliable information quickly and widely (Dubé et al., 2013). A content analysis of websites that publish anti-vaccination information (Wolfe et al., 2002) found the most common content claims were that vaccines cause idiopathic illness (e.g. autism, SIDS, immune dysfunction, diabetes, neurologic disorders such as ADD); vaccines erode immunity or provide only temporary immunity; vaccine injury is under-reported; vaccination policy is motivated by profit for drug manufacturers; vaccinations are a violation of civil liberties; diseases are declining anyway, and natural, holistic approaches offer a preferable alternative to vaccination. These websites sometimes use emotionally

charged anecdotes, such as stories about children or babies who have allegedly been harmed or killed as result of vaccinations. They also convey varying levels of distrust in conventional medicine in general, and there is an emphasis on emotional appeal to convey messages (Moran, 2015).

The anti-vaccination movement is primarily responsible for raising doubts among parents about the safety and efficacy of vaccinations, and convincing a significant proportion of parents to refuse to vaccinate their children or to refuse some vaccines (Edelstein et al., 2020; Hussain et al., 2018; Kempe et al., 2020; Olpiński, 2012; Szilagyi et al., 2020). Childhood vaccination rates have fallen below acceptable levels in certain geographic areas of the USA, UK, Europe (Kempe et al., 2020; Mallory et al., 2018; Sangha & Mac McCullough, 2020; Szilagyi et al., 2020) and in some pockets of Australia (Dawson & Apte, 2015), with subsequent outbreaks of measles, mumps, varicella and pertussis (Andrews et al., 2008; Damm et al., 2016; Mallory et al., 2018; Najjar et al., 2014; Sangha & Mac McCullough, 2020; Wood et al., 2015). Reductions in rates of vaccination have been costly to communities in terms of death and disease resulting from outbreaks of previously controlled diseases (Bass, 2015; Leggiadro, 2009; Nandi & Shet, 2020; Poland & Jacobson, 2011; Wang et al., 2020; Wong et al., 2020).

This thesis frequently refers to *vaccine scepticism*, which describes an attitude involving suspicion or doubt about the benefits of vaccination. Vaccine scepticism can be seen to be on a continuum from having strong anti-vaccination convictions at one end, to having some minor concerns and hesitancy about the use of vaccination at the other end (Dubé et al., 2013, 2014, 2015). An emerging term in the literature on decision-making regarding vaccinations is ‘vaccine hesitancy’ (Luthy et al., 2009). This term acknowledges that people do not often fall neatly into the categories of anti-vaccine or

pro-vaccine, but rather fall somewhere on a continuum between the two domains.

Vaccine hesitant parents can include parents who delay vaccines, who may refuse one or two vaccines but agree to others, and who may accept vaccines but are unsure of their decision (Opel et al., 2011). Parents and other individuals who are vaccine hesitant are far more common than those who completely reject vaccination (Holroyd et al., 2020; Santibanez et al., 2020; Szilagyi et al., 2020).

1.1.2 Embracing CAM

Many people appear to have little interest in scientific evidence when it comes to choosing their healthcare products and providers. This is particularly evident in the popularity of CAMs despite the fact that the majority of CAMs have limited scientific evidence for effectiveness beyond placebo (AMA, 2012). Historically, CAMs were popular and available to people when there were no medical doctors, or doctors were too expensive, too far away or otherwise not accessible (Foley, 2015). In the last couple of decades the growth of CAM products and users appears to be steadily increasing in concert with, and in competition to, science-based medicine (Coulter & Willis, 2004; Coulter & Willis, 2007; Ernst, 2001). Some have attempted to explain this popularity by suggesting that CAM use is addressing the social, emotional, and psychological needs of people; and that the emphasis on naturalness, holism, vitalism, purity, and spirituality found in CAM addresses these needs (Kaptchuk & Eisenberg, 1998). Some facets of broader belief systems which are correlated with CAM include holism or a holistic orientation to healthcare, spirituality, a postmodern worldview, and valuing self-expression and personal growth (Astin, 1998).

A range of psychosocial factors have been found to be associated with CAM use. Studies have shown that being employed, middle-aged, female, higher household income,

greater education, poorer health status, and chronic health problems, predict increased use of CAM (Thomson et al., 2014). The personality factor of openness to experience has been shown to predict increased use of CAM (Astin, 1998; Sirois & Gick, 2002; Smith et al., 2008; Thomson et al., 2014). Openness to experience is one of the Big Five personality dimensions, as outlined in the Five Factor Model, and describes being open to new ideas, experiences and approaches, being artistic, curious, imaginative, insightful, original, with wide interests (McCrae & John, 1992), and being less concerned with conventional belief systems (Saroglou, 2002).

CAM consists of a vast array of therapies, philosophies, and individual therapies; with many specific CAM practices changing over time. The National Center for Complementary and Alternative Medicine (NCCAM), based in the USA, defines CAM as ‘a group of diverse medical and healthcare systems, practices, and products that are not presently considered to be part of conventional medicine’ (NCCAM, 2012). The term complementary medicine refers to using CAM together with mainstream medicine, whereas alternative medicine refers to using CAM in place of mainstream medicine. The National Institute of Complementary Medicine (NICM, 2008) based in Australia outlines five broad categories (and examples):

- Biologically based practices (e.g. herbal medicines, vitamins and minerals, aromatherapy).
- Mind-body therapies (e.g. meditation, hypnosis, relaxation therapy, music therapy, spiritual healing).
- Manipulative and body-based practices (e.g. acupuncture, chiropractic, osteopathy, reflexology, shiatsu).
- Energy therapies (e.g. Reiki, Qigong, electromagnetic field therapy).

- Traditional and holistic medical systems (e.g. Traditional Chinese medicine, Ayurvedic medicine, Kampo medicine, naturopathy, anthroposophical medicine, homeopathy).

CAM is by definition an unorthodox healthcare choice: ‘a group of diverse medical and healthcare systems, practices, and products that are not presently considered to be part of conventional medicine’ (NCCAM, 2012). Most CAMs have little scientific evidence to support their use and are not generally endorsed by the medical establishment. There is a widespread belief that CAMs are natural and safe, however, this assumption is problematic, primarily because CAMs are not currently included in adverse event reporting schemes, which are used for monitoring orthodox medical practice. There is generally a limited regulatory setting for CAM products and providers (White et al., 2014). Moreover, there are dangers associated with the use of supplements or natural-product derived drugs, including toxicity of some herbs or herbal extracts, and interactions with regular medications that might include reducing the effectiveness of drugs or introducing drug toxicity. Some CAM products can be toxic, with studies showing mercury, arsenic and lead intoxication associated with the use of Ayurvedic herbal medicine products (Saeed et al., 2011; Saper et al., 2004). These risks increase when the products are not produced under the Therapeutic Goods Administration’s (TGA) Good Manufacturing Practice standards (Braun et al., 2014; Weir, et al., 2013). However, arguably the greatest negative impact of CAM is when it functions as a substitute for more efficacious conventional treatments (White et al., 2014). A further indirect risk of CAM has also been identified through surveys which have shown that a significant proportion of CAM providers actively discourage vaccination (Ernst, 2011).

Some CAMs not only do not work, but are also expensive, time-consuming, and harmful. For example, in the treatment of cancer, research using clinical trials has shown that no current CAM treatments have any benefit over and above that of the placebo effect. The use of CAM supplements has no proven effect as supportive care during chemotherapy, except for ginger in the treatment of chemotherapy-induced nausea (Smith et al., 2011). Those CAMs that are biologically active and ingested or absorbed into the body can also potentially interfere with chemotherapy. However, there is some evidence for the use of supportive mind-body therapies in the care of cancer patients (Smith et al., 2011). One of the main hazards associated with CAM is the issue of delaying or substituting effective healthcare to favour CAM (Han et al., 2011; Margină et al., 2015; White et al., 2014/8). Perhaps unsurprisingly, studies of breast cancer patients have shown that patients who opt to use CAM alone as treatment have increased recurrence of cancer and increased rates of mortality (Chang et al., 2006; Han et al., 2011).

Some CAMs have a degree of biological plausibility for the active mechanism, but are yet to be adequately tested for efficacy and effectiveness. These types of CAMs typically become orthodox medicine if they are proven to work. There are some benefits to CAM, particularly in the palliative care setting. For example, studies have shown benefits in the form of relief from anxiety, even if there is no evidence of other treatment benefits (Braun et al., 2014). Health consumers may also perceive benefits to using CAM because they believe that it works for them, or because of the satisfaction they receive as they experience congruence between CAM and their values, beliefs and philosophical or cultural orientation towards healthcare in general (Coulter & Willis, 2007). CAM proponents argue that orthodox medicine has much to learn from the CAM emphasis on treating the healthcare consumer in a holistic manner which is empowering and accessible

(Barrett et al., 2003). It is also important to recognise that, like CAM, orthodox medicine is not always safe, or evidence based. However, orthodox medicine incorporates system-wide mechanisms to evaluate evidence, monitor adverse events and to monitor health care providers in the provision of orthodox medicine (i.e. professional registration systems for doctors, nurses, allied health professionals). Furthermore, it is common for medications and other medical treatments to undergo rigorous scientific testing. Ideally, all systems of healing and health, both orthodox and CAM, would be held to the same rigorous standards of science. This being said, this thesis takes a socio-psychological approach to understanding beliefs and behaviour regarding vaccination and CAM adherence, and does not directly deal with the question of the relative safety and efficacy of conventional or alternative treatments.

1.2 Worldview and Risk Perception

1.2.1 Culture and Health Beliefs

Cultures and societies throughout the world have developed systems of health beliefs that explain the aetiology of illness, and mechanisms for curing or treating illness (Arousell & Carlbom, 2016; Bhui & Dinos, 2008; Vaughn et al., 2009). Many societies, such as in the UK, USA, and Australia, believe that disease is a result of observable scientific phenomena such as microorganisms, and they seek out medical treatments that are based on scientific evidence. Other cultures have health beliefs that incorporate the supernatural and spiritual (Jurkowski et al., 2010). Therefore, it is important to understand culture in relation to healthcare, and to develop culturally appropriate healthcare consumer education and interventions (Henderson et al., 2011).

1.2.2 Cultural Theory of Risk

Cultural theory of risk or Cultural Theory (Douglas & Wildavsky, 1983) maintains that an individual's perceptions of dangers or risks in society, such as the risks of vaccinating or not vaccinating, are influenced by culture more than other factors. Culture in this instance is reduced primarily to the structure of groups in society and these are reduced to four cultural biases: hierarchy, egalitarianism, fatalism, and individualism. It is notable that this definition is quite different from that used in most cultural studies that typically involve categories such as social class, gender, nationality or ethnicity. The Douglas and Wildavsky (1983) group/grid hierarchy of worldviews holds that cultural worldviews can be characterized along the two dimensions of group and grid. Group ranges from a high (group) to low (individualistic) degree of collective control. Grid ranges from a high degree of stratification in authority and role (hierarchical), to a low degree of stratification (egalitarian). In relation to human-induced climate change, research shows that individuals who have a cultural worldview described as hierarchical/individualistic (e.g. the type of people who trust and respect industry leaders, and who do not appreciate government interference in their business) are more likely to reject the risks of human-induced climate change (Kahan et al., 2011), because accepting the risks may have significant implications for them in terms of tightening of government regulation or the introduction of new taxes. They would rather underestimate the dangers of climate change than risk contradicting their own worldview, and that of influential members of their peer group (Kahan, 2010).

Kahan and his colleagues (2010) have put forward the notion that we can view misperceptions of risk in a social context, in that an individual's worldview affects their risk perception (Kahan et al., 2010). This 'cultural cognition of risk' is the tendency for

individuals to perceive risk, and information relating to those risks, in line with their values, thus explaining why people from different cultural groups often disagree about important issues in society. The theory posits that people are processing information in a motivated and biased way in line with their cultural worldview. Kahan (2010) suggests that people may oppose scientific evidence because they would rather follow the beliefs of their ‘tribe’ or peers; that people seek out and filter information about an issue through the lens of their ‘tribe’, ignoring information that contradicts their tribal view and absorbing information supportive of these views. A form of confirmation bias can occur (Kahneman et al., 1982) which involves a ‘filter bubble’ or ‘echo chamber’ of knowledge, particularly in online communications (Williams et al., 2015).

A study of cultural worldview and preference for childhood vaccination policy (Song et al., 2014), based on Cultural Theory (Douglas & Wildavsky, 1983), found that grid/group cultural biases have a significant impact on preferences for different vaccination policies. The researchers included cultural worldview (i.e. hierarchism, egalitarianism, fatalism, individualism) and ‘other personal values/beliefs’ (i.e. organic culture, political ideology) in the study. The results showed that egalitarians and hierarchs were more likely to be pro-vaccination, and individualists and fatalists had the opposing view. Hierarchs had the strongest opposition to the policies of philosophical and religious exemptions, and believed the government should be responsible for vaccination-related decisions. Fatalists had the greatest opposition to mandatory vaccination policy and were supportive of the role of parents in vaccination-related decisions, and toward philosophical and religious exemptions. An experimental study of over 1,500 subjects found that the mechanisms of biased assimilation of information, and source credibility, influenced people with different values to adopt opposing stances on the issue of

mandatory HPV vaccination (Kahan et al., 2010). Biased assimilation is similar to confirmation bias and refers to selectively interpreting information in a manner that confirms existing beliefs. There was support for the cultural cognition thesis which purports that this bias will interact with culture. That is, people will assimilate risk data and other information in a way that is congruent with their cultural predispositions, and therefore individuals will be polarized along cultural lines in regard to the issue.

1.3 Personality and Sociocultural Factors

1.3.1 Personality (the Big Five)

The Five Factor Model of personality features the Big Five personality dimensions of neuroticism, extraversion, openness, conscientiousness, and agreeableness (Costa & McCrae, 1992). It is one of the most commonly used models for assessing the relationship between personality and healthcare behaviours. A recent National survey conducted in the USA (Lin & Wang, 2020) showed that people high in agreeableness, emotional stability, and conscientiousness were more likely to consider vaccinations beneficial, and additionally those high in conscientiousness were more likely to support school-based vaccination requirements. The personality factor of conscientiousness is characterized by the tendency to be dutiful, show self-discipline and abide by social norms (Lin & Wang, 2020). Openness to experience is the only personality dimension which has been shown to predict use of CAM (Sirois & Gick, 2002; Smith et al., 2008; Thomson et al., 2014). Openness has been associated with creativity, intelligence, fantasy, liberal social views, and a need to examine and enlarge upon experiences; positively related to spirituality and is negatively associated with religious fundamentalism (Saroglou, 2002).

1.3.2 Cognitive Style

Cognitive style is a dimension of personality used to describe an individual's thinking style - how they perceive information, remember information, and problem solve (Kozhevnikov, 2007). There is consensus in the field of cognitive psychology that the brain assesses everyday cognitive and sensory information using two discrete information- processing systems: one system is intentional, rational, and analytic; the other automatic, affective, and intuitive (Kahneman, 2013). Individuals who tend more toward an intuitive style of thinking are more prone to cognitive biases and to use heuristics (mental shortcuts) in their decision making, than individuals with a more analytic style of thinking (West et al., 2008).

Heuristics and cognitive biases have been found to be involved in decision making related to vaccinations, including for example, the availability bias and the compression bias (Chapman & Coups, 2006; Luz et al., 2020; Niccolai & Pettigrew, 2016; Seethaler, 2016; Voinson et al., 2015). The availability bias involves relying on examples that quickly come to a person's mind when they are considering how risky an outcome is, and the compression bias involves over-estimating the rate of rare risks occurring. The very success of vaccination programs has meant that most people have not been exposed to diseases that have been almost eliminated, and therefore these people do not have ready access to negative outcomes in their memories, which increases the effect of the availability bias. In contrast, the common negative outcome of soreness at the vaccine injection site is far more available to people, and this may have a greater impact on judgements about the safety of vaccines (Luz et al., 2020). Individual differences in cognitive style, analytic versus intuitive has also been found to be related to a favourable attitude to CAMs and increased use of CAMs (Browne et al., 2015; Wheeler & Hyland,

2010). People who have a more analytic cognitive style are more likely to endorse vaccination (Anderson, 2015), are more sceptical about conspiratorial and paranormal concepts and make less emotional or disgust-based moral judgments (Pennycook et al., 2015).

1.3.3 Sociocultural Factors

There is growing evidence that sociocultural (i.e., involving both social and cultural) values impact on the decision-making process regarding whether or not to participate in vaccination programs. A systematic review of published research from 1999-2009 that investigated factors relating to non-vaccination and under-vaccination of children in low- and middle-income countries (Rainey et al., 2011), revealed multiple determinants, including strong social and cultural (e.g. religious or traditional) beliefs opposing vaccination, and a distrust in the healthcare systems that provide vaccination. Identified factors relating to cultural values and parental attitudes, and religious beliefs, were usually region or country specific. A systematic review of published literature from 2007-2012 to identify determinants of vaccine hesitancy showed that factors relating to vaccine hesitancy are complex and context-specific; they vary across vaccines, place, and time (Larson et al., 2014). The review found that perceptions around professional and social support, both positive and negative, were important explanatory factors; as were beliefs, attitudes, and motivations around health.

Lifestyles and values that have been associated with a negative attitude to vaccination include ‘alternative living’ lifestyles and a natural living philosophy (e.g. use of natural healing remedies such as herbs and homeopathic solutions, use of chiropractic techniques as a form of primary healthcare, veganism, vegetarianism, organic gardening, natural childbirth, breastfeeding); varying degrees of distrust of the medical community

(Gullion et al., 2008; Sobo, 2015), and membership of a like-minded community such as parents whose children were enrolled in Waldorf (Steiner) schools (Sobo, 2015). An Australian population study of factors that underlie the ‘vaccination confidence gap’ found that psychological and cultural factors were important predictors of vaccination scepticism and other non-evidence-based healthcare choices, such as the use of alternative therapies (Browne et al., 2015). Significant factors included: preferring CAM to conventional medicine; endorsement of spirituality as a source of knowledge; and the personality characteristic of openness. The authors conclude that scepticism toward vaccination may be a product of a particular psychological and cultural standpoint; one which is unwilling to embrace scientific evidence. Therefore, appealing to features associated with CAM, such as naturalness and holistic healing, may be more effective for these groups of people than the traditional information-based educational approach.

Qualitative research, particularly content analyses of anti-vaccination websites, has identified a range of attitudinal and cultural factors that are contributing to vaccination scepticism. These include an anti-authoritarian worldview where there is distrust of government, authorities, scientists, medical professionals, and pharmaceutical companies (Salmon et al., 2005), along with a tendency to reject advice from the establishment (Larson et al., 2011). This can merge into the realm of conspiracy theories when taken to extremes (Jolley & Douglas, 2014). Vaccine scepticism is also predicted by support for natural, alternative, and holistic healthcare, conspiracy ideation, an emphasis on civil liberties and parental rights (Bean, 2011; Briones et al., 2012; Kata, 2010, 2012; Lewandowsky et al., 2013; Yaqub et al., 2014). Studies have shown that specific healthcare beliefs, such as the belief that vaccines are unsafe and ineffective, and that medical professionals and experts cannot be trusted, are predictive of vaccine

scepticism and vaccine refusal and delays (Furnham & Beard, 1995; Gust et al., 2004; Poethko-Müller et al., 2009; Prislin et al., 1998). Some aspects of belief systems shown to be associated with the anti-vaccination movement include valuing holistic and spiritual aspects of healthcare, a valuing of the natural over the artificial, and a postmodern worldview in which patients have personal power, and the legitimacy of science and experts is questioned (Kata, 2010). These kinds of values, particularly those relating to natural treatments, are mostly in opposition to the very nature of ‘unnatural’ vaccinations, where an artificial product is produced by the biomedical industry with the use of artificial needles to inject laboratory produced contaminants involving viral material into a healthy body.

1.4 Emotional Reactions to vaccination and CAMs

The emotional states of fear and disgust have been found to be factors underlying a reluctance to vaccinate (Luz et al., 2019; Hornsey et al., 2020; Tomljenovic et al., 2020; Majid & Ahmad, 2020; Reuben et al., 2020; Roulin, 2015). Navin’s (2013) review of ‘Disgust, Contamination, and Vaccine Refusal’ found that those who refused vaccines were often motivated by disgust for potential contaminants in vaccines and vaccination in general. They were also attracted to concepts of sanctity and purity that were grounded in political, social, and moral and religious values. He argues that persuading these individuals to vaccinate is made more difficult as the basic emotion of disgust and associated values are not easily amenable to change using scientific evidence or arguments. Disgust is experienced as a transitory emotional state when a person is exposed to disgust-inducing stimuli, and is a primary emotion which evolved to motivate disease avoidance behaviours (Toronchuk & Ellis, 2007). A 24-nation investigation of the psychological roots of anti-vaccination attitudes (Hornsey et al, 2018) found that reported

high levels of disgust toward blood and needles predicted anti-vaccination attitudes. A study of 484 parents (Reuben et al., 2020) recruited via Amazon MTurk, found vaccine hesitant parents had greater disgust sensitivity for pathogens. It has been suggested that vaccine hesitancy is based on a 'health purity attitude' that causes an affective disgust response, and functions as a protective mechanism against contamination (Clifford & Wendell, 2016). They have argued that certain health and food attitudes (e.g. attitudes to genetically modified foods, use of preservatives, and vaccines) are related to positive attitudes toward purity and negative attitudes to contamination. They designed an experiment where a temporary emotional state of disgust was induced via exposure to photographs and an autobiographical writing task (Clifford & Wendell, 2016). The results indicated that greater disgust-sensitivity to pathogens was related to greater vaccine scepticism. Those most sensitive to disgust were more likely to believe in the discredited theory that vaccines cause autism. However, the experimental manipulation to induce disgust (i.e. priming for disgust) did not have a significant effect on vaccine scepticism.

Appeals to nature and naturalness, and the invoking of concepts of naturalness and purity, are central to most CAM practitioners and proponents (Browne et al., 2015; Nissen, 2015). Bishop and colleagues conducted a systematic review (2007) of the beliefs of CAM users. This review found there was an emphasis on natural treatments rather than artificially processed medicines. Lifestyles and values associated with both a preference for CAM and a negative attitude to vaccination includes a desire for cleanliness, purity, natural living, and a belief in the necessity of removing toxins (Gullion et al., 2008; Sobo, 2015). Anti-vaccination websites often refer to the purported toxins contained in vaccinations, such as heavy metals, and they promote alternative therapies to remove these contaminants (Moran et al., 2016). CAM advocates often promote a natural

lifestyle, with a focus on whole or natural foods and medicines, and they endeavour to reduce exposure to contaminants, or attempt to remove them using such interventions as chelation therapies and detoxification diets (Bihari, 2006). Further research into the role of emotional reactions, particularly disgust and fear of contamination, is needed to fully understand the relationship between these emotions and vaccine scepticism and use of CAMs.

1.5 Unorthodox Beliefs

There are few studies which look specifically at the worldview of individuals who have a range of unorthodox or alternative beliefs, including belief in conspiracies, the paranormal and magical, spiritual worlds and holistic health beliefs. There is also little information on whether a cultural worldview which embraces the unorthodox or non-evidence-based phenomena predicts unorthodox and potentially risky healthcare choices, including vaccine refusal and use of CAMs.

1.5.1 Definition of Unorthodox Beliefs

Unorthodox beliefs for the purposes of this thesis are defined as those alternative or unusual beliefs which break with convention or tradition, are not supported by scientific evidence, and are largely non-conformist (i.e. not conforming to generally accepted patterns of behaviours or thoughts) (Collins English Dictionary, 2014). Some unorthodox beliefs which we will look at in this thesis include conspiracy beliefs, paranormal beliefs, spiritual beliefs, magical health beliefs, holistic health beliefs, embracing CAM, and vaccination scepticism. Studies have shown that cognitive, personality, social and cultural factors can explain individual differences in a range of non-conformist or unorthodox attitudes, beliefs, and behaviours, such as those relating to conspiracies, the supernatural, the paranormal, and mysticism (Darwin et al., 2011; Farias

et al., 2005; Lindeman et al., 2012). This thesis looks specifically at the following beliefs and constructs:

1.5.2 Conspiracy Beliefs

Conspiracy beliefs are a type of non-evidence based or unorthodox belief. Conspiracy theories are the tendency of people to believe that significant events or activities have been secretly manipulated by groups or organisations (Grimes, 2016). They include for example, the idea that evidence of alien contact is being concealed from the public and the belief that the moon landing was a hoax. Some conspiracies are based in fact, but generally the term conspiracy theory has a pejorative connotation that suggests an unwarranted explanation or hypotheses that contradict the evidence or the prevailing explanation for events (Pigden, 2007). Conspiratorial thinking features in both anti-vaccination and CAM discourse. The anti-vaccination literature and websites often contain examples of conspiratorial thinking (Jolley & Douglas, 2014; Kata, 2010), involving for instance the Government, researchers, medical practitioners and ‘Big Pharma’ conspiring to make money while actively hurting or killing children with ‘toxic’ vaccines. Conspiracies in the CAM world include the belief that the Therapeutic Goods Association (TGA) and the pharmaceutical industry are colluding to harm the CAM supplement industry (Wardle, 2013). A study of conspiracist ideation in 1,817 Britons (Swami et al., 2011) showed that people with conspiracy beliefs often believed in a range of conspiracy theories, had more negative attitudes to authority, higher political cynicism, greater support for democratic principles, lower self-esteem, and scored lower on a measure of agreeableness.

A group of researchers (Goldberg & Richey, 2020) have suggested that anti-vaccination beliefs are rooted in a general propensity to believe in conspiracies, and that

these attitudinal traits are interconnected. The researchers recently conducted a study looking at data from a nationally representative sample of US citizens and found that belief in two unrelated conspiracies, such as 9/11 trutherism, and Obama is a Muslim, were highly correlated with anti-vaccination beliefs, and all three beliefs were positively correlated with authoritarianism, and negatively related to education, political knowledge and political trust. Another recent study (Sallam et al., 2021) in Jordan and Kuwait found low rates of acceptance of influenza and COVID-19 vaccines (29.4% and 30.9% respectively), and concerning rates of belief in COVID-19 conspiracy beliefs (i.e. 27.7% of respondents believed that the vaccine would contain microchips, and 23.4% that the vaccine caused infertility). Higher vaccine conspiracy scores were found among persons with lower education levels, females, and those with a reliance on social media platforms for information. An online cross-sectional study in Europe (Tomljenovic et al., 2020) looked at vaccine conspiracy beliefs and the uptake of vaccinations in children, specifically the relationship between vaccine conspiracy beliefs, intuitive versus analytic thinking styles, emotions around vaccination, and uptake of vaccinations. The results indicated that stronger negative emotions towards vaccines, intuitive thinking styles, and lower educational levels, were related to higher levels of vaccine conspiracy beliefs, and that both intuitive thinking style and a negative emotion toward vaccination were associated with vaccine refusal. The authors conclude that parents' affect or emotions are of primary importance, along with an intuitive thinking style, in the uptake and refusal of vaccinations. The use of CAM has also been shown to be related to both conspiracy beliefs and vaccine scepticism. An online survey of adults from Finland, via Facebook marketing (Soveri, Karlsson, Antfolk, et al., 2020), revealed that people's willingness to take a COVID-19 vaccination and to adhere to COVID restrictions (e.g. handwashing,

masks), was related to endorsement of CAM, as well as conspiracy beliefs, distrust of information sources, and state reactance (i.e. negative emotions that arise when individuals feel their freedom of choice is being taken away). A 2014 study of university students (Lobato et al., 2014) also showed that there is a considerable overlap between those who accept pseudoscience, believe in the paranormal and believe in conspiracy theories.

1.5.3 Paranormal Beliefs

Paranormal beliefs are those beliefs, as outlined in folklore or popular culture, in phenomena that sit outside the norm and are not explained by science (Lindeman et al., 2012). Paranormal beliefs include phenomena such as levitation, psychokinesis, mind reading, ghosts, astral travelling, reincarnation, astrology and psychic ability. Belief in the paranormal has been found to be related to belief in a range of pseudoscientific phenomena including CAMs (Darwin et al., 2011; Farias et al., 2005; Lindeman et al., 2000; Lindeman et al., 2012; Soveri, Karlsson, Mäki, et al., 2020). A study of an adult Flemish population found a strong, positive relationship between paranormal beliefs and use of CAM (Van den Bulck & Custers, 2010). The correlation was significant even after controlling for demographic variables, social desirability, and attitude to science. Paranormal beliefs also predicted attitudes to CAM in a study of health science students (Pettersen & Olsen, 2007). The authors concluded that a ‘less scientific worldview’ predicts positive attitudes to CAM. Another study of teenagers who believed in the paranormal (i.e. being able to contact spirits of the dead) displayed higher anxiety, lower psychological wellbeing, greater isolation, less positive social attitudes, and less socially conforming lifestyles than teenagers without those beliefs (Francis & Williams, 2009).

1.5.4 Spiritual Beliefs

Dr Maya Spencer (2012) of the Royal College of Psychiatrists defines spirituality as ‘the recognition of a feeling or sense or belief that there is something greater than myself, something more to being human than sensory experience, and that the greater whole of which we are part is cosmic or divine in nature.’ In contrast, religions are organised systems of practices and beliefs, with rituals and official doctrines such as Catholicism or Islam, and involve aspects of material and spiritual existence. A more concise definition of spiritual beliefs is that they are beliefs in spiritual things and the spiritual world, as opposed to physical or earthly things; a belief in supernatural spirits is the defining feature of spirituality (Lindeman et al., 2012). It could be argued that spiritual beliefs are so common that they are not really unorthodox, but some spiritual beliefs are far more non-conformist than others. For instance, astral travelling would be considered non-conformist by most. This is a spiritual belief that the spirit separates from the body and travels while the person is asleep. There is a strong relationship between belief in the spiritual and CAM, particularly as CAMs have non-scientific theoretical bases which have insights that appeal to intuition, as well as spiritual and mystical foundations (Anlauf et al., 2015). A study by Browne and colleagues (2015) looked at both cultural and psychological factors underlying a lack of confidence in vaccination, and they found that ‘endorsement of spirituality as a source of knowledge’ predicted reduced confidence in vaccination (OR .83, 95% CI .71–.96). It is not surprising that patients or healthcare consumers whose belief systems encompass spirituality or mysticism are often attracted to CAMs (Thomson et al., 2014). Spiritual aetiologies and treatments are fundamental to many CAM practices. For instance, to this day, there is a belief among some CAM proponents that epilepsy is a transcendent experience (the

epileptic seizure is a mystical state) that can be treated by CAMs, such as spiritual healing (Cohen, 2003).

1.5.5 Magical Health Beliefs

Magical health beliefs that rely on laws of magic, such as the laws of contagion and similarity (Lindeman et al., 2000), hold that events or things can be influenced by forces that sit beyond the laws of nature (i.e., evidence-based forces such as gravitation); mysterious or supernatural forces. Many CAMs have magical health beliefs as core beliefs and promulgate a range of non-evidence-based instructions regarding food and health which obey universal laws of magic or magical thinking. For example, there is a widespread belief among CAM proponents, especially naturopaths, that toxins are stored in the body if cleansing or detoxification is not undertaken (Klein & Kiat, 2015). This ignores the scientific evidence that the body has evolved effective mechanisms for eliminating toxins via, for example, the kidneys and liver. Another example of magical beliefs in CAM is the homeopathic doctrine that miniscule amounts of a substance are thought to cause a disease and will cure that disease. This despite the evidence that the dilutions of homeopathic remedies are so weak that they are essentially water without any active ingredient (Smith, 2012).

Magical health beliefs (MHB) as defined by Lindeman and colleagues (2000) have no empirical, logical or scientific basis, but are thought to have intuitive appeal due to suppositions regarding contagion, naturalness, as well as certain core knowledge or ontological confusions, cognitive errors and biases (Lindeman et al., 2000). The laws of magic purport that ‘things act on each other at a distance through a secret sympathy’ (Lindeman et al., 2000), and the two laws of sympathetic magic include contagion and similarity. The law of contagion holds that things will still have an effect on each other,

even after contact has been discontinued. An example is the belief that an amulet brings good luck to a person. The law of similarity asserts that a superficial likeness can influence or cause a deep likeness. An example is the modern magical health belief that if you drink red drinks your haemoglobin level will increase. Many non-scientific food and health pronouncements, often portrayed in popular magazines, obey these magical laws. A study of men and women from Finland (Aarnio & Lindeman, 2004) found that those attracted to magical beliefs about food and health were more likely to be female, vegetarian, intuitive thinkers, more eating disordered, and more likely to use CAMs. The authors suggest that food and health beliefs which are unfounded in science are embraced by some people and held in the arena of intuition, emotions, identity, and approach-avoidance behaviours.

1.5.6 Holistic Health Beliefs

Holistic health (or holistic medicine, holism, holistic care) refers to approaches that focus on the whole person rather than just the illness, and where the physical, psychological, spiritual, and emotional components of the individual are considered as one (Pietroni, 1997). Many CAM users subscribe to a holistic worldview and embrace the philosophy of holistic health (Astin, 1998). This is a view that it is beneficial to treat the body, mind, and spirit as a whole rather than isolating specific body parts for treatment, as is often the case with orthodox medicine (Vincent & Furnham, 1996). CAM is often considered by practitioners as more attractive than conventional medicine because it is holistic and empowering (Barrett et al., 2003). A range of studies have linked beliefs in holistic health with the use of CAM (Astin, 1998; Hyland et al., 2003; Siahpush, 1999). However, a recent study of 4370 Australians which looked at holistic health, use of CAM, and vaccination attitudes, found that those with the most negative attitudes to

vaccination were engaged, informed health consumers who embraced CAM, but converse to what would be expected, had lower belief in holistic health. They were also high in conspiratorial ideation, had a distrust in the system of mainstream healthcare, often voted for minor political parties, were more likely to be religious, male, with children, and had the self-perception that they were of good health.

1.6 Unorthodox Healthcare Choices

For the purposes of this thesis unorthodox healthcare choices are defined as those healthcare choices or behaviours which are not considered part of conventional or evidence-based medicine (EBM), including vaccine refusal or delays in vaccination, and the use of CAM. Conventional medicine or healthcare is defined as that type of medicine provided by doctors and allied health professionals (e.g. physical therapists, psychologists, registered nurses). Other terms for conventional medicine include mainstream medicine, regular medicine, orthodox medicine, Western medicine, and biomedicine (Marks, 2021).

1.7 Encouraging Evidence-Based Healthcare Choices

Beyond adding to the existing knowledge base regarding the psychological, social, cultural, and emotional basis of unorthodox beliefs and unorthodox healthcare choices, it is important that a comprehensive understanding of how unorthodox worldviews influence unorthodox healthcare choices can be directly applied to the future development of tailored and persuasive health promotion strategies for people who eschew evidence-based healthcare. These types of health promotion strategies or campaigns can encourage the uptake of vaccination, and other evidence-based healthcare practices. It is particularly important that vaccine hesitant individuals are encouraged to vaccinate themselves, and even more crucial that vaccine hesitant parents are persuaded

to allow their children to get vaccinated (Poland & Jacobson, 2011). Currently there is little research to inform effective strategies to persuade the vaccine hesitant in the community (Sadaf et al., 2013), therefore research in this area is timely.

1.7.1 Facts - Necessary but not Sufficient

The traditional public health communications approach has been to ‘educate’ people with facts from an ‘expert’. However, it is becoming increasingly clear that this form of health promotion is not always effective and may be counterproductive with some groups of people. For example, a web-based nationally representative 2-wave survey experiment (Nyhan et al., 2014) of 1759 parents, using four standard educational approaches, found that none of the interventions increased parental intention to vaccinate. In fact, one strategy that attempted to correct the incorrect but widely promoted idea that the MMR vaccination causes autism was counterproductive (i.e. decreasing intent to vaccinate) for individuals who had the least favourable existing attitudes to vaccines. The notion that people often interpret evidence in a biased manner (Lord et al., 1979) was considered key to the results, and the authors conclude that more study of pro-vaccine messaging is required if we are to successfully persuade people to accept vaccinations. Given the limitations of the traditional educational or information-based approach it is becoming clearer that more novel strategies need to be developed if we are to persuade anti-vaccine and vaccine hesitant individuals to vaccinate.

1.7.2 Psychology of Influence and Persuasion

Research into the psychology of influence and persuasion has clearly revealed that humans are mostly not rational decision makers; often making important decisions based on other factors, including personal and cultural values and beliefs, emotional appeal, and persuasive techniques (Cialdini, 1991). The literature on persuasive communication

(Cooper et al., 2015) can provide guidance for understanding why beliefs and attitudes regarding unorthodox healthcare choices are so resistant to change, and may provide pointers to the development of health promotion strategies which can persuade people to choose evidence-based healthcare. For instance, it has been found that when beliefs and attitudes are strongly linked to lifestyles or overarching values, then those beliefs and attitudes will be very strong and particularly difficult to change (Blankenship & Wegener, 2008).

Anti-vaccine websites often use persuasive strategies to persuade individuals, and particularly parents, that vaccination is to be avoided. A content analysis of 480 anti-vaccine websites (Moran et al., 2016) was undertaken by trained coders who analysed the content through the lens of persuasion theory. Coding included types of persuasive tactics used, as well as the lifestyle norms and values associated with anti-vaccine advocacy. The results reveal a number of established persuasive strategies being used to persuade parents not to vaccinate their children. These websites associate vaccine refusal with the values of individuality, freedom, and choice, and lifestyle factors such as alternative medicine/homeopathy and healthy/organic eating. Cherry picked scientific evidence and emotional anecdotes were commonly used persuasive strategies. The authors conclude that the inclusion of similar persuasive strategies (e.g. emotional anecdotal evidence, appeals to parents' values and lifestyles) could be of benefit to the promotion of vaccinations.

1.7.3 Social Marketing

Social marketing is an example of a novel approach that can be used to increase rates of vaccination (Opel et al., 2009) and to promote the uptake of other evidence-based healthcare choices. Social marketing is a model for behaviour change which 'applies

traditional marketing principles and techniques to influence target audience behaviours that benefit society as well as the individual' (Lee & Kotler, 2011). An innovative approach using social marketing and theory from the psychology of persuasion would assist with addressing the problem of vaccine rejection or vaccine hesitancy. A comprehensive identification and understanding of different groups of healthcare consumers, that is 'market segments' in social marketing terminology, who are not persuaded by evidence-based products or techniques, would be the first stage of a social marketing campaign or initiative. Researchers could develop an understanding of how healthcare consumer market segments can be persuaded to choose an evidence-based healthcare option such as vaccination. It is the rigorous segmentation of markets that is an essential component of social marketing, and one which helps with the targeting and tailoring of strategies.

1.8 Conclusion

This chapter has provided an overview of the literature on unorthodox worldviews that predict vaccine scepticism and use of CAM. It begins with a look at what drives people away from vaccination and toward CAM. This is followed by a review of a range of concepts or factors that have been found to predict vaccine scepticism and CAM use, including worldview and risk perception, personality, socio-cultural factors, emotional reactions, and unorthodox beliefs (i.e. conspiracy, paranormal, spiritual, magical health, and holistic health beliefs). This is then followed by a section defining unorthodox beliefs, unorthodox healthcare choices, and conventional medicine. Finally, a discussion on why facts are necessary but not sufficient in the quest to motivate people to vaccinate, and some potential ways to encourage evidenced-based healthcare choices, particularly using the psychology of persuasion and social marketing techniques.

Chapter 2. Rationale and Framework for the Research Program

2.1 Purpose of the Research Program

In the previous chapter a review of the literature was conducted on vaccine scepticism and use of CAMs, exploring the different traditions of individual differences (inclusive of personality, attitudes, and beliefs), socio-demographics, and emotional reactions, which underpin vaccine scepticism and use of CAMs. This thesis consolidates and extends on previous research with a focus on unorthodox psychological, socio-cultural, and emotional worldviews of those who are vaccine hesitant and who embrace CAMs. A comprehensive understanding of these worldviews can inform the future development of tailored, and persuasive health promotion strategies to encourage participation in evidence-based healthcare, particularly vaccination programs.

2.2 Goal of the Research

The overall goal of this thesis is to explore unorthodox worldviews that predict vaccine scepticism and use of CAM, in order to inform the future development of persuasive strategies to encourage participation in evidence-based interventions.

2.3 Rationale for Research Studies

Four studies have been conducted in this thesis which contribute to the goal of the research. The first study deals with a measurement issue identified in the review of the literature, which showed there was no quantifiable measurement tool to assess use of CAMs. This was important as CAM use is a key factor being explored in this thesis. Studies 2-4 address respectively the areas of individual differences, socio-demographics, and emotional reactions in relation to vaccine scepticism and use of CAMs.

2.3.1 Rationale for Study 1 (Measurement of CAM Use)

CAM use is a key factor being explored in this thesis, and therefore it is important to have reliable and valid measurement of CAM use. However, the review of studies into the prevalence of CAM use was striking in that estimates of use of CAM were extremely variable from study to study, and there was also a lack of consistency in regard to what psychological and socio-demographic variables predicted CAM use. One of the difficulties in this area of research was the use of different methodologies, including the way CAM use is defined and measured. A systematic review of studies of CAM-use in paediatrics (Toupin et al., 2012) found 96 different survey instruments were used in 104 publications, and no studies were considered to have sound methodological quality. The International Questionnaire to Measure Use of Complementary and Alternative Medicine (I-CAM-Q) was developed to address some of these methodological issues (Quandt et al., 2009). The I-CAM-Q is a comprehensive instrument which covers a broad range of CAM products and practices, but unfortunately it is essentially descriptive in nature, and was not created with the intention of providing a single (or multi-) dimensional quantitative index of CAM utilisation. There was clearly a need for a quantifiable and psychometrically sound measure of CAM utilisation, and the first study in this research program addressed this need. The aim and objectives of the first study are as follows:

Aim:

Develop a standardized measure of CAM utilisation based on the International CAM Questionnaire (I-CAM-Q) (Quandt et al., 2009).

Objectives:

- The identification of specific CAM practices that do (or do not) reflect a general tendency to utilise CAM.

- An assessment of the effectiveness of the revised instrument (R-I-CAM-Q) as a unitary, quantitative index of CAM utilisation.
- An assessment of the convergent validity of the instrument using an established measure of attitudes to CAM.

2.3.2 Rationale for Study 2 (Individual Differences)

The use of CAM has been identified as one possible factor in the development of vaccine scepticism and vaccine refusal. A systematic review of the literature (Wardle et al., 2016) on the links between the use of CAM and the development of vaccine scepticism and vaccine refusal revealed that CAM providers had significant anti-vaccination attitudes, and there was a positive correlation between use of CAM products and lower uptake of vaccination. It is not clear whether CAM providers are directly influencing their clients to avoid vaccines or whether individuals with negative attitudes to vaccination are also attracted to CAM because of other cultural or psychological factors. There is also little empirical evidence into whether negative attitudes to vaccination are due to a worldview that rejects orthodox approaches in favour of alternative wisdom that values naturalness, spirituality and intuitive understanding of disease and health. The second study in this research program addresses these issues and the aim and objectives are as follows:

Aim:

Investigate explanatory factors for the relationship between CAM use and vaccination scepticism.

Objectives:

- Investigate whether CAM use directly predicts vaccination scepticism.

- Investigate whether the relationship between CAM use and vaccination scepticism is best understood to occur at the attitudinal level, including pro-CAM attitudes, and more general alternative health attitudes or beliefs - magical health beliefs and holistic health beliefs - as well as socio-demographic differences.

It should be noted that the original intention was to use the R-I-CAM-Q (as developed in Study 1) in this second study, as measurement of CAM use was required. However, instead the I-CAM-Q was quantified into three sub-scales: provisions of CAM services, use of CAM products, and self-help practices. This was done in this context to reduce loss of valuable information. As outlined in the first study (Bryden & Browne, 2016), the impact of removal of some questions needs to be considered by researchers in various settings and countries, where some items may be more relevant and others not relevant.

2.3.3 Rationale for Study 3 (Socio-demographics)

The majority of studies which survey attitudes to vaccination and uptake of vaccinations, including factors of an environmental and socio-cultural nature, have focused on individual-level variables rather than geographic/area-based factors. However, vaccine refusal and under immunisation tend to cluster geographically (Lieu et al., 2015; Onnela et al., 2016), and vaccine preventable outbreaks also cluster geographically (Atwell et al., 2013; Roggendorf et al., 2012). It is likely that geographic or area-based clustering of socio-demographic factors impact rates of vaccination because of the influence of cultural norms and social networks, as well as accessibility issues related to distance and cost. A few area-based studies have been conducted in other parts of the world, but there have been no area-based studies conducted for the whole of Australia. The third study in this research program addresses this need through an analysis of area-

based indicators associated with lower vaccination rates for children throughout the entire country. The aim and objectives are as follows:

Aim:

To investigate the relationship between area-level socio-demographic indicators and compliance with the National Immunisation (NIP) Schedule for children in Australia.

Objective:

To identify postcode-level socio-demographic indicators that are associated with lower rates of vaccination for 5-year old children, including SEIFA Index of Relative Disadvantage; SEIFA Index of Education & Occupation; socio-demographic indicators of parents/partners in families with children aged between 4 and 7 (i.e. education, employment, occupation, indigenous status, language spoken at home, religion, age and personal income); and Remoteness Area classifications (i.e. major cities, inner regional, outer regional, remote and very remote areas of Australia (ABS, 2017).

2.3.4 Rationale for Study 4 (Emotional Reactions)

The emotional states of disgust and fear have been found to be drivers underlying a reluctance to vaccinate (Luz et al., 2019; Majid & Ahmad, 2020), and some health and food attitudes have been found to be related to positive attitudes to purity (Clifford & Wendell, 2016). There is limited research into whether the specific emotive reaction of disgust, or feeling personally contaminated, plays a role in the formation of beliefs around vaccine scepticism. If high levels of contamination fear or disgust sensitivity are a key facilitator of vaccine hesitancy, then experimentally inducing feelings of contamination (i.e. priming for contamination) may reduce favourability to vaccination and increase favourability to CAMs. Similarly, priming for purity/naturalness may increase favourability toward CAMs and decrease favourability to vaccination. As the

majority of studies outlined in the review (see Chapter 1) are cross-sectional and correlational by design, an experimental design will be used in the fourth study of this program of research, with the aim and hypotheses outlined below.

Aim:

Assess whether increasing the salience of concepts of contamination or purity will produce changes in the reactions to a range of health interventions, including vaccination and CAMs.

Hypotheses:

- Priming with images of contamination will cause a negative change in attitudes to vaccination (relative to a control condition) and a positive change in attitudes to CAMs.
- Priming with natural/pure images will cause a negative change in attitudes to vaccination (relative to a control condition) and a positive change in attitudes to CAMs.

2.4 Research Design and Methodological Approach

Three methodologies were used in this research program as follows:

1. Multivariate analyses of an archived, cross-sectional, online population survey for (1) the development of a standardised CAM utilisation questionnaire based on the International CAM Questionnaire (I-CAM-Q) (Quandt et al., 2009); and (2) the investigation into explanatory factors for the relationship between CAM use and vaccination scepticism.
2. A public health focused ecological methodology where postcode-level socio-demographic variables from the 2016 Census are combined with postcode-level vaccination data, in order to examine associations between area-level socio-

demographic factors and uptake of vaccination among 5-year-old children throughout Australia.

3. An online priming experiment with four between-subject experimental conditions including photos of 1) biological contamination, 2) chemical contamination, 3) pure environments, such as pristine landscapes, and 4) hazard signs/icons indicating physical threats. Two control conditions included photos of neutral scenes and neutral icons, whereby experimental groups were compared against the related control groups (photograph for conditions 1-3 and neutral icons for condition 4).

2.5 Thesis Structure

This thesis is presented as a thesis with publications, with 7 chapters as follows. Chapter 1 provided an overview of research related to unorthodox worldviews that predict vaccine scepticism and use of CAM. Chapter 2 outlined the rationale and framework for the research program, including overall purpose, and the goal, aims and objectives of this thesis. Chapter 3 presents a published study (Bryden & Browne, 2016) on the development of a standardized measure of CAM utilisation, based on the I-CAM-Q (Quandt et al., 2009), using an archived population survey of Australian adults. Chapter 4 presents a published study (Bryden et al., 2018) which investigated explanatory factors for the relationship between CAM use and vaccination scepticism, including an examination of the relationship between personality (openness to experience), cognitive style, and a range of unorthodox beliefs, with unorthodox healthcare choices including vaccine scepticism and use of CAM. Chapter 5 presents a published study (Bryden et al., 2019) which identified postcode-level socio-demographic indicators associated with lower rates of vaccination for 5-year-old children in Australia. Chapter 6 presents a

published experimental study (Bryden et al., 2021) which assessed whether increasing the salience of concepts of contamination or purity produced changes in the reactions to a range of health interventions, including vaccination and CAM. Chapter 7 contains the discussion and conclusions, including key findings from the research; strengths and limitations of the research; implications of the findings; areas for further investigation, and final conclusion.

Chapter 3. Develop a Measure of CAM Utilisation

3.1 Declaration of Co-authorship and Contribution

Title of paper:

Development and evaluation of the R-I-CAM-Q as a brief summative measure of CAM utilisation.

Full bibliographic reference for journal in which the paper appears:

Bryden, G. M., & Browne, M. (2016). Development and evaluation of the R-I-CAM-Q as a brief summative measure of CAM utilisation. *Complementary Therapies in Medicine*, 27, 82–86. <https://doi.org/10.1016/j.ctim.2016.05.007>

Status: Published (Open Access).

Nature of candidate's contribution:

- Conception and design of the research.
- Collation of literature.
- Data collation and statistical analysis.
- Analysis and interpretation of the findings.
- Majority writing of the publication.
- Responsible for submission, revision, and re-submission throughout the peer-review process.

Nature of co-author's contribution:

- Conception and design of the research.
- Statistical analysis.
- Analysis and interpretation of the findings.
- Critical appraisal of content.

- Editorial assistance and assistance with re-submission throughout the peer-review process.

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<https://www.sciencedirect.com/journal/complementary-therapies-in-medicine>

Candidate's Declaration:

I declare that the publication below meets the requirements to be included in the thesis as outlined in the Research Higher Degree Theses Policy and Procedure.

Date:_____

3.2 Introduction

This chapter outlines the development and testing of a standardised measure of use of CAM based on revisions to the International CAM Questionnaire (I-CAM-Q) (Quandt et al., 2009). Specifically, the identification of specific CAM practices that do (or do not) reflect a general tendency to utilise CAM; an assessment of the effectiveness of the revised instrument (R-I-CAM-Q) as a unitary, quantitative index of CAM utilisation; and an assessment of the convergent validity of the instrument using an established measure of attitudes to CAM.



Development and evaluation of the R-I-CAM-Q as a brief summative measure of CAM utilisation[☆]



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ABSTRACT

Objective: This study evaluates a revised version of the I-CAM-Q, the R-I-CAM-Q, which is a shorter scale, and suitable for use as a brief, summative measure of CAM utilisation.

Design: Online survey with an Australian sample (n = 2697).

Analysis: The psychometric properties of the I-CAM-Q were analysed using Mokken Scaling Analysis and Structural Equation Modelling.

Results: A subset of items were identified as having an adequate uni-dimensional structure that can be aggregated to yield a scalar measure of CAM utilisation. Certain items, including prayer for health purposes, and chiropractic, were not indicative of general CAM use.

Conclusions: The R-I-CAM-Q provides a unitary, aggregate measure of CAM utilisation that provides scope for replicable research into the determinants of CAM use. It is the first quantitative and summative measure of general CAM use, developed and tested using modern psychometric methods.

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1. Introduction

The use of complementary and alternative medicine (CAM) is widespread and increasing in many parts of the world.¹ However, studies into the prevalence of CAM utilisation have revealed variable results²; one of the difficulties being due to the use of different methodologies, including the way CAM use is defined and operationalised for data collections.³ A systematic review of the prevalence of CAM use in general populations showed variations from 9.8% to 76%³; and a systematic review of CAM use in children showed prevalence rates from 8% to 48.5%.⁴ A further systematic review into the measurement properties of questionnaires assessing CAM use in paediatrics,⁵ found 96 CAM questionnaires in 104 publications; and none of these studies were considered to have adequate methodological quality.

The International Questionnaire to Measure Use of Complementary and Alternative Medicines (I-CAM-Q)⁶ was specifically developed to address this issue. It was the aim of the developers of the I-CAM-Q to develop a comprehensive measure of the use of CAM applicable to different populations, taking care (through a 2-

day workshop involving 35 expert participants) to ensure effective coverage of specific forms of CAM. The outcome of the workshop was the I-CAM-Q,⁶ which asks about visiting health care providers, complementary treatments received from physicians, use of herbal medicine and dietary supplements, and self-help practices. It elicits frequency of use of CAM, purpose and satisfaction, and use of specific types of CAM.

Whilst the I-CAM-Q provides a comprehensive and well-considered set of items, measuring a broad range of products and practices, it also has several limitations. First, it is essentially descriptive in nature, and was not created with the intention of providing a single (or multi-) dimensional quantitative index of CAM utilisation. As such, there are no published psychometric properties of the questionnaire and, in its present form the I-CAM-Q cannot be aggregated to measure a general use of CAM, as opposed to utilisation of specific products or services. This represents a serious deficiency in the I-CAM-Q as a tool for advancing our understanding of the determinants of between-individual variation in CAM use—a topic of growing interest.^{7,8} Second, the I-CAM-Q is lengthy and has a somewhat idiosyncratic format, which makes it difficult to integrate into a typical multi-instrument survey; a recent study of CAM use in Europe using the I-CAM-Q found the questionnaire had low face validity and acceptability, and was likely to produce biased estimates of CAM use when used in England, Romania, Italy, Netherlands or Spain.⁹ It is perhaps for these reasons that

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only a handful of studies have incorporated the I-CAM-Q into their design.^{10–14}

Although there are a number of quantitative measures of CAM attitudes and beliefs, with well-documented psychometric properties,^{15–18} there are no validated scales for the general population which summate information across all of the CAM products and services. Hitherto, studies that have investigated CAM utilisation have in nearly all cases treated the diverse set of products or services as separate outcomes.^{2–4} Whilst this may suit some applications, it complicates the task of understanding the cognitive and psycho-social determinants of CAM utilisation.^{7,19–21} The premise of the present study is that a unitary measure of CAM utilisation is meaningful and useful.

The aim of this study is to develop and test a revised version of the I-CAM-Q. The objectives include the identification of specific CAM practices that do (or do not) reflect a general tendency to utilise CAM; an assessment of the effectiveness of the revised instrument (R-I-CAM-Q) as a unitary, quantitative index of CAM utilisation; and an assessment of the convergent validity of the instrument using an established measure of attitudes to CAM.

2. Method

A modified I-CAM-Q (described below) was included in a multi-instrument online survey, which covered a variety of health-related beliefs, attitudes, and behaviours, as well as basic demographic information. The survey also included the 6 item CAM sub-scale of the Holistic Complementary and Alternatives Medicines Questionnaire (HCAMQ).¹⁵ Higher scores on this sub-scale reflect more positive attitudes towards CAM. The HCAMQ has been shown to possess good psychometric properties,^{15,22} with results supporting a two-factor structure corresponding to the subscales (CAM and HH subscales). The present survey was hosted online using Sawtooth Software Version 8.²³

2.1. Participants

The first stage of sampling involved inviting panel participants of the Australian Health and Social Science (AHSS) project (run by CQUniversity Australia), to complete an online survey. The AHSS national panel is recruited annually via dedicated computer assisted telephone interviewing (CATI) and random number land-line and mobile calling, with participants also invited via annual institutional omnibus CATI surveys recruited via the same method. At the time of the survey launch, the panel comprised 3864 members. Each participant was sent a personalised e-mail that contained instructions on how to complete, with a link and password to the SSI hosting software. A total of 1744 complete responses were obtained from the AHSS panel. This dataset was supplemented by utilising SSI's commercial recruitment services—with instructions to provide 1000 general-population Australian participants, with an approximate balance with respect to gender and major age categories. Members of the SSI panel are provided with cash and in-kind incentives to complete online surveys. A further 953 complete responses were obtained by this method, yielding a dataset for analysis of 2697 cases (1306 male). The mean participant age was 58 (min = 18, max = 89, SD = 14.8).

2.2. Modified I-CAM-Q

The full I-CAM-Q⁶ was modified with several goals in mind; (a) to reduce time to complete, (b) to reformat in a manner conducive to quantitative analysis, (c) to eliminate redundancy and qualitative (i.e. free text answer) components, (d) to retain the original coverage of the specific CAMs utilised. The original instrument includes four sections: (1) visiting health care providers, (2)

complementary treatments received from physicians, (3) use of herbal and dietary supplements, and (4) self-help practices. Section 3 involves eliciting qualitative detail on supplements and was accordingly eliminated, as use of these categories of supplements are captured in other sections. Section 2 contains a similar set of probes to section 1, differentiated by the direction towards treatment by a *physician*—a practice that is very rare in Australia. Accordingly, Section 2 was eliminated to reduce redundancy without loss of coverage. The resulting set of probes comprised the modified I-CAM-Q, and were organised as follows: (a) *providers of CAM services*—homeopath, acupuncturist, herbalist, spiritual healer, chiropractor, naturopath, hypnotherapist, body manipulation therapies such as Bowen Therapy or Reiki (excluding massage or physiotherapy), therapeutic massage, and other (please specify); (b) *use of CAM products*—herbs/herbal medicine; vitamins/minerals; homeopathic remedies; other (please specify), and (c) *self-help practices*—meditation, yoga or tai chi, detox or cleansing diet, prayer for your own health, relaxation techniques or visualization, aromatherapy, any form of traditional or spiritual healing ceremony. We also included other specific products which might be relevant to indicating CAM use in the Australian context (i.e. home weight loss equipment, magnetic bracelets or rings, and non-fluoridated or non-chlorinated distilled water for health purposes).

The original I-CAM-Q measures only whether or not a CAM was used in the last 12 months. Nevertheless, historic use of CAM is still likely to be a moderately positive indication of CAM use. Accordingly, the modified I-CAM-Q incorporated three ordered response categories: No (0); Yes (Not in the last 12 months) (1); and Yes (in the last 12 months) (2).

2.3. Analysis

An ideal scale is comprised of individual items (specific CAMs) that co-vary reliably with a common construct (general CAM use or utilisation), but are otherwise unrelated. In order to refine the set of candidate CAM probes, we applied Mokken Scale Analysis^{24,25}, a non-parametric scale development procedure. We subsequently validated the reduced set using a parametric model; a confirmatory factor analysis (CFA) with an ordinal response model (GRM). Standard measures of reliability were also computed. Finally we checked the correlation of the resulting scale total with the HCAMQ.¹⁵ All analyses were conducted in the open source statistical programming environment R.²⁶

3. Results

3.1. Mokken Scale Analysis (MSA)

MSA was conducted using the Automated Item Selection Procedure (AISP) in program R²⁷ to identify scalable set(s) of items from the original set of 24 items of the modified I-CAM-Q using the default *H* coefficient threshold of 0.3. Sixteen candidate items were identified in a single scale, whilst the remaining eight items were found to be un-scalable, i.e. could not be combined with other items to yield a scale with sufficient homogeneity. The non-scalable items were: Providers (acupuncturist, chiropractor, hypnotherapist, and other); Products (home weight loss equipment, magnetic bracelets or rings, and other); and Self-help practices (prayer for your own health).

Table 1 shows the final Mokken analysis of items that were scalable. As shown in Table 1, item scalability coefficients were generally close to 0.4, with a few exceptions. A final item included for exploratory purposes, 'non-fluoridated or non-chlorinated water for health purposes' had unsatisfactory (<0.3) item *H* coefficient

Table 1
Mokken Scale Analysis and threshold analysis of the modified I-CAM-Q (n = 2697).

Item	H _j	se	T1	T2
Providers				
Homeopath	0.396	0.016	1.057	1.989
Herbalist	0.382	0.015	0.964	1.729
Spiritual healer	0.379	0.022	1.453	2.002
Naturopath	0.383	0.013	0.609	1.603
Body manipulation therapies (e.g. Bowen/Reiki)	0.301	0.014	0.709	1.422
Therapeutic massage	0.328	0.013	0.041	0.629
Products				
Herbs/herbal medicine	0.392	0.012	0.134	0.758
Vitamins/minerals	0.441	0.021	1.044	0.414
Homeopathic remedies	0.389	0.014	0.813	1.586
Non-fluoridated or non-chlorinated water for health purposes	0.285	0.018	na	na
Self-help practices				
Meditation	0.373	0.012	0.362	0.8
Yoga or Tai Chi	0.306	0.014	0.529	1.09
Detoxification or cleansing diet	0.313	0.014	0.729	1.338
Relaxation techniques or visualization	0.382	0.012	0.228	0.672
Aromatherapy	0.356	0.013	0.732	1.287
Any form of traditional or spiritual healing ceremony	0.387	0.020	1.425	1.932
Scale H	0.357	0.010		

H_j = Loevinger item homogeneity coefficients; H = scale homogeneity coefficients; T1 = No versus Ever Used 1; T2 = Ever Used versus Used last 12 m.

and was accordingly removed. The scale *H* increased to 0.367 with removal of this weak item, suggesting reasonably good item homogeneity. As shown in Table 1, the item thresholds (T1 = No versus Ever Used, T2: Ever Used versus Used last 12m) were uniformly well-ordered; that is, T1 < T2 in all cases. This supported the hypothesis that more recent CAM utilisation is an indicator of CAM use. Comparison of threshold coefficients across different CAMs is also informative, given they share a common z-score metric. For example, having consulted a homeopath (T2 = 1.99), or spiritual healer (T2 = 2.00) in the last 12 months differentiated those with the highest level of CAM use. Having had therapeutic massage (T2 = 0.63) or having used vitamins or minerals (T2 = 0.76), differentiated individuals with low to moderate levels of CAM use from those with little or no usage.

3.2. Reliability

Reliability coefficients were calculated for the reduced set of items: Guttman's lambda 3 (alpha) = 0.85; minimum split half reliability (beta) = 0.74, suggesting satisfactory reliability but some item heterogeneity. Application of Revelle's coefficient omega (hierarchical), suggests that although 87% of variability in the data is due to common variation, only 69% can be attributed to a common factor. This confirms the existence of residual correlation among the CAM usage items, after factoring in the general trait.

3.3. Confirmatory Factor Analysis (CFA)

A simple uni-dimensional CFA model, with all items loading on the latent factor, was specified; the goal being to identify the source of this heterogeneity, and then to determine whether it caused any conceptual or practical problems for the proposed aggregate scale. Ordinal logistic link functions were used to accommodate the three level ordinal response variables. In the initial model, the CFI (0.96) and GFI (0.97) indices were good (>0.95), but the RMSEA (0.08) and SRMR (0.09) were above threshold (0.05).²⁸ From inspection of the modification indices, we added the residual correlations: meditation ~ relaxation (*b* = 0.41); spiritual healer ~ traditional ceremony (*b* = 0.31); and meditation ~ Yoga/Tai Chi (*b* = 0.34). These residual correlations are not surprising, given the content similarity between these pairs of practices, and confirm the source of item heterogeneity observed previously. With

these additions, the RMSEA improved to 0.05 and the SRMR to 0.06 (Model 2). We then proceeded to allow for correlations to account for progressively more marginal additional covariance until both the SRMR (0.05) and RMSEA (0.039) were below 0.05 (Model 3). The additional correlations were between: homeopathic practitioners ~ homeopathic products; relaxation ~ Yoga/Tai Chi; body manipulation ~ massage; meditation ~ traditional ceremony; and homeopath ~ naturopath. All residual correlations appeared to be a natural consequence of bivariate similarities between various practices. Therefore, the theoretical issues in aggregating over the group appear to be minimal. The question then became, whether or not the item clustering observed presented any practical difficulty for calculating an aggregate score. The correlation between the estimated latent scores of Model 3 (which accommodates the residual correlations) and a simple sum of CAM utilisation (using the [0,1,2] scoring scheme) was 0.96. From this it is concluded that clustering among specific CAMs does not present a practical difficulty in utilising the R-I-CAM-Q as a summative scale.

3.4. Convergent validity

Finally, we calculated the correlation of the R-I-CAM-Q with the HCAMQ attitudes to CAM scale: *r* = 0.43, *p* < 0.001. The mean Spearman correlation of usage of any single CAM with the HCAMQ was 0.24. Therefore, more positive attitudes to CAMs are related to greater use of CAM; providing convergent validity for the R-I-CAM-Q.

4. Discussion

Progress in better understanding the determinants of CAM usage is hindered by the lack of a validated, single measure of CAM utilisation. The I-CAM-Q was developed with the goal of ensuring good coverage of the major forms of CAM; but the current format is not suitable for quantitative analysis. We have developed, using modern psychometric procedures, the R-I-CAM-Q, which retains the coverage of the original scale, and offers a briefer, summative and unitary measure of CAM utilisation.

In standard scale development, item probes are developed in order to best reflect an underlying hypothesised construct. In the present case, the probes were specified a-priori, and it was proposed that usage of specific CAMs, to some degree, reflects an

Table 2

R-I-CAM-Q. There are a variety of complementary and alternative medicines (CAM) available to treat different health problems and ailments. The following questions ask you about the sorts of treatments you have tried.

Which of the following providers have you personally used the services of? (circle one relevant number for each category)			
Providers	No	Yes (Not in last 12 months)	Yes (In last 12 months)
Naturopath and/or Homeopath	0	1	2
Herbalist	0	1	2
Spiritual healer/traditional medicine or spiritual healer	0	1	2
Body Manipulation Therapies (e.g., Bowen Therapy/Reiki/therapeutic massage)	0	1	2
Which of these products have you personally used? (tick relevant boxes)			
Products	No	Yes (Not in last 12 months)	Yes (In last 12 months)
Herbs/herbal medicine	0	1	2
Vitamins/minerals	0	1	2
Homeopathic remedies	0	1	2
What forms of CAM self-help practices have you used? (tick relevant boxes)			
Self-help practices	No	Yes (Not in last 12 months)	Yes (In last 12 months)
Meditation/Relaxation Techniques/Visualization/Yoga or Tai Chi	0	1	2
Detoxification or cleansing diet	0	1	2
Aromatherapy	0	1	2

underlying predisposition to utilise CAM in general. The analyses largely support this assumption, most notably that 87% of variation in specific CAM use is related to use of other CAMs, and 69% of this is due to a common tendency to use CAM in general. One of the challenges in CAM research is in making sense of results applying to the great diversity of specific CAMs. The positive implication is that considerable advantages can be gained by treating a reasonably large number of CAMs as a group. The intercepts (or item-locations) of the various specific CAMs accord with intuition, that use of certain CAMs (such as homeopathy) reflects a more intense use of alternative therapies, whilst others (such as massage) indicate only low or moderate interest in using CAM.

As detailed above, not all practices that fall within the definition of CAM warranted inclusion in the scale. Non-scalable items included acupuncture, chiropractic, and hypnotherapy services. This is not to say that utilisation of these are unrelated to general CAM use (e.g. Spearman correlation of chiropractic with the R-I-CAM-Q is 0.33). Nevertheless, researchers interested in utilisation of these specific procedures are encouraged to treat them as separate outcomes. These results may reflect the fact that these procedures are viewed as more orthodox medical practices, and/or that they are employed as a response to a specific ailment, rather than reflecting an underlying general tendency to use CAM. In the case of prayer for health reasons, our view is that this behaviour is more likely a reflection of particular religious views, rather than a general enthusiasm for CAM. Interestingly, other researchers³ have stated that the inclusion of prayer and other forms of religious practice as CAMs overly inflates prevalence estimates of CAM use. None of the speculative CAM products suggested by the authors were suitable for inclusion into the scale. To some degree, this evidences that the original items sourced from the I-CAM-Q are difficult to improve upon.

Clustering of CAMs can be explained by similarities between certain sub-sets of CAMs. For example, individuals with the common goal of wanting to achieve a state of relaxation might be particularly attracted to meditation, relaxation techniques, visualization, and/or yoga and Tai Chi. Body manipulation therapies (such as Bowen/Reiki) and massage have similarities in practice, and those who are interested in these CAM's may have similar underlying health issues, such as back pain. While these relationships are interesting, and may promote new lines of inquiry, our results suggest that they do not present a theoretical or practical problem for aggregation in a composite measure.

4.1. Future research

In its present form, the R-I-CAM-Q (Table 2) should provide a solid basis for future research exploring the personal, environmental, and cultural determinants of CAM utilisation. Scoring of the R-I-CAM-Q simply requires a summation of all items that have been selected (i.e., 1 point for each item in the 'Not in last 12 months'; 2 points for each item selected in the 'In last 12 months'). Further work on measurement of CAM utilisation might focus either on optimising the R-I-CAM-Q further as a uni-dimensional tool, or alternatively consider a multi-dimensional approach, that separately measures different categories of CAM.

4.2. Limitations

One of the major limitations of this study involves the loss of information when using the shorter R-I-CAM-Q. One of the key aims of the original I-CAM-Q was the 'international' nature of the questionnaire.⁶ The impact of removal of some questions, particularly Section 2, needs to be considered by countries where those items may be more relevant; and additional items added if further information is sought.

5. Conclusion

The R-I-CAM-Q is the first quantitative and summative measure of overall CAM utilisation, developed and tested using modern psychometric methods. It should be particularly useful for researchers who wish to explore why some people use CAM more than others, without necessarily delving into the complex specifics of each individual practice.

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Chapter 4. Investigate Explanatory Factors for the Relationship Between CAM use and Vaccination Scepticism

4.1 Declaration of Co-authorship and Contribution

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Nature of candidate's contribution:

- Primary conception and design of the research.
- Collation of literature.
- Data collation and analysis.
- Analysis and interpretation of the findings.
- Majority writing of the publication.
- Responsible for submission, revision, and re-submission throughout the peer-review process.

Nature of co-authors' contribution:

- Conception and design of the research.
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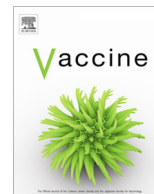
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4.2 Introduction

This chapter outlines a study which investigates whether CAM use directly promotes vaccination scepticism, or whether the relationship between CAM use and vaccination scepticism is best understood to occur at the attitudinal level. The study looks at the relationship between personality, cognitive style and a range of unorthodox beliefs (paranormal, conspiracy, magical health beliefs, spiritual beliefs, holistic health beliefs) and endorsement and use of unorthodox healthcare practices and attitudes (including pro-CAM attitudes and more general alternative health attitudes or beliefs – magical health beliefs and holistic health beliefs).



Anti-vaccination and pro-CAM attitudes both reflect magical beliefs about health[☆]

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ABSTRACT

We examined the relationship between complementary and alternative medicine (CAM) use and vaccination scepticism; and specifically whether a person's more general health-related worldview might explain this relationship. A cross-sectional online survey of adult Australians ($N = 2697$) included demographic, CAM, and vaccination measures, as well as the holistic and magical health belief scales (HHB, MHB). HHB emphasises links between mind and body health, and the impact of general 'wellness' on specific ailments or resistance to disease, whilst MHB specifically taps ontological confusions and cognitive errors about health. CAM and anti-vaccination were found to be linked primarily at the attitudinal level ($r = -0.437$). We did not find evidence that this was due to CAM practitioners influencing their clients. Applying a path-analytic approach, we found that individuals' health worldview (HHB and MHB) accounted for a significant proportion (43.1%) of the covariance between CAM and vaccination attitudes. MHB was by far the strongest predictor of both CAM and vaccination attitudes in regressions including demographic predictors. We conclude that vaccination scepticism reflects part of a broader health worldview that discounts scientific knowledge in favour of magical or superstitious thinking. Therefore, persuasive messages reflecting this worldview may be more effective than fact-based campaigns in influencing vaccine sceptics.

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1. Introduction

The uptake of vaccinations in developed countries is generally high, however, there is a potentially growing minority of individuals, often concentrated in specific locations, who are sceptical about the importance and safety of vaccines, and who refuse or delay vaccination, or who selectively vaccinate [4,31]. Childhood vaccination rates in some pockets of Australia have fallen below herd immunity levels and there have been a number of measles outbreaks around the country, including a measles outbreak in New South Wales in 2012 where the majority of infections were in unvaccinated individuals, with a significant proportion identifying as anti-vaccine [10]. Recently there has been resurgence of pertussis in the USA due mainly to parental vaccine refusal [3]. There are a range of psychological, social and cultural factors that can affect an individual's attitudes towards vaccination, and any attempt to influence public opinion must recognise these complexities [10,17,18].

The use of complementary and alternative medicines (CAM) has been identified as one possible factor in the development of vaccine scepticism and vaccine refusal. Historically many CAM service providers have adopted an anti-vaccination stance [11,32]. They have questioned the efficacy and effectiveness of vaccinations [15], and some have offered ineffective alternatives such as homeopathic 'vaccinations' [28]. The first critical review in the field was undertaken by Wardle et al. [35] to summarise the limited research available on the relationship between CAM and childhood vaccinations. The authors identified 23 studies which met their criteria, and concluded that the relationship was complex and multifactorial. Their conclusions were somewhat mixed, noting a heterogeneity of effect on childhood vaccination across CAM disciplines, users and regions. However, significant anti-vaccination attitudes were found among CAM providers, and there was a positive correlation between use of CAM products and lower vaccination uptake.

In summary, the available evidence suggests that there is an association between CAM and anti-vaccine attitudes. However, it is not currently clear whether CAM providers are directly influencing vaccine scepticism by communicating vaccination concerns with clients, or whether individuals with negative attitudes to vaccination are also attracted to CAM – due to, for example, other

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cultural, or psychological factors. To the extent that there is an attitudinal correspondence, it is an open question as to whether it is a direct relationship from social influence, or whether it may be explained by more general alternative health beliefs underlying both positions. On one hand, a direct influence may be observed due, for instance, chiropractors directly counselling their clients to avoid vaccination [30] or CAM material being promoted on anti-vaccination websites [15]. On the other hand, specific CAM and vaccination attitudes may reflect broader concerns or misunderstandings regarding science-based medicine [9]. This latter explanation is consistent with the idea that negative vaccination attitudes are due to a worldview that rejects orthodox approaches in favour of alternative wisdom that values naturalness, spirituality, and intuitive understandings of disease and health [6,34,2]. There is some evidence for the ‘shared worldview’ explanation of the link between CAM and vaccination scepticism. Browne et al. [6] found that vaccine sceptics tended not only to prefer CAM to conventional medicine, but also valued spirituality as a source of knowledge, tended to be more open to new ideas, and to prefer intuitive over analytic reasoning. Other general explanatory factors of vaccine scepticism include a belief in natural immunity, conspiracy ideation, an anti-authoritarian worldview, and general distrust of the medical community and expertise [5,16,19,24,27,36].

There is little empirical evidence to support a relationship between more general alternative beliefs about health, such as a belief in magical concepts regarding health, or holistic health beliefs, and an anti-vaccination stance. However, there are reasonable grounds to assume that these types of alternative health beliefs may be instrumental in pre-disposing individuals towards vaccination scepticism. Magical health beliefs (MHB) as defined by Lindeman and colleagues [22] have no empirical, logical or scientific basis, but are thought to have intuitive appeal due to suppositions regarding contagion, naturalness, as well as certain core knowledge or ontological confusions, cognitive errors and biases [22]. One example of a modern MHB is that consuming red drinks will raise your haemoglobin level. In contrast, holistic health beliefs (HHB) relate to the philosophy that in order to maintain health the whole person must be considered as the mind, body and spirit are integrated [12]. Unlike MHB, HHB are not necessarily demonstrably false, or reflect biases or errors of cognition. For example, the HHB that it is important to find a balance between work and relaxation in order to stay healthy is a reasonable supposition [25]. To our knowledge, neither MHB nor HHB have been previously employed to explain vaccination scepticism. Therefore, we believe that inclusion of these factors is important if we are to develop a greater understanding of the relationship between CAM use and attitudes and vaccination scepticism.

The present study aimed to investigate explanatory factors for the relationship between CAM use and vaccination scepticism. Specifically, the study aimed to (a) investigate whether CAM use directly promotes vaccination scepticism, or (b) whether the relationship between CAM use and vaccination scepticism is best understood to occur at the attitudinal level, including pro-CAM attitudes, and more general alternative health attitudes or beliefs – magical health beliefs and holistic health beliefs – as well as socio-demographic differences.

2. Methods

2.1. Design and sample

A cross-sectional survey was conducted in Australia with the first stage of sampling involving the invitation of participants from an institutional health survey panel to complete a standalone web-based survey. This online panel group is re-populated on an annual

basis via computer assisted telephone interviewing (CATI) from random number landline and mobile telephone contacts, which results in an online panel with sampling properties similar to the contributing CATI surveys. At the time of the survey launch, the panel comprised 3864 members. Each participant was sent a personalised e-mail that contained instructions on how to complete the survey, along with a link and password directing them to the Survey Sampling International (SSI) host software. A total of 1744 complete responses were obtained from the panel with 45% completion rate. This dataset was supplemented by utilising a commercial panel provider with instructions to recruit 1000 additional general-population Australian participants with an approximate balance across gender and major age categories. Members of the commercial panel were provided with cash and in-kind incentives to complete online surveys. A further 953 complete responses were obtained by this method.

2.2. Measures

2.2.1. Socio-demographics

Information was collected on age, gender, education level, total household income, and location (urban, regional town or city, and rural).

2.2.2. CAM use

The International Questionnaire to Measure Use of Complementary and Alternative Medicine (I-CAM-Q) [26], is a comprehensive measure of the use of CAM which asks about visiting CAM providers, using CAM products, and self-help CAM practices. The original instrument includes four sections: (1) visiting health care providers, (2) complementary treatments received from physicians, (3) use of herbal and dietary supplements, and (4) self-help practices. It was adapted for the purpose of quantitative assessment [7], and is organised into three sub-scales: provision of CAM services, use of CAM products, and self-help practices. The I-CAM-Q, modified for an online quantitative survey format [7], is included in [Appendix A](#).

2.2.3. Vaccination scepticism questions

Questions on vaccination were selected by the authors of this current study from a review of the scientific literature containing questions on attitudes, beliefs, and behaviours regarding vaccination of children. The format was designed to be applicable to those with or without children. If the respondent does not have a child, they are asked to imagine having the responsibility of making a decision to vaccinate a child in their care. The resultant questionnaire is a continuous measure of vaccination scepticism with a range from 1 to 4 (averaged over 9 questions), with greater scores reflecting a high degree of scepticism toward vaccination. Descriptive statistics using the sample from this current study ($N = 2754$) showed skewness = 1.14 ($SE = 0.047$) and kurtosis = 1.57 ($SE = 0.093$). The distribution is positively skewed but within acceptable levels for analysis. The majority (75%) of respondents scored 2 or less on this vaccination scale. Given the large sample size in this study, there was a large enough sample of individuals scoring at the ‘vaccine sceptics’ end of this scalar measurement for all analyses to be considered methodologically robust. The scale also has good internal consistency (Cronbach’s $\alpha = 0.85$). See [Appendix A](#) for vaccination questions.

2.2.4. Magical health beliefs (MHB)

The General Magical Beliefs subscale of *The Magical Beliefs about Food and Health Scale* developed by Lindeman and her colleagues [22], (referred to here as MHB) was included in the survey. An example includes, “An imbalance between energy currents lies behind many illnesses”. A factor analysis conducted by Lindeman

Table 1Bivariate correlations, means, standard deviations, minimums and maximums for study variables (n = 2665^a).

Measure	1	2	3	4	5	6	7	8	M	SD	Min	Max
1. CAM Attitudes	1								2.80	0.57	1	4
2. CAM Services	−0.399**	1							2.51	2.32	0	10
3. CAM Products	−0.374**	0.619**	1						1.99	1.38	0	6
4. CAM Self-Help Practices	−0.315**	0.563**	0.558**	1					1.89	1.90	0	7
5. Vaccination Scepticism	−0.443**	0.242**	0.261**	0.199**	1				1.73	0.55	1	4
6. Magical Health Beliefs	−0.433**	0.365**	0.406**	0.392**	0.344**	1			1.99	0.63	1	4
7. Holistic Health Beliefs	−0.131**	0.227**	0.231**	0.319**	0.017	0.359**	1		3.35	0.49	1	4
8. Age	0.106**	0.008	−0.070**	−0.101**	−0.177	−0.075	0.006	1	55.77	14.88	18	89

^a Listwise deletion of missing data.

** Correlation is significant at the 0.01 level (2-tailed).

Table 2

Linear regression model predicting vaccination scepticism from CAM attitudes and CAM use.

	Coefficients				ANOVA (Type II Tests)			
	Estimate	SE	t value	p (t)	SS	df	F	p (F)
Intercept	4.435	0.051	86.233	p < .001***				
CAM Attitudes	−0.376	0.019	−19.879	p < .001***	97.38	1	395.183	<.001***
CAM Services	−0.074	0.042	−1.760	p = .079	0.76	1	3.097	0.079
CAM Products	−0.157	0.038	−4.160	p < .001***	4.26	1	17.309	<.001***
CAM Self-Help Practices	−0.012	0.027	−0.445	p = .656	0.05	1	0.198	0.656
Residuals					662.59	2689		

Residual SE: 0.496 (df = 2689); R² = 0.2045; R²_{adj} = 0.2034; F (4, 2689) = 172.9, p < .001***.

*** p < .001.

and the team who developed the scale [22] supported the validity of this sub-scale. Reliability (Cronbach's alpha = 0.85), and test-retest reliability (r = 0.83) were also adequate [22]. The MHB sub-scale is included in [Appendix A](#).

2.2.5. The holistic complementary and alternative medicine questionnaire (HCAHQ)

The HCAHQ is an 11 item questionnaire [14] included in the survey. Hyland and his team [14] conducted a factor analysis of the scale that revealed two distinct but related constructs: beliefs about holistic health, and beliefs about the scientific validity of CAM, as outlined below.

2.2.5.1. Holistic health beliefs (HHB). The Holistic Health subscale of the HCAHQ (referred to here as HHB) developed by Hyland et al. [14] measures belief in a holistic model of health. An example question is "Positive thinking can help you fight off a minor illness." The HHB subscale has good internal validity as indicated by factor analysis; and test-retest reliability was adequate (r = 0.77) [14]. The HHB is included in [Appendix A](#).

2.2.5.2. CAM attitudes. The CAM subscale of the HCAHQ (referred to here as CAM attitudes) measures attitudes regarding the efficacy and desirability of CAM [14]. Hyland et al. [14] reported that the CAM attitudes subscale appears to have good internal validity as indicated by factor analysis, and good test-retest reliability (r = 0.82). High scores on the CAM attitudes subscale indicate negative attitude or beliefs about CAM, and low scores indicate a positive attitude to CAM. The CAM Attitudes subscale is included in [Appendix A](#).

2.3. Data analysis

The first step of this study was to assess the relative importance of CAM attitudes, as distinct from CAM use, in predicting vaccination scepticism. This was addressed through the use of multiple regression and Type II sums of squares tests. The *relaimpo* package [13] in the R Statistical Programming environment [33] was used

to assess relative importance of each predictor using the recommended *lmg* metric. Similar to running Type II sums of squares over all possible combinations of predictors, this metric provides a consistent method to estimate the proportion of explained variance in the response attributable to each predictor. The second step was to assess the degree to which accounting for the influence of MHB, HHB, and socio-demographics variables on both vaccination scepticism and CAM attitudes attenuated the observed relationship between these two variables. This was addressed through path analytic models using the *lavaan* package [29] in R.

3. Results

The total dataset for analysis included 2758 cases. There were slightly more females (51.9%) than males in the surveyed sample, with an age range from 18 to 89 (M = 56, SD = 15). [Table 1](#) presents bivariate correlations and descriptive statistics for study variables: CAM attitudes, CAM use (services, products, and self-help practices), vaccination scepticism, MHB, HHB, and age.

3.1. Pro-CAM attitude, rather than CAM use, predicts vaccination scepticism

[Table 2](#) summarises a linear regression model predicting vaccination scepticism using CAM attitudes (i.e., CAM attitudes subscale of the HCAHQ) and CAM use (i.e., I-CAM-Q subscales: providers, products, and self-help practices) as predictors. Parametric tests on estimated beta coefficients, as well as Type II sums of squares, are shown. The four CAM variables explained 20% of the variability in vaccination scepticism. Furthermore, Type II tests suggested that the large majority of covariance could be attributed to pro-CAM attitudes, rather than CAM use.

[Fig. 1](#) illustrates the relative importance of each of the four predictor variables using the *lmg* metric [13]. From the regression and the relative importance procedure, we concluded that pro-CAM attitudes, rather than CAM use, were instrumentally related to vaccination scepticism. As indicated in [Table 1](#), CAM attitudes were

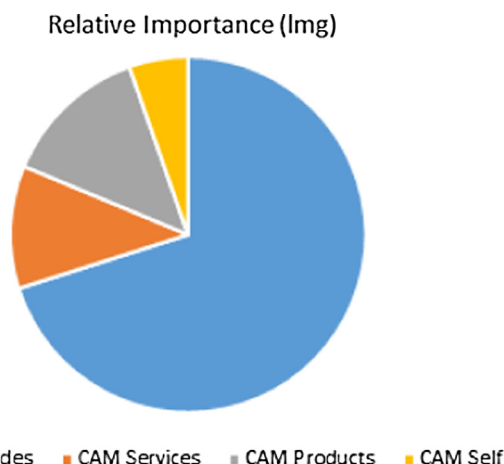


Fig. 1. Relative importance of CAM attitudes and use in predicting vaccination scepticism as measured by the *lmg* metric.

reliably negatively associated with vaccination attitudes, $r = -0.437$ (CI $-0.467, -0.406$), $t(2692) = -25.25$, $p < .001$.

3.2. The importance of general alternative health beliefs, particularly MHB, in explaining the relationship between CAM attitudes and vaccination scepticism

Table 3 summarises two path analytic models, with CAM attitudes and vaccination scepticism predicted by MHB and HHB (Model 1), and then with the addition of socio-demographic covariates (Model 2). As shown in Table 3, the zero-order correlation between CAM attitudes and vaccination scepticism diminished significantly from -0.437 to -0.287 (CI $-0.253, -0.320$) after accounting for the influence of MHB and HHB. Converting this reduction to variances, this calculation entails that $0.287^2/0.437^2 = 43.1\%$ of the covariance between vaccination scepticism and CAM attitudes can be explained by MHB and HHB. However, the residual

correlation did not significantly decrease further with the addition of the socio-demographic covariates in Model 2: $r = -0.276$ (CI $-0.243, -0.309$). This suggests that more general alternative health beliefs, rather than socio-demographics, are instrumental in explaining the relationship. Of particular note is that MHB was a much stronger predictor than HHB of both CAM attitudes and vaccination scepticism, as can be seen by the standardised regression coefficients in Table 3.

4. Discussion

This study advances our understanding of the complex and sometimes contradictory relationship between the use of CAM and vaccination scepticism, building on the results of the Wardle et al. [35] critical review.

4.1. Pro-CAM attitudes rather than CAM use predicts vaccination scepticism

The first finding, that pro-CAM attitudes predicted vaccination scepticism to a far greater degree than CAM use, supports the hypothesis that the relationship between CAM use and vaccination scepticism is best understood at the attitudinal level and as a consequence of a consistent worldview on health, rather than being explained by the health consumer's use of CAM. This strongly suggests that the correspondence is not primarily due to the direct influence of CAM providers, but rather due to the characteristics of the clients. It should be noted that this does not entirely preclude the influence of some CAM providers who are anti-vaccination, and who may attempt to engender some vaccine scepticism amongst their clientele [11,35].

4.2. Anti-vaccination and pro-CAM attitudes both reflect magical beliefs about health

The second, and most significant finding in this study, is that belief in magical health concepts was the most influential variable

Table 3
Summary of path analytic models predicting CAM attitudes and vaccination scepticism ($n = 2964$).

Paths		Model 1			Model 2		
		Estimate	SE	Z	Estimate	SE	Z
<i>Regressions:</i>							
Magical Health Beliefs	→ Vaccination Scepticism	-0.384	0.019	-20.05***	-0.367	0.019	-18.85***
Holistic Health Beliefs	→ Vaccination Scepticism	0.118	0.019	6.14***	0.104	0.019	5.394***
Age	→ Vaccination Scepticism	-	-	-	0.157	0.019	8.455***
Gender	→ Vaccination Scepticism	-	-	-	0.042	0.018	2.292*
Education Level	→ Vaccination Scepticism	-	-	-	0.008	0.019	0.444
Income	→ Vaccination Scepticism	-	-	-	-0.002	0.020	-0.088
Location	→ Vaccination Scepticism	-	-	-	-0.049	0.018	-2.718**
Magical Health Beliefs	→ CAM Attitudes	0.438	0.019	23.64***	0.434	0.019	22.845***
Holistic Health Beliefs	→ CAM Attitudes	-0.030	0.019	-1.62	-0.043	0.019	-2.268*
Age	→ CAM Attitudes	-	-	-	-0.062	0.018	-3.439***
Gender	→ CAM Attitudes	-	-	-	0.068	0.018	3.856***
Education Level	→ CAM Attitudes	-	-	-	0.021	0.019	1.101
Income	→ CAM Attitudes	-	-	-	0.037	0.019	1.929
Location	→ CAM Attitudes	-	-	-	0.057	0.018	3.195**
<i>Covariance:</i>							
Vaccination Scepticism	↔ CAM Attitudes	-0.287	0.017	-16.77***	-0.276	0.017	-16.521***
<i>Variances:</i>							
Vaccination Scepticism		0.870	0.024	36.70***	0.843	0.023	36.701***
CAM Attitudes		0.816	0.022	36.70***	0.801	0.022	36.701***

*** $p < .001$.

** $p < .01$.

* $p < .05$.

explaining the relationship between pro-CAM attitudes and vaccination scepticism, over and above belief in holistic health, and socio-demographics. These MHBs rely on unscientific, or non-evidence based, so called *laws of magic* which hold that events or things can be influenced by forces that sit beyond the laws of nature, including mysterious or supernatural forces [21,22]. Many CAMs have magical health beliefs as core propositions and promulgate a range of non-evidence based instructions regarding food and health that obey these *laws of magic*. The role of more general alternative health beliefs, including belief in magical concepts regarding food and health, and belief in holistic health, in the development of an anti-vaccination stance, is far less clear. However, the current study has provided an important first step in understanding how these non-evidence based, alternative health beliefs, may influence both pro-CAM attitudes and vaccination scepticism.

4.3. Summary

The results strongly suggest that it is not a direct communication of ideas from CAM practitioners to clients supporting an anti-vaccination stance, but rather that both specific attitudes – pro-CAM and anti-vaccination attitudes – reflect more general alternative health attitudes or beliefs, particularly magical thinking about health. Of less importance, but still evident, is a holistic view of health that supports both CAM use and anti-vaccination attitudes. In the original article describing the development of *The Magical Beliefs about Food and Health Scale (MFH)* Lindeman et al. [22] discusses the importance of experiential learning and the cognitive basis of MHBs, particularly individual differences in intuitive versus rational thinking in the genesis of magical beliefs. Magical beliefs have also been shown to originate from cognitive errors and from affective processes and subsequent judgments [1]. The results of the current study are in line with a further study by Lindeman [20], in which ontological confusions between the core features of physical, mental, and biological entities, intuitive thinking, and paranormal beliefs predicted 34% of variation in CAM belief, but only 4% of the variation in other variables that previous researchers have attempted to link with CAM attitudes; such as demographics, and educational attainment [20].

4.4. Implications for health initiatives targeting vaccine sceptics

There are people who have little interest in whether their healthcare choices are supported by research and evidence, and then there are others who have an interest in both evidence-based and alternative approaches to healthcare. These groups often select their healthcare based on other factors, such as their cultural worldview or the influence of their peer group [23]. The provision of rational argument and supporting data is not always an ideal or sufficient persuasive health promotion strategy with these types of consumers. Persuasion can benefit from the addition of strategies such as the right messenger, a message that can arouse the audience emotionally, and one which is congruent with audience worldviews [8]. Examples could include using messengers, such as television celebrities who embrace CAM but who are also pro-vaccination, that speak, in person or via social media or YouTube, directly to vaccine sceptics in terms that reflect their shared worldview; or emotive personal stories told on radio, television or other media, from parents who have embraced holistic health as an alternative to vaccination but who are devastated by the death of an unvaccinated baby from whooping cough or other infectious disease. This study has identified a group of vaccine sceptical

healthcare consumers, holding a worldview or system of beliefs which embrace magic and a holistic approach to health, who may benefit from these types of persuasive strategies.

It is also important to note that many CAM practitioners are pro-vaccination. Given that anti-vaccination healthcare users are more likely to visit CAM providers and trust the information that they disseminate, then there is also the potential for CAM providers to influence or encourage vaccine sceptics to embrace vaccination.

5. Limitations

The main limitation of this study is the correlational nature which limits the degree to which causal statements can be made. Another limitation is that the questions on intention to vaccinate are based on attitudes rather than actual behaviour. Despite some individuals indicating an intention to vaccinate or not to vaccinate, this choice could change in the future. Finally, the MHB scale includes a question “an illness should be treated with a medicine that has properties similar to that of the illness” [22]. This question may represent for some people a simplified, and not completely accurate, mechanism of vaccination. If so, this item could be considered problematic when using the MHB in relation to questions on vaccination. However, we do not consider the questions to be overly problematic given that the question could refer to a number of CAMs, such as homeopathy. The initial psychometric study done by Lindeman et al. [22] provided validation for this question as part of a magical beliefs factor.

5.1. Future research

Further in-depth qualitative studies such as content analyses of alternative healthcare internet sites would be useful to develop a greater understanding of the cultural and philosophical worldview of vaccine sceptics, particularly in relation to magical health beliefs. Experimental studies using priming techniques to engender feelings of, for example, disgust or creativity, would also be beneficial to investigate the effect of priming on attitudes to vaccination and CAM.

6. Conclusion

This study provided evidence that the use of CAM does not directly promote vaccination scepticism, but that the relationship is best understood at the attitudinal level, due to a supportive underlying worldview which incorporates magical beliefs about health and generally non-evidence based or an unscientific assessment of health issues.

Conflict of interest

The authors declare they have no conflict of interests.

Declarations of interest

None.

Appendix A. (Survey Questionnaires)

A.1. I-CAM-Q [26]

There are a variety of alternative medicines available to treat different health problems and ailments. The following questions ask you about the sorts of treatments you have tried.

Which of the following complementary providers have you personally used the services of?

- 1 Homeopath
- 2 Acupuncturist
- 3 Herbalist
- 4 Spiritual healer
- 5 Chiropractor
- 6 Naturopath
- 7 Traditional Medicine or Spiritual Healer
- 8 Hypnotherapist
- 9 Body manipulation therapies, such as Bowen Therapy or Reiki (excluding massage or physiotherapy)
- 10 Therapeutic massage
- 11 Other (please specify)

RESPONSES

- 1 No
- 2 Yes, but not in the last 12 months
- 3 Yes, in the last 12 months

Q10: Which of these products have you personally used?

- 1 Herbs/herbal medicine
- 2 Vitamins/minerals
- 3 Homeopathic remedies
- 4 Home weight loss equipment
- 5 Magnetic bracelets or rings
- 6 Non-fluoridated or non-chlorinated distilled water for health purposes
- 7 Other Supplements (please specify)

RESPONSES

- 1 No
- 2 Yes, but not in the last 12 months
- 3 Yes, in the last 12 months

Q11: What forms of self-help practices have you used?

- 1 Meditation
- 2 Yoga or Tai Chi
- 3 Detox or cleansing diet
- 4 Prayer for your own health
- 5 Relaxation techniques or visualization
- 6 Aromatherapy
- 7 Any form of traditional or spiritual healing ceremony

RESPONSES

- 1 No
 - 2 Yes, but not in the last 12 months
 - 3 Yes, in the last 12 months
-

A.2. Vaccination questions

The following items relate to your intentions to be vaccinated or to have a child vaccinated if you had a child in your care. If you do not have a child, just imagine that you had the responsibility of making a decision to vaccinate a child in your care.

Q12: Please select how much you agree with the following statements.

- 1 Immunizations sometimes overload/weaken the body's natural defences.
- 2 If I had a child to care for, I would ensure that they received all scheduled vaccinations.
- 3 If I had a child to care for, I would want them to receive the annual influenza (flu) vaccine, even though it is not 100% effective.
- 4 If it was free, and convenient, I would prefer to receive the annual influenza (flu) vaccine.
- 5 I would worry about having my child or a child in my care vaccinated.
- 6 Having my child vaccinated would stop them from getting diseases.
- 7 With regard to having my child vaccinated, I want to do what healthcare professionals at my practice think I should.
- 8 Having my child vaccinated is important to help prevent disease from spreading in the community.
- 9 There is some uncertainty about whether vaccination is truly the best option for preventing disease.

SCALE

- 1 Strongly disagree
 - 2 Somewhat disagree
 - 3 Somewhat agree
 - 4 Strongly agree
-

A.3. Magical health beliefs subscale [22]

The following sentences describe various views on keeping the body in a state of health and certain types of health care.

Q6: Please select the degree to which you agree with these statements.

- 1 An imbalance between energy currents lies behind many illnesses.
- 2 Colours change the organism's energy vibration in a direction that is beneficial to health.
- 3 Plants are living beings whose energy potentials can be transmitted to human beings.
- 4 By massaging a diseased organs surrogate in the sole of the foot, the organ will be restored.
- 5 An incorrect diet makes food rot in the body
- 6 If we don't somehow clean our bodies, unhealthy toxins remain in them.
- 7 It is good to detoxify one's body every now and then with a fast.
- 8 An illness should be treated with a medicine that has properties similar to those of the illness
- 9 Since our bodies are 70 percent water, we should be eating a diet that has an approximate water content of 70 percent.
- 10 The statement that red drinks improve haemoglobin is probably valid.

SCALE

- 1 Strongly disagree
 - 2 Somewhat disagree
 - 3 Somewhat agree
 - 4 Strongly agree
-

A.4. Holistic health beliefs subscale [14]

The following statements describe various views on how the mind and body are related.

Please select the degree to which you agree with each statement.

- 1 Positive thinking can help you fight off a minor illness
- 2 When people are stressed it is important that they are careful about other aspects of their lifestyles as their body already has enough to cope with
- 3 The symptoms of an illness can be made worse by depression
- 4 If a person experiences a series of stressful life events they are more likely to become ill
- 5 It is important to find a balance between work and relaxation in order to stay healthy

SCALE

- 1 Strongly disagree
- 2 Somewhat disagree
- 3 Somewhat agree
- 4 Strongly agree

A.5. CAM attitudes subscale [14]

Complementary therapies are becoming very popular in Australia as a way of maintaining good health. These include homeopathy, naturopathy, chiropractic, energy medicine, and various forms of acupuncture, Chinese medicine and faith healing. Attitudes towards the use of complementary medicine vary and we are interested in your opinion.

Please select the degree to which you agree with each statement.

- 1 Complementary medicine should be subject to more scientific testing before it can be accepted by conventional doctors
- 2 Complementary medicine can be dangerous in that it may prevent people getting proper treatment
- 3 Complementary medicine should only be used as a last resort when conventional medicine has nothing to offer
- 4 It is worthwhile trying complementary medicine before going to the doctor
- 5 Complementary medicine should only be used in minor ailments and not in the treatment of more serious illness
- 6 Complementary medicine builds up the body's own defences, so leading to a permanent cure

SCALE

- 1 Strongly disagree
- 2 Somewhat disagree
- 3 Somewhat agree
- 4 Strongly agree

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Chapter 5. Investigate the Relationship Between Area-level Socio-demographic Indicators and Compliance with the Vaccination Schedule for Children

5.1 Declaration of Co-authorship and Contribution

Title of paper:

The privilege paradox: Geographic areas with highest socio-economic advantage have the lowest rates of vaccination.

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Nature of candidate's contribution:

- Primary conception and design of the research.
- Collation of literature.
- Data collation and analysis.
- Analysis and interpretation of the findings.
- Majority writing of the publication.
- Responsible for submission, revision, and re-submission throughout the peer-review process.

Nature of co-authors' contribution:

- Conception and design of the research.
- Analysis and interpretation of the findings.
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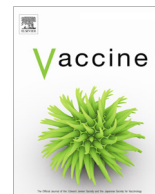
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5.2 Introduction

This chapter examines the association between postcode-level socio-demographic indicators and lower rates of vaccination for 5-year old children, including SEIFA Index of Relative Disadvantage; SEIFA Index of Education & Occupation; Socio-demographic indicators of parents/partners in families with children aged between 4 and 7 (i.e. education, employment, occupation, indigenous status, language spoken at home, religion, age, and personal income); the Australian Statistical Geography Standard (ASGS) (ABS, 2017); and Remoteness Area classifications (i.e. major cities, inner regional, outer regional, remote and very remote areas of Australia).



The privilege paradox: Geographic areas with highest socio-economic advantage have the lowest rates of vaccination

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ABSTRACT

The present study is the first to examine associations between area-level socio-demographic factors and uptake of vaccination among 5-year old children throughout Australia. A public-health focused ecological methodology was used that combined postcode-level socio-demographic variables from the 2016 Census with postcode-level vaccination data. Analyses included one-way analysis of variance and assessment of linear trends for each socio-demographic variable across five categories of vaccination rate; ranging from lowest ($\leq 90\%$) to highest (96.1–100%), as well as using vaccination rate as a continuous variable. Multiple regression analysis was also conducted using select indicators to predict vaccination rates in postcodes from major cities. The results of the univariate analyses showed that communities with lower rates of vaccination had relatively less disadvantage, and had relatively greater education and occupation status, as measured by SEIFA (ABS [4]). When we looked at the ASGS Remoteness Areas, we saw that the vaccination rates were lowest in postcodes from the major cities of Australia, and vaccination rates increased as communities became more remote. When the community is further refined to postcodes located in the major cities, and to the target group of parents/partners in a family with children aged 4–7, we found that postcodes with lower vaccination rates were characterised as having a relatively greater proportion of people with: a high education level (bachelor degree level or higher); having white-collar jobs as managers; having no religion, having people in the older age category (50–54); and conversely being unemployed.

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1. Introduction

Immunisation programs rely on high uptake of vaccines [53] in order to be successful in reducing the prevalence and incidence of vaccine preventable disease (VPD), and an aspirational vaccination target rate of 95% in children has been set in Australia [18]. High uptake of vaccines, with threshold levels varying by disease, from 83 to 85% for diphtheria and rubella, and 92–94% for measles and pertussis [10], contributes to “herd immunity” [21,49], whereby indirect protection is provided to the whole community, including individuals who cannot be vaccinated for medical reasons [41]. The National Centre for Immunisation Research and Surveillance has shown that in the past decade Australia has improved the overall vaccination coverage for young children and adolescents [25]; using Government incentives to encourage vaccination, including the No Jab, No Pay policy [30,55] requiring children are vaccinated before parents receive Family Assistance Payments. However, despite these gains, there have been geo-

graphic clusters with lower than average vaccination rates, as well as clusters of recorded objection to vaccination in all States [10]. Logistical barriers to accessing vaccination, such as issues of poverty or geographic isolation, are important contributors to lower vaccination coverage [10] in Australia. However, some parents of infants and young children are either delaying or selectively vaccinating (vaccine hesitancy), or are otherwise refusing to vaccinate (vaccine refusal) for other non-access related reasons, and this is also contributing to reduced rates of childhood vaccination in areas of Australia, the USA, as well as other developed countries [11,19,20,35]. This vaccine hesitancy/refusal, in turn, is leading to a resurgence of previously controlled diseases such as pertussis (i.e., whooping cough) and measles in some local areas [9,12,29,40,44].

Recent literature is indicating that vaccine refusal and under-immunisation tend to cluster geographically [34,38], and VPD outbreaks also cluster geographically [7,44]. A study in Australia [26] mapped vaccination coverage, including specifically conscientious objectors, across geographic regions of the State of New South Wales (NSW), and found a number of areas with lower than optimal coverage across all age groups and all vaccines. The lowest

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coverage was found in the north coast area of NSW, and this area also had the highest proportion of conscientious objectors. A study in Australia of trends and patterns in vaccination objections [10] from 2002 to 2013, compared officially recorded objections to vaccination in the highest and lowest deciles of socio-economic status. The results showed that the proportion of officially recorded objections to vaccination was highest (1.9%) in the highest decile of socio-economic status, and lowest (1.1%) in the lowest decile. The proportion that were only partly vaccinated (for vaccines due at 2, 4 and 6 months of age), but not affected by a recorded objection, was however higher among those in the lowest decile, which the authors suggest indicates logistical difficulties, and problems of access to health services. The authors also mapped the distribution of recorded vaccination objection and this showed geographical clustering. Atwell and colleagues [7] investigated non-medical vaccine exemptions in California and rates of pertussis in the year 2010, and found evidence of temporal and spatial clustering of cases of pertussis with non-medical exemptions; suggesting that high rates of exemptions were related to increased rates of pertussis.

Studies of rates of vaccination are often conducted looking at the influence of individual level socio-economic factors on rates of vaccination, and these studies have shown contradictory results with regard to associations between deprivation or low socio-economic status and compliance with vaccination schedules [51]. In the field of public health, including cancer prevention, the investigation of area-based factors is commonplace, and many socio-demographic factors or indicators (e.g., poverty, ethnicity, and education) have been shown to influence health behaviours and health status. However, very few studies have investigated area-based or geographic clustering of socio-demographic factors and their relationship to vaccination rates. It is highly plausible that area-based factors are having an impact on vaccination rates; e.g., through the influence of social networks, cultural norms, language barriers in ethnic minority groups, perception of risk, education levels, geographic accessibility, and access to free health programs for those in poorer areas [24,52].

A recent study in the USA [24] was the first to study the potential influence of area-based socio-economic factors on rates of Human papillomavirus (HPV) vaccination among boys. This study showed that boys living in high-poverty areas were *more* likely to have completed the series of HPV vaccinations (receipt of three doses to complete immunisation) than boys in low-poverty areas. The probability of completing the series of vaccinations was higher for Hispanic and African-American boys in high poverty areas, and also boys in general from areas with high population density. The authors surmise that greater access to HPV vaccines through a program providing free vaccines for children with little or no insurance may be positively influencing the uptake of HPV vaccination in these groups. In contrast, an ecological study in the United Kingdom [47] looking at area-level socio-economic deprivation and compliance with the booster immunisation schedule (by age five), found that lower immunisation coverage was associated with *higher* area-level deprivation. An ecological study in England [47] found a significant relationship between area-level socio-economic deprivation and coverage of vaccinations (including Tetanus, Diphtheria, Pertussis, Polio, and MMR) by age five, with those areas of greatest deprivation having lower vaccination coverage. Deprivation was also a factor in explaining lack of uptake of HPV vaccination for teenage girls across England [31]. Two other studies in England, of the combined measles, mumps, rubella (MMR) vaccination at age two [32] and the HPV vaccination for young women [22], found no association between deprivation and uptake of these specific vaccinations; however, barriers to services (road distance to services) and adequate housing (overcrowding and affordability) were strongly related to *reduced* vaccination

levels. A systematic review and *meta-analysis* of social determinants of vaccine uptake in the elderly in Europe, also looked at area-level deprivation, finding a correlation between deprivation and lower uptake of vaccination in the elderly [28].

A USA study by Omer and colleagues (2008) investigated the relationship between non-medical exemptions and vaccination within schools in the state of Michigan, looking specifically at rates of pertussis cases by geographic area. This revealed exemption clusters characterised by a higher percentage of 5-year old children, a larger average family size, a higher population density, and a higher percentage of ethnic/racial minorities. The authors theorise that cultural and social aspects of particular communities are playing a role in non-medical exemptions to vaccination. A study in the USA by Lieu and colleagues [34] also investigated geographic clusters in vaccination rates in Northern California, using spatial scan statistics to identify clusters of under-immunisation and vaccine refusal. They found clustering by geographic areas of under-immunisation for the varicella vaccine, and the combined measles, mumps, rubella (MMR) vaccine, as well as for vaccine refusal. Analyses were adjusted for ethnicity/race and neighbourhood income, though these demographic characteristics were not considered major factors in clustering. A study in Ontario [43] looked at both individual-level and regional-level factors relating to refusal of the free-of-charge HPV vaccine, and found that at an individual-level both the lowest and the highest incomes were associated with refusing this vaccine. However, geographic areas of high social and material deprivation were associated with greater acceptance of the vaccine. It is possible that contradictory results in both individual and area-based studies as outlined above, are the result of for example, variations in types of vaccine studied; whether vaccine programs are free or self-paid; the country in which the study is undertaken; and the type of healthcare systems available [13].

The goal of this current study was to investigate the relationship between area-level socio-demographic indicators and compliance with the National Immunisation Program (NIP) Schedule¹ [8] for children in Australia. The aim was to identify postcode-level socio-demographic indicators that are associated with lower rates of vaccination for 5-year old children, including:

- SEIFA Index of Relative Disadvantage; and SEIFA Index of Education & Occupation.
- Socio-demographic indicators of parents/partners in families with children aged between 4 and 7 (i.e., education, employment, occupation, indigenous status, language spoken at home, religion, age, and personal income).
- The Australian Statistical Geography Standard (ASGS) [3] Remoteness Area classifications (i.e., major cities, inner regional, outer regional, remote, and very remote areas of Australia).

Based on findings of prior studies, we expected that socio-economic advantage within geographic regions might be related to vaccination rates in Australia. Given the contradictory findings in past studies, we maintained a non-directional hypothesis that socio-economic advantage would influence vaccination in some way (positive or negative). Moreover, the influence of other demographic factors on vaccine compliance were explored in this study as potential predictors.

¹ Note, throughout this document the terms immunisation and vaccination are considered interchangeable, but we have generally used the term vaccination. In particular, the Australian Government refers to child immunisation rates (as outlined in the My Healthy Communities website [6], but we will refer to the data in terms of vaccination rates.

2. Methods

2.1. Design

A public-health focused ecological methodology was used, which combined postcode area-level socio-demographic variables from the 2016 *Census of Population and Housing* [2] with postcode area-level vaccination data made available by the Australian Institute of Health and Welfare [6]. An ecological study uses the population or community as the unit of observation, rather than analysis at the individual level [48].

2.2. Measures

2.2.1. Census of population and housing

The ABS regularly conduct a census of the Australian population [2]. In this study socio-demographic variables from the 2016 Census (the night of Tuesday, 9th of August) were analysed at the geographic level of postcode. De-identified and summary data from the 2016 Census are publicly available on the ABS website for analysis by interested parties [2]. However, in this study a request was made to the ABS for a data matrix of socio-demographic variables at the postcode level; restricted to a target population of *parents/partners in a family with at least one child aged between four and seven years of age*. This selective aggregation targeted most parents or caregivers who would be responsible for the vaccination of children aged five years; the age of vaccination that we are investigating as the outcome variable in this study. We note that several concerns were raised about the implementation of the 2016 Census, including the first time use of online forms, public issues regarding privacy, and four denial-of-service attacks on the Census website on the night of the Census leading to problems with filling out online forms. However, an Independent Assurance Panel [23] concluded that 2016 Census data could be used with confidence and was comparable in quality to previous censuses.

2.2.1.1. Socio-Economic indexes for areas (SEIFA). SEIFA have been developed by the ABS [4] using data from the 2016 Census to create indexes which rank areas in Australia according to four summary measures broadly relating to advantage and disadvantage. Note that the SEIFA in this study are computed for the whole Australian population rather than for the target population of *parents/partners in a family with at least one child aged between 4 and 7 years of age*. Two SEIFA were selected for this study: The Index of Relative Socio-economic Disadvantage (IRSD); and the Index of Education and Occupation (IEO). These indexes are assigned to geographic areas, rather than individuals, and are ordinal measures that can be used to rank local areas by these measures. The IRSD is a socio-economic index that summarises a range of information from the census. Low scores indicate in general that the local area has greater disadvantage in relation to other local areas. A high score indicates that the local area has a relative lack of disadvantage compared to other local areas. The IEO is an index that reflects the education and occupation level of local areas. Low scores in general indicate a relatively lower education and occupation status of the local community compared to other local areas in Australia. High scores indicate relatively higher education and occupation status of the local community compared to other local areas.

2.2.1.2. Area-based Socio-demographic indicators from a target population. The following postcode-level socio-demographic variables or indicators were selected for inclusion in this study, with summary data across postcodes limited to the target population of *parents/partners in a family with at least one child aged between 4 and 7 years of age*:

- Highest Level of Education (Bachelor degree level or higher; and completed year 10, 11, or 12).
- Labour Force Status (Unemployed – as derived by the ABS [1] via the combination of four census questions – the standard ABS definition of Unemployed requires that the person not be working more than 1 h the previous week, that the person is actively looking for work, and available to start work).
- Occupation (Managers; Professionals; Technicians and Trade Workers; Clerical and Administrative Workers; Sales Workers; Machinery Operators and Drivers; and Labourers).
- Indigenous Status (Aboriginal).
- Language Spoken at Home (English; Mandarin).
- Religion (No Religion; Catholic; Anglican; Buddhism; Hinduism; and Islam).
- Age Categories (20–24, 25–29, 30–34, 35–39, 40–44, 45–49, 50–54).
- Weekly Personal Income (Low < \$1000, \$1000–2000, \$2000–3000, Very High \$3000 and over).

Note, only key indicators are included in analyses to avoid duplication, and to cover the most important variables. Some variables were excluded because of low prevalence rates. For example, the census also includes the religions of Uniting Church, Presbyterian, Baptist, and Greek Orthodox. Uniting Church was excluded as the religions of Catholic and Anglican were considered sufficient to cover Christian religions. The other religions were not included because they had on average less than 2% representation across Australia. Mandarin was selected as a language because it was the second most common language spoken at home. The languages Italian, Arabic, Cantonese, Greek, and Vietnamese were not included because they had on average less than 2% representation across the country.

2.2.2. AIHW vaccination data

The AIHW routinely analyses data from the Australian Immunisation Register (AIR) which is administered by the Australian Government Department of Human Services. This includes surveillance data on rates of vaccination for children and teenagers, by geographic area, including percentage of fully immunised or vaccinated 5-year old children. All people enrolled with Medicare are included in the AIR. Also, persons who are not enrolled with Medicare can be added to the AIR via a supplementary number, and if vaccinations are given overseas, this information can also be added if it can be verified. This data is publicly available and can be accessed through the AIHW website “My Healthy Communities” [6]. It should be noted that The National Centre for Immunisation Research and Surveillance [25] identifies that the “fully immunised” coverage figures are likely an underestimate for a range of reasons, including under-reporting. It should be noted that some overseas born children may be vaccinated overseas but not have this information recorded in the AIR. In this study vaccination rates of 5 year olds for the financial year 2015/16 were analysed at the geographic level of postcode. The data from both the ABS and the AIHW sources are only made available in summary statistical format (e.g., percentage of 5-year olds fully vaccinated for each postcode; percentage unemployed for each postcode) and no individuals can be identified. To further ensure confidentiality, data on location is not included in this report (only summary statistical information).

2.2.3. ASGS remoteness areas

The Australian Statistical Geography Standard (ASGS) Remoteness Areas, developed by the ABS [3] fall into five categories (i.e., major city, inner regional, outer regional, remote, and very remote areas of Australia) and are derived by road distance to urban areas

and population density. In this study these classifications were applied to postcodes throughout Australia.

2.3. Data analysis

Data from the ABS and the AIHW were initially obtained in Microsoft Excel spreadsheets. Both databases were then sorted, matched and merged at the postcode level, in order for further analyses to be conducted with IBM SPSS Statistics for Windows, Version 24.0 [17]. Analyses included one-way analysis of variance (ANOVA) for each socio-demographic variable across five categories of vaccination rate. The five categories, ranging from lowest ($\leq 90\%$) to highest (96.1–100%), were derived using the 20th percentile to categorise data into bins of roughly equal sizes. Linear trends were assessed using the contrast function in one-way ANOVA. Simple linear regression was conducted for each socio-demographic variable using vaccination rate as a continuous variable to obtain standardised beta weights. Multiple regression was also conducted, using all socio-demographic variables as predictors, but due to multicollinearity issues the model resulted in unstable beta weights. A smaller multiple regression was conducted using a subset of key indicators (to reduce the effects of multicollinearity) to predict vaccination rate of 5-year olds in the major cities (as defined by Remoteness Areas) of Australia ($N = 897$). Analysis was restricted to major cities to ensure adequate representation of low prevalence variables such as Buddhist religion (e.g., the proportion of Buddhists is less than 1 percent in all remoteness areas, except for major cities (3% Buddhists)). The sub-group of major cities was also selected as they had the lowest vaccination rates, as revealed in the final analysis – an assessment of the impact of ASGS Remoteness Areas (five categories) using a one-way ANOVA with vaccination as a continuous dependent variable.

3. Results

Vaccination data were available for analysis from 1490 different postcodes. The mean rate of fully vaccinated 5-year olds across postcodes in 2016 was 92.5% ($Md = 93.20\%$; $Mo = 100\%$; $SD = 4.35$), with 70.4% of postcodes having vaccination rates less than or equal to Australia's national aspirational coverage target of 95% [18]; and 21.0% of postcodes having vaccination rates less than or equal to 90%. Table 1 displays the standardised beta weights for each socio-demographic variable using vaccination as a continuous variable; and the mean of each socio-demographic variable across vaccination levels (postcodes with the lowest through highest level of vaccination), linear trends, and effect sizes. The results show that there were significant linear trends for all variables, except the age category 35–39.

3.1. SEIFA: Disadvantage (IRSD); and education and occupation (IEO)

The IRSD was higher (relatively less disadvantaged) in those areas with the lowest vaccination rates and lower (more disadvantaged) in those areas with the highest vaccination rates. The IEO was also higher (relatively more education and occupation status) in those areas with the lowest vaccination rates and lower (relatively less education and occupation status) in those areas with the highest vaccination rates.

3.2. Area-based socio-demographic variables for the target population

Those postcodes with relatively lower vaccination rates were characterised as having, on average, more of the target population:

- with a Bachelor degree level or higher as their highest level of education;
- being unemployed;
- having an occupation as a Manager;
- having an occupation as a Professional;
- speaking Mandarin at home;
- having no religion, so described;
- with the religion Buddhism;
- with the religion Hinduism;
- with the religion Islam;
- in the older age categories (40–44, 45–49, 50–54);
- with a weekly income of \$2000–3000;
- with a very high personal weekly income (\$3000 and over).

Those postcodes with relatively higher vaccination rates were characterised as having, on average, more of the target population:

- having only completed year 10, 11, or 12 as their highest level of education;
- with an occupation as Technicians and Trade Workers;
- with an occupation as Community and Personal Service Workers;
- with an occupation as Clerical and Administrative Workers;
- with an occupation as Sales Workers;
- with an occupation as Machinery Operators and Drivers;
- with an occupation as Labourers;
- being Aboriginal;
- speaking English at home;
- with the religion Catholic;
- with the religion Anglican;
- in the younger age categories (20–24; 25–29; 30–34);
- with a lower personal weekly income ($< \$1000$; and $\$1000$ – 2000).

Table 2 displays the results of a multiple linear regression analysis conducted on a sub-set of data restricted to postcodes from major cities of Australia ($N = 897$) as defined by the ASGS Remoteness areas [3]. The dependent variable in this multiple regression was vaccination rate among 5-year olds in postcodes from major cities of Australia. The predictors were a subset of key indicators from each variable grouping (e.g., Highest Level of Education) including: Bachelor Degree level or Higher; Being Unemployed; Occupation of Manager; Being Aboriginal; Speaking Mandarin at home; having No Religion; Religions - Catholic, Buddhism, Hinduism, and Islam; \$2000–3000, and \$3000 and over weekly personal income, and Ages 40–44, 45–49, and 50–54. The results of the multiple regression indicated the 15 predictors explained 30.0% of the variance ($R^2 = 0.30$, $F(15,896) = 24.66$, $p < .001$). Variables that significantly predicted a lower vaccination rate included having a bachelor degree level or higher; being unemployed; having an occupation as Manager; having no religion; and being aged 50–54. Variables that significantly predicted a higher vaccination rate included being Aboriginal, having the religion Catholic, and having a weekly personal income \$2000–3000.

3.3. ASGS remoteness areas

The mean vaccination rate decreased proportionately as postcodes became more urban, as defined by ASGS Remoteness Areas: Very Remote: $M = 95.43$; $SD = 2.74$; $N = 19$; Remote: $M = 94.94$; $SD = 3.70$; $N = 27$; Outer Regional: $M = 93.73$; $SD = 4.24$; $N = 171$; Inner Regional: $M = 93.09$; $SD = 4.68$; $N = 334$; and Major Cities: $M = 91.98$; $SD = 3.91$; $N = 897$. A one-way ANOVA revealed a significant effect of Remoteness Area on vaccination rates ($F(4,1443) = 17.61$, $p < .001$). There was a significant linear trend ($R^2 = 0.04$, $F(1,1443) = 17.61$, $p < .001$) indicating that vaccination rates

Table 1

Standardized beta weights, means for each socio-demographic indicator across vaccination levels (postcodes with lowest through highest vaccination levels), linear trends, and effect size for each socio-demographic variable.

		Vaccination Rate					Linear Trend		Effect Size
Socio-Demographic Variables	Standardised Beta Weights	Lowest (≤90%)	(90.1–92%)	(92.1–94%)	(94.1–96%)	Highest (96.1–100%)	F(1,1443)	p	R ²
		M	M	M	M	M			
		(N = 305)	(N = 245)	(N = 326)	(N = 315)	(N = 257)			
Socio Economic Indexes for Areas (SEIFA):									
IRSD (Disadvantage)	−0.11	6.25	6.27	6.07	5.73	5.21	21.88	<.001	0.02
IEO (Education & Occupation)	−0.25	6.75	6.26	5.98	5.24	4.5	96.44	<.001	0.06
Highest Level of Education									
Bachelor Degree or higher	−0.29	41.17	38.51	36.1	30.07	24.25	144.11	<.001	0.09
Year 10, 11, and 12	0.24	21.96	23.13	23.81	26.28	28.17	91.96	<.001	0.06
Labour Force Status									
Unemployed	−0.1	4.3	3.95	3.83	3.77	3.64	17.76	<.001	0.01
Occupation									
Managers	−0.16	17.79	16.01	16.17	15.06	15.43	24.16	<.001	0.02
Professionals	−0.27	30.3	28.53	27.22	24.12	20.71	118.82	<.001	0.08
Technicians/Trade Workers	0.23	12.47	13.78	13.89	15.19	16.09	73	<.001	0.05
Community/Personal Service Workers	0.15	8.91	9.11	9.22	9.94	10.73	36.46	<.001	0.03
Clerical/Administrative Workers	0.21	11.75	12.85	13.35	13.72	13.36	54.36	<.001	0.06
Sales Workers	0.09	5.76	6.15	6.12	6.51	6.23	11.05	<.01	0.01
Machinery Operators/Drivers	0.22	4.78	5.51	5.79	6.35	7.53	54.24	<.001	0.04
Labourers	0.12	6.81	6.67	6.94	7.59	8.42	23.13	<.001	0.02
Indigenous Status									
Aboriginal	0.14	2.3	1.58	2.61	4	5.65	39.54	<.001	0.03
Language Spoken at Home									
English	0.18	74.8	71.8	74.53	80.8	86.77	68.65	<.001	0.06
Mandarin	−0.22	3.05	2.93	2.43	1.67	0.61	65.3	<.001	0.05
Religion									
No religion	−0.18	37.46	34.06	33.5	33.9	31.5	33.5	<.001	0.03
Catholic	0.27	20.88	21.94	23.17	24.72	26.22	117.66	<.001	0.08
Anglican	0.26	11.03	10.75	11.74	13.71	17.16	146.51	<.001	0.11
Buddhism	−0.21	2.67	2.95	2.5	1.84	1.14	60.66	<.001	0.05
Hinduism	−0.16	2.87	3.11	2.4	1.89	1.11	38.54	<.001	0.03
Islam	−0.07	3.46	4.92	4.08	2.35	1.5	9.59	<.001	0.03
Age Categories									
20–24	0.16	1.12	1.08	1.27	1.58	1.9	45.11	<.001	0.03
25–29	0.23	6.3	6.43	7.09	8.55	9.66	84.77	<.001	0.06
30–34	0.25	18.19	19.38	19.56	21.38	21.36	98.22	<.001	0.07
35–39	−0.01	30.14	31.32	30.82	30.6	30.17	0.67	.41	0.01
40–44	−0.23	27.17	26.53	25.97	24.17	21.96	93.9	<.001	0.07
45–49	−0.29	11.91	10.86	10.82	9.55	8.55	131.5	<.001	0.09
50–54	−0.27	3.11	2.7	2.66	2.37	2.29	78.66	<.001	0.06
Weekly Personal Income									
Low (<\$1000)	0.08	45.74	46.28	45.68	46.92	48.13	10.34	<.01	0.01
\$1000–2000	0.18	27.44	29.38	29.62	30.31	30.08	32.58	<.001	0.03
\$2000–3000	−0.06	8.92	9.49	9.32	8.85	8.05	6.32	<.05	0.01
Very High (\$3000 and over)	−0.22	9.05	7.22	7.12	4.91	4.04	74.11	<.001	0.05

decreased proportionately, from the *highest* rates in postcodes from Very Remote locations, to the *lowest* rates in postcodes from Major Cities.

4. Discussion

The WHO has highlighted the importance of both individual-level and regional-level factors in the analysis of vaccine hesitancy and refusal [33], including those factors of an environmental and socio-cultural nature. However, most studies have focused on individual-level variables, rather than area-based factors. This current study is the first of its kind in Australia to research area-based indicators associated with lower vaccination rates for children throughout the country. It is evident that, except for the unemployed indicator, postcodes with lower vaccination rates were characterised by indicators of high socio-economic status (e.g., high levels of education, and white-collar occupations); as well as higher levels of the older age groups (50–54); and lower levels

of indicators of disadvantage (e.g., SEIFA Index of Relative Disadvantage, and being Aboriginal). Not identifying with formal religions (i.e., no religion, so described) was associated with postcodes having lower rates of vaccination. Levels of vaccination were also clearly related to Remoteness Areas, with the mean vaccination rate decreasing proportionately as communities become more urban, with Major Cities having the lowest vaccination rates.

Area-level deprivation has long been associated with negative health behaviours and health outcomes [37,46], so it is counter-intuitive to expect indicators of high socio-economic status to be associated with vaccine hesitancy and refusal. However some studies have shown that indicators of high socio-economic status are associated with lower rates of vaccination [24,28,50]. A study in California [36] clearly showed that affluence was associated with a greater prevalence of personal belief exemptions (PBEs) to immunisation requirements for private kindergartens. The study also showed that those private kindergartens with higher fees had a greater proportion of students admitted without being fully vaccinated. Another California study of PBEs from mandatory

Table 2

Summary of multiple regression analysis for select indicators predicting rate of vaccination in major cities (n = 897) of Australia.

	<i>B</i>	<i>SE B</i>	β	<i>p</i>
Constant	97.109	1.537		<.001
Highest Level of Education				
Bachelor degree or Higher	–0.068	0.019	–0.339	<.001
Labour Force Status				
Unemployed	–0.62	0.094	–0.263	<.001
Occupation				
Managers	–0.151	0.044	–0.241	<.01
Indigenous Status				
Aboriginal	0.272	0.098	0.107	<.01
Language Spoken at Home				
Mandarin	–0.004	0.032	–0.005	ns
Religion				
No Religion	–0.053	0.021	–0.149	<.05
Catholic	0.067	0.026	0.109	<.01
Buddhism	–0.023	0.043	–0.019	ns
Hinduism	–0.047	0.038	–0.058	ns
Islam	0.025	0.021	0.056	ns
Age Categories				
40–44	0.077	0.04	0.141	ns
45–49	–0.052	0.065	–0.054	ns
50–54	–0.571	0.13	–0.166	<.001
Weekly Personal Income				
\$2000–3000	0.252	0.046	0.307	<.001
Very High (\$3000 and over)	0.01	0.032	0.022	ns

Note: $R^2 = 0.30$; *B* = unstandardized beta; *SE B* = standard error of unstandardized beta; β = standardized beta.

vaccination, using regional models, showed that exemptions were more common in areas with a higher percentage of higher median household income, private school type, and white race; but no effect was found for educational attainment [54]. A qualitative analysis [42] showed a close relationship between PBEs and the concept of “privilege” at a socio-economic level; identifying issues of choice against vaccination in relation to class, gender, and social responsibility. Interviews with 25 mothers who were vaccine refusers by choice, rather than because of issues of access, identified narratives relating to intensive mothering practices (e.g., around feeding, natural living, and nutrition - which they perceive incorrectly as a superior form of support for immunity and disease prevention than vaccination), drawing on access to resources and privilege, to employ choice. They often rejected the notion that their choices against vaccination adversely affected the health of children in the general community. Reich’s study highlights underlying themes of natural living which relate to those found with the use of complementary and alternative medicine (CAM). Indeed, our previous research found a close relationship between the use of CAM and anti-vaccination attitudes [16,45], tied together via an underlying worldview which embraced magical health beliefs, and to a lesser extent holistic health beliefs.

It is important to note that logistical and access barriers are still playing a significant role in the ability of parents to vaccinate their children. A longitudinal study of Australian children [39] found that the majority of mothers of children who were incompletely immunised, did not disagree with vaccination, but rather had difficulty overcoming a range of access barriers. Our data showed that postcodes with higher percentages of unemployed parents had significantly lower levels of vaccination, thus providing some evidence that access issues are still important. Australians who live in rural and remote areas of the country have poorer health outcomes, including lower life expectancy, higher rates of injury and disease, and reduced access to the range of health services available to residents in cities [5]. However, our study has shown that rates of vaccination among children were lower in the major cities than in the rural and remote areas of Australia. It is likely that this finding is a result of non-access related issues, such as the promulgation of anti-vaccination attitudes via social and parenting networks, cultural norms, and language and other barriers among

ethnic minorities who often live in the cities [24,52]. Finally, local areas with a larger proportion of the community having no religion (as categorised in the 2016 Census) had relatively lower rates of vaccination. It is possible that personal worldviews that are underpinned by beliefs in spirituality, rather than formal religion, may be key to these results. Our previous research has shown that people who do not identify with major religions, may have a belief in spiritual and metaphysical ideas which lie outside formal religions [14]; and we have shown [15] that psychosocial factors including endorsement of spirituality as a source of knowledge predict negative attitudes to vaccination.

The results of this current study provide important evidence to inform public health interventions to increase participation in the Australian National Immunisation Program in local areas with lower rates of vaccination. The disproportionate under-vaccination of children from affluent and well educated families in the major cities of Australia has significant implications in terms of increased clusters of unvaccinated children; reduced herd immunity; the spread of vaccine hesitancy/refusal [27]; the spread of VPDs and the undermining of public health policy. These findings highlight a concern that less privileged Australians are shouldering a disproportionate burden of responsibility for reducing VPDs at the population or public health level. This issue is of such a complex nature that multiple intervention strategies will be required to increase vaccination coverage. Australia links immunisation status with eligibility for welfare and benefits to ‘encourage’ full vaccination of children [55]. However, these types of financial incentives or punishments have minimal impact on the more affluent members of society who do not receive these types of benefits, and who have greater resources available to justify (from their perspective) the opting out from vaccination programs (e.g., access to private health care; better nutrition; access to CAM). Legislation has its place in increasing rates of vaccination, but it is important to develop a far greater understanding of the motivations and reasoning behind vaccine hesitancy and refusal, particularly among the more urban and privileged groups of Australians, as well as those with more alternative worldviews regarding the place of science in healthcare. Public health interventions that rely on persuasive messaging targeting specific groups and their worldviews would be a useful adjunct to existing legislative approaches.

5. Limitations

The main limitation of this study is the ecological nature of the methodology, which means characteristics of individuals cannot be directly linked to their vaccination behaviours (as would be the case in survey data). Therefore, any inferences arising from the results must be applied to groups of people at the postcode level, rather than individuals. Inferences applied to individuals is referred to as 'the ecological fallacy' [48]. It is also noted that the census data is collected in August 2016, which is just outside the collection time period for vaccination data (the 2015/16 financial year). However, given that the target group includes parents/partners with children of the age range from 4 to 7, we feel that the data adequately captures the necessary groups and timeframes.

6. Future research

Future research would benefit from more detailed study into the characteristics of local communities identified as having lower vaccination levels, particularly those more affluent postcodes in the major cities of Australia. These studies could include in-depth qualitative interviews with parents who refuse or are hesitant about letting their children receive the recommended vaccinations. Further research is also required to clarify the results regarding groups who do not identify with formal religion (no religion), and the unemployed, to ascertain possible reasons for lower rates of vaccination in postcodes with significant proportions of these people.

7. Conclusion

This study identified characteristics of communities, at the postcode level, that were associated with lower rates of vaccination. These communities had relatively less disadvantage, and had greater education and occupation status, as measured by two SEIFA's [4] – IRSD and IEO. When we looked at the ASGS Remoteness Areas, we saw that the vaccination rates were lowest in postcodes from the major cities of Australia, and vaccination rates increased as communities became more remote. When the community is further refined to postcodes located in the major cities, and to the target group of parents/partners in a family with children aged 4–7, we found that postcodes with lower vaccination rates were characterised as having a relatively greater proportion of people with: a high education level (bachelor degree level or higher); having white-collar jobs as managers; having no religion, having people in the older age category (50–54); and conversely being unemployed.

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Declaration of Competing Interest

The authors declared that there is no conflict of interest.

Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.vaccine.2019.06.060>.

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Chapter 6. Conduct a Contamination and Purity Priming Experiment

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Nature of candidate's contribution:

- Design of the research.
- Collation of literature.
- Data collation and analysis.
- Analysis and interpretation of the findings.
- Majority writing of the publication.
- Responsible for submission.

Nature of co-authors' contribution:

- Conception and design of the research.
- Analysis and interpretation of the findings.
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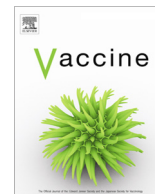
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6.2 Introduction

This chapter outlines an experimental study which investigates whether the emotional reaction of disgust, or feeling personally contaminated, plays a role in the formation of beliefs around vaccine scepticism. If high levels of contamination fear or disgust sensitivity are key facilitators of vaccine hesitancy, then experimentally inducing feelings of contamination could temporarily reduce approval of vaccination and increase approval of CAMs. Conversely, priming for purity/naturalness could increase approval of CAMs and decrease approval of vaccinations. This experiment was designed to assess whether priming for contamination or purity would produce changes in reactions to a range of conventional and alternative health interventions, including CAMs and various types of vaccination.



Effect of contamination and purity priming on attitudes to vaccination and other health interventions: A randomised controlled experiment



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ABSTRACT

The objective of this experiment is to assess whether priming for contamination and purity causes a change in attitudes to health interventions, including vaccination, and complementary and alternative medicines (CAMs). An online priming experiment was conducted with four between-subject experimental conditions including photos of: 1) biological contamination, 2) chemical contamination, 3) pure environments, such as pristine landscapes, and 4) hazard signs/icons indicating physical threats. Two control conditions included photos of neutral scenes and neutral icons, whereby experimental groups were compared against the related control groups (photograph for conditions 1–3 and neutral icons for condition 4). Subjects were randomly assigned to one of the six conditions, and after exposure to the images they were asked to rate 10 conventional and alternative health interventions for effectiveness and safety, as well being assessed for disgust sensitivity using the reduced-item DPSS-R [10]. A total of 642 adults completed the experiment. Exposure to primes did not cause a differential change in ratings of health interventions. Nevertheless, higher levels of sensitivity to disgust were associated with lower ratings of the effectiveness of MMR vaccination, tetanus injection, antibiotics, and surgery; and higher levels of sensitivity to disgust were associated with higher ratings of effectiveness of vitamins/minerals. In conclusion, this online experiment did not find an experimental effect of priming for contamination and purity on subjects' ratings of the safety and effectiveness of conventional and alternative health interventions. This indicates that attitudes to these health interventions are not influenced by a temporary increase in the salience of feelings of contamination or purity. However, individual differences in disgust sensitivity are related to their attitudes to vaccination and CAM interventions.

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1. Introduction

The World Health Organisation (WHO) has listed vaccine hesitancy as one of the top 10 threats to global health [25]. Several behavioural correlates and psychological traits have been associated with vaccine hesitancy, such as the use of CAMs [1,8,13], beliefs about well-being and health, including magical health beliefs [7,8] and emotions including disgust and fear [13,16,29]. Navin's [20] review of 'Disgust, Contamination, and Vaccine Refusal' found that vaccine refusers were often motivated by disgust for vaccination and potential contaminants in the vaccines, and were attracted to concepts of sanctity and purity that were grounded in social, political, and religious/moral values. He argues

that this has made it difficult to persuade these individuals to vaccinate, as the basic emotion of disgust and associated values are not easily amenable to change using scientific evidence or arguments.

The invoking of concepts of naturalness and purity, and appeals to nature and naturalness are central to most CAM practitioners and proponents [6,21]. A systematic review [4] of the beliefs of CAM users found there was an emphasis on natural remedies rather than artificially processed medicines. Lifestyles and values associated with both a negative attitude to vaccination and a preference for CAM include a desire for purity, cleanliness, natural living, and a belief in the necessity of removing presumed toxins [12,28]. Anti-vaccination websites often refer to the purported toxins contained in vaccinations (e.g., aluminium), and they promote alternative therapies to remove these contaminants [19]. CAM proponents often promote a natural lifestyle, with a focus on whole/natural foods and medicines, and they endeavour to reduce

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exposure to contaminants, or attempt to remove them using such interventions as chelation therapies and detoxification diets [3].

The emotional states of disgust and fear have been found to be drivers underlying a reluctance to vaccinate [16,17,24]. Disgust is a primary emotion which evolved to motivate disease avoidance behaviours and is experienced as a transitory emotional state when a person is exposed to disgust-inducing stimuli [30]. Clifford and Wendell [9] have argued that certain food and health attitudes (e.g. attitudes to foods that are genetically modified, use of preservatives, and vaccine scepticism) are related to positive attitudes toward purity. They designed an experiment where a temporary emotional state of disgust was induced via exposure to photographs and an autobiographical writing task [9]. The results indicated that greater pathogen disgust-sensitivity in the adult samples was related to greater vaccine scepticism; those most sensitive to disgust were more likely to believe in the discredited theory that vaccines cause autism. However, the experimental manipulation to induce disgust (i.e., priming for disgust) did not have a significant effect on vaccine scepticism.

This present study looked at whether the specific emotive reaction of disgust, or feeling personally contaminated, plays a role in the formation of beliefs around vaccine scepticism. If high levels of contamination fear or disgust-sensitivity are key facilitators of vaccine hesitancy, then experimentally inducing feelings of contamination could reduce favourability to vaccination and increase favourability to CAMs. Similarly, priming for purity/naturalness ought to increase favourability towards CAMs and decrease favourability to vaccination. Therefore, the present experiment was designed to assess whether increasing the salience of concepts of contamination or purity will produce changes in reactions to a range of health interventions, including vaccination and CAMs. The following hypotheses were tested:

1. Priming with images of contamination will cause a negative change in attitudes to vaccination (relative to a control condition) and a positive change in attitudes to CAMs.
2. Priming with natural/pure images will cause a negative change in attitudes to vaccination (relative to a control condition) and a positive change in attitudes to CAMs.

An online priming experiment was conducted that involved four between-subject experimental conditions and two control conditions. The four experimental conditions involved exposure to images which primed for the three recognised domains of contamination: biological, chemical, and physical contamination [23], as well as additional images evoking purity/naturalness. This study differs from Clifford and Wendell's [9], most notably through the use of different priming techniques, disgust measures, and a broader focus toward attitudes to both vaccines and CAMs.

2. Method

2.1. Transparency and openness statement (TOPS)

In this article, reports are made on sample sizes, data exclusions, manipulations, and all measures included in this study. All data, analysis code, and research materials are available via a request to the lead author or to the Institution. Data were collected by external survey company Qualtrics and analysed by the lead author using SPSS V26. The Consolidated Standards of Reporting Trials (CONSORT) guidelines have been followed, apart from the absence of pre-registration of the experiment. This experiment is not an evaluation of a clinical trial, but the CONSORT guidelines are appropriate to ensure clear, transparent and complete information are included on the methodology and findings.

3. Measures/Materials

3.1. Priming materials

Priming materials used in the experiment included predominantly photographic images, but also symbols/icons used in signage (e.g., work hazard signage, pedestrian signage). Symbols were used in the fourth physical contamination condition to avoid ethical issues in exposing participants to graphic images of violations of the body envelope (e.g., wounds, amputations). Photographic images were selected from two standardized picture systems available to University researchers: the Nencki Affective Picture System (NAPS) [18] and the Open Affective Standardized Image Set (OASIS) [14]. Symbols were obtained from a Google search of open-source images for work hazards and other signs (note, these symbols were edited to remove extraneous colour and words), as well as from Microsoft Office 365 Word standard icons. A summary of images is as follows (see Appendix A for the complete set of images in experimental order):

- (1) Biological contamination prime (photographs - medical waste, a cockroach, and a dirty toilet).
- (2) Chemical contamination prime (photographs - polluted water, a coal fired power station, people in hazmat suits spraying foam).
- (3) Physical contamination prime (icons - arm crushed in gears, finger cut off with circular saw, person crushed against a wall by a moving object).
- (4) Purity/naturalness prime (photographs - oranges, leaf on snow, pristine scenery).
- (5) Control (photographs - fence, plastic containers, cotton reels, writing paper, office supplies, paperclips).
- (6) Control (icons - person with cogs in their head, person with lightbulb overhead, hitchhiker, muscled arm, two people at a table, two hands moving).

3.2. Primary outcome measure – Ratings of health interventions

Participants were asked to rate 10 health interventions (five conventional and five alternative health interventions) on a 6-point scale (strongly disagree, disagree, disagree a little, agree a little, agree, strongly agree) for effectiveness at curing illness and/or maintaining wellness; and perceived safety of the intervention. The name of the intervention was accompanied by a photograph, to make salient to the subjects the nature of the intervention. Health interventions included antibiotics, herbal medicine, flu vaccination, vitamins/minerals, surgery, meditation, tetanus injection, aromatherapy, measles/mumps/ rubella (MMR) vaccination and therapeutic massage (see Appendix B for a list of health intervention questions).

3.3. Reduced-item disgust Propensity and sensitivity Scale-Revised (DPSS-R)

The reduced-item DPSS-R [10] is a questionnaire designed to measure two factors which contribute to disgust reactions: disgust propensity (i.e., how easily a person is disgusted by stimuli) and disgust-sensitivity (i.e., how bothered one is by disgust reactions). This reduced-item DPSS-R has been found to have adequate reliability and validity, as well as concurrent validity in predicting disgust-relevant phobias [10]. This questionnaire has been included to control for variations in sensitivity to disgust reactions among participants in the experiments. The Disgust Sensitivity subscale alone was used in the present study as it is related to a wider range of phobia symptoms, such as injection anxiety, relative to the Disgust Propensity scale. In support of this decision,

there was a high correlation between the Disgust Sensitivity and Disgust Propensity subscales, $r(640) = 0.63$, $p < .001$, making the latter somewhat redundant.

4. Design and procedure

4.1. Design

A between-subject design was employed where participants were randomly assigned to one of six groups, with four experimental conditions (biological primes, chemical contamination primes, purity primes using photographs, and lastly physical contamination primes using icons), as well as two control conditions (neutral photographs and neutral icons). For the analyses, experimental groups were compared against the related control groups (photographs for conditions 1–3 and signs for condition 4). Subjects were randomly assigned to one of the six conditions, and after exposure to the images they were subsequently and immediately asked to rate 10 conventional and alternative health interventions for effectiveness and safety. Lastly, participants were assessed for general disgust sensitivity using the reduced-item DPSS-R [10].

4.2. Procedure

Ethics approval was obtained prior to commencement of data collection. Participants were recruited online by an external agency, Qualtrics, specialists in online survey panel administration. They were contracted to recruit approximately 600 adults (100 subjects per condition with roughly equal numbers of males and females). A weblink was provided to interested participants which took them to the Qualtrics platform where they were presented with a consent form and experiment survey form. Participants received information prior to undertaking the experiment informing them of the purpose of the study in general terms. That is, to assess individual differences in the visual processing and assess-

ment of online images. Informed consent was obtained prior to participants being directed to the survey questions. Eligibility criteria was a minimum age of 18 years and an Australian resident. Participants were compensated with points redeemable for gift cards and small value prizes. They provided information on their gender, personal income, and age. They were then randomly assigned to one of the six conditions (see Fig. 1) via the Qualtrics randomisation software. Fig. 1 contains the CONSORT flow diagram of this experiment from assessment for eligibility through to analysis, as outlined in the CONSORT guidelines [26].

Participants in each condition were exposed to six images in total: three priming images and three neutral images that were included to obscure the purpose of the study. These images were ordered in each condition as follows (with N referring to neutral images and P referring to the priming images): N, N, P, N, P, P. This fixed order, rather than a random order, acted to reduce variance, but more importantly ensured that subjects were exposed to priming images at the end of the sequence, to maximise the priming effect. Neutral images were included to disguise the purpose of the experiment. Each control group was exposed to six neutral images: one control group was exposed to six neutral photographs, and the other control group was exposed to six neutral icons. Statistical analysis involved four experimental group versus control between-group comparisons:

Biological contamination (photographs) vs Control condition (photographs)
Chemical contamination (photographs) vs Control condition (photographs)
Physical contamination (icons) vs Control condition (icons)
Purity/naturalness (photographs) vs Control condition (photographs)

As detailed above, the relevant control was chosen based on the similarity of the visuals (photograph vs icons) to better maintain

CONSORT Flow diagram for Randomised Contamination and Purity Priming Experiment

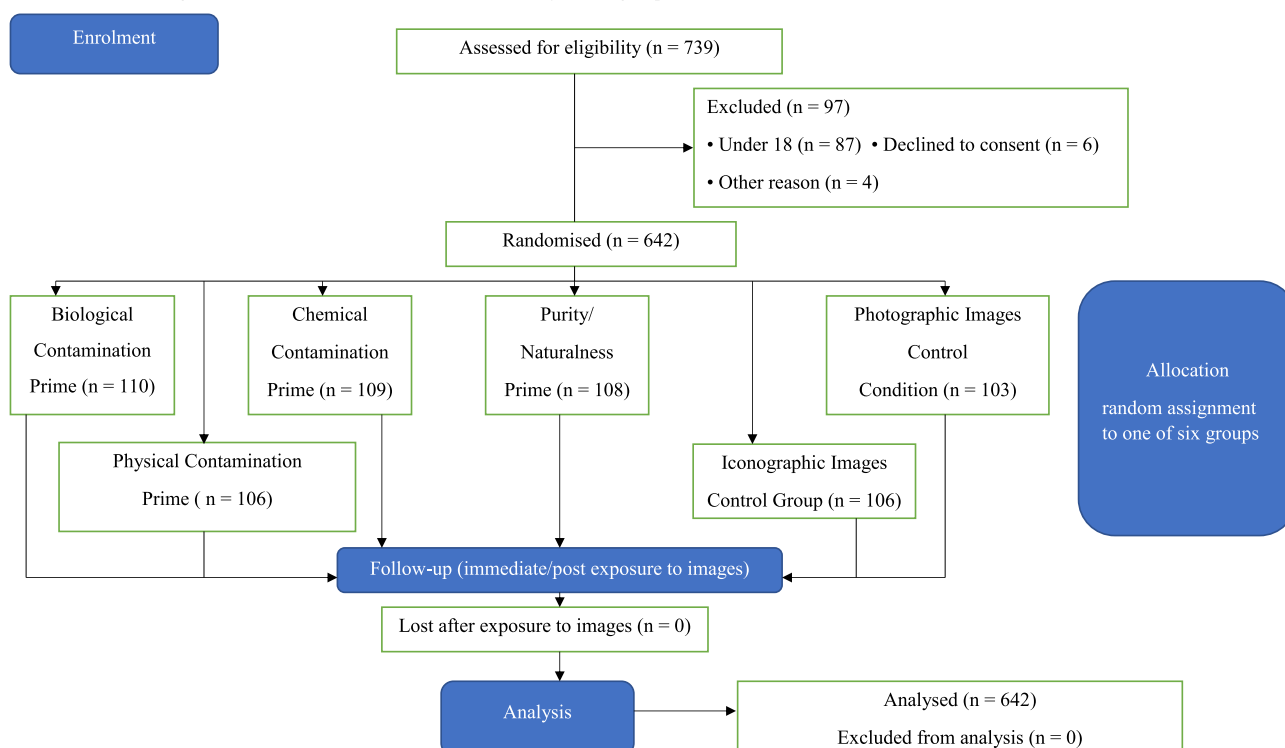


Fig. 1. CONSORT Flow diagram for Randomised Contamination and Purity Priming Experiment.

experimental control. Subjects had to answer a short series of filler questions after viewing each image. They were asked to identify a few characteristics of each photo (e.g., What is the dominant colour?). The purpose of the filler task was to conceal the true objective of the experiment and to ensure they were paying sufficient attention to each image.

Subjects were then asked to rate the 10 health interventions on effectiveness and safety and lastly, complete the reduced-item DPSS-R questionnaire [10]. On completion of the experiment a brief summary of the purpose of the experiment was provided to participants. The true purpose was revealed at the end of the experiment to ensure participants left the study fully informed. Participants were given the option of leaving the survey without data being saved if they felt uncomfortable with the purposes of the study, although nobody left for this reason.

5. Results

5.1. Data analysis

The data for this experiment was generated using Qualtrics software, Version 2020 of Qualtrics (Copyright © 2020 Qualtrics). Qualtrics and all other Qualtrics product or service names are registered trademarks or trademarks of Qualtrics, Provo, UT, USA (<https://www.qualtrics.com>). Data analysis was conducted using IBM SPSS V26 (George & Mallery, 2019) (Generalised Linear Models). A series of 40 ordered logistic regression models (cumulative logit linked function) were conducted that predicted 10 conventional and alternative health interventions ratings on effectiveness and safety. There were two types of logistic regression models: (1) disgust sensitivity and group (biological contamination prime, chemical contamination prime, purity/naturalness prime, and control group with photos) predicting ratings of health interventions, and (2) disgust sensitivity and group (physical contamination prime and control group with icons) predicting ratings of health interventions for safety and effectiveness. The 40 ordered logistic regressions are a result of 2 models, each with 20 outcome measures (10 ratings of safety, and 10 ratings on effectiveness). Adjustments were made for multiple comparisons using the Benjamini-Hochberg method [2].

6. Results

A total of 652 participants met the eligibility criteria (aged 18 or over) of the experiment. Six participants refused their consent after reading the consent form and four participants dropped out during the experiment. No subjects left the experiment when advised of the true nature of the study. A total of 642 participants provided complete data for analysis. There was a nearly equal distribution of females ($N = 318$, 50%) and males ($N = 320$, 50%), with four participants preferring not to specify their gender. Participants' ages ranged from 18 to 87 ($M = 45$, $SD = 17$), with a medium income of \$25,000–\$49,000. Table 1 contains baseline characteristics and

the variable disgust sensitivity by experimental and control conditions.

Table 2 contains the results of the 40 ordered logistic regressions with disgust sensitivity and group membership predicting ratings of each of 10 health interventions on effectiveness and safety, with separate models for groups that were exposed to photos and iconographic images. After controlling for multiple comparisons using the Benjamini-Hochberg method [2], the results indicated that group membership did not predict ratings of health interventions. Nevertheless, in relation to disgust sensitivity, there were five comparisons that were significant (i.e., p -value was smaller than the false discovery rate). In the ordered logistic regressions where disgust sensitivity and group (physical contamination prime icons and control icons) were predictors of health interventions, disgust sensitivity significantly predicted the rating of the effectiveness of the MMR vaccination ($B = -0.09$, $SE = 0.03$, $p = .002$); the effectiveness of surgery ($B = -0.09$, $SE = 0.03$, $p = .001$); the safety of antibiotics ($B = -0.10$, $SE = 0.03$, $p = .001$), and the safety of the tetanus injection ($B = -0.11$, $SE = 0.03$, $p = .0003$). The results revealed that the higher the level of disgust sensitivity the lower the rating of the effectiveness of the MMR vaccination, antibiotics and surgery. In the ordered logistic regression models where disgust sensitivity and group (biological contamination, chemical contamination, purity/naturalness priming and control photos) were predictors of ratings of health interventions, disgust sensitivity significantly predicted the positive rating of the effectiveness of vitamins/minerals ($B = 0.06$, $SE = 0.02$, $p = .001$).

7. Discussion

The results did not support the main hypotheses that creating a contamination mindset, through priming with images of contamination, causes a negative change in attitudes to vaccination and a positive change in attitudes to CAM. Further, creating a purity/naturalness mindset, through priming with pure/natural images, did not cause a negative change in attitudes to vaccination and a positive change in attitudes to CAM. Therefore, priming in this experiment had no effect on health attitudes. These null results could indicate that it is not possible to prime for disgust or purity, or that the effect was so minimal that it did not impact assessments of health interventions. The type of primes may have had an impact on the power of the experiment. For example, there is evidence that inducing feelings of disgust via olfactory primes (e.g., smell of a rotten egg) produces a stronger priming effect than photographs [5,27]. However, this type of priming is time and resource intensive, given that an olfactory experiment of this nature would need to be done in-person rather than online. It is also more likely that health attitudes are not susceptible to temporary priming effects, but may reflect more stable attitudes that do not vary contextually.

There is some support for the idea that a person's general sensitivity to disgust affects their assessment of some health interventions. Sensitivity to disgust shows a negative relationship with four conventional health interventions (i.e., MMR vaccination, tetanus

Table 1
Baseline demographic characteristics and disgust sensitivity by experimental and control conditions*

	Conditions					
	Biological Contamination Priming Condition ($N = 110$)	Chemical Contamination Priming Condition ($N = 109$)	Physical Contamination Priming Condition ($N = 106$)	Purity/Naturalness Priming Condition ($N = 108$)	Control Condition (Photographs) ($N = 103$)	Control Condition (Icons) ($N = 106$)
Age (years)	45.3 (17.2)	46.8 (16.8)	43.8 (15.6)	44.8 (16.4)	48.5 (18.3)	42.0 (17.4)
Gender (female)	62 (56.4%)	46 (42.2%)	53 (50.0%)	57 (52.8%)	44 (42.7%)	56 (52.8%)
Disgust Sensitivity	15.2 (4.8)	14.8 (5.1)	14.4 (4.8)	14.8 (4.8)	15.7 (4.9)	14.8 (4.3)

*Data are means (SD) or numbers (%)

Table 2

Ordered logistic regression models for predicting conventional and alternative health interventions rated on effectiveness and safety (N = 642).

Dependent Variables	(a) Priming with Photos				(b) Priming with Icons	
	Disgust Sensitivity		Group		Disgust Sensitivity	Group
	Disgust	Biological Contamination Prime	Chemical Contamination Prime	Naturalness/Purity Prime	Disgust	Physical Contamination Prime
	<i>B (SE B)</i>	<i>B (SE B)</i>	<i>B (SE B)</i>	<i>B (SE B)</i>	<i>B (SE B)</i>	<i>B (SE B)</i>
EFFECTIVENESS						
–Conventional						
MMR Vaccination	–0.014 (0.0190)	0.251 (0.2599)	–0.196 (0.2596)	–0.042 (0.2564)	–0.093 (0.0295)**	0.176 (0.2625)
Flu Vaccination	0.004 (0.0182)	0.256 (0.2468)	0.292 (0.2486)	0.009 (0.2493)	–0.045 (0.0279)	0.216 (0.2512)
Tetanus Injection	–0.039 (0.0187)	0.232 (0.2577)	–0.082 (0.2564)	0.024 (0.2562)	–0.083 (0.0291)	0.526 (0.2622)
Antibiotics	0.000 (0.0186)	0.315 (0.2530)	–0.160 (0.2548)	0.034 (0.2502)	–0.064 (0.0287)	0.107 (0.2573)
Surgery	–0.023 (0.0189)	0.749 (0.2626)	0.179 (0.2623)	0.291 (0.2690)	–0.093 (0.0293)**	–0.139 (0.2601)
–Alternative						
Herbal Medicine	0.041 (0.0185)	0.156 (0.2495)	0.306 (0.2500)	–0.036 (0.2534)	0.004 (0.0272)	0.058 (0.2480)
Vitamins/Minerals	0.062 (0.0188)*	0.498 (0.2479)	–0.009 (0.2488)	0.523 (0.2559)	–0.048 (0.0278)	0.295 (0.2527)
Aromatherapy	0.051 (0.0187)	0.411 (0.2448)	0.107 (0.2435)	0.107 (0.2474)	0.051 (0.0274)	0.162 (0.2479)
Meditation	0.028 (0.0179)	0.263 (0.2483)	–0.012 (0.2483)	0.020 (0.2505)	0.025 (0.0279)	0.264 (0.2487)
Therapeutic Massage	0.017 (0.0186)	0.415 (0.2520)	0.324 (0.2580)	0.351 (0.2571)	–0.030 (0.0276)	0.288 (0.2539)
SAFETY						
–Conventional						
MMR Vaccination	–0.009 (0.0185)	0.042 (0.2519)	–0.476 (0.2539)	–0.278 (0.2533)	–0.074 (0.0289)	0.041 (0.2550)
Flu Vaccination	–0.015 (0.0179)	0.114 (0.2474)	–0.016 (0.2468)	0.060 (0.2473)	–0.062 (0.0277)	0.026 (0.2525)
Tetanus Injection	–0.048 (0.0187)	–0.010 (0.2521)	–0.494 (0.2512)	–0.182 (0.2508)	–0.106 (0.0293)***	0.337 (0.2576)
Antibiotics	0.004 (0.0184)	–0.162 (0.2508)	–0.442 (0.2499)	–0.172 (0.2510)	–0.095 (0.0282)**	0.518 (0.2564)
Surgery	–0.036 (0.0181)	0.319 (0.2523)	0.011 (0.2546)	–0.113 (0.2529)	–0.030 (0.0282)	0.136 (0.2504)
–Alternative						
Herbal Medicine	0.026 (0.0183)	0.045 (0.2466)	–0.031 (0.2438)	–0.165 (0.2525)	0.041 (0.0279)	0.104 (0.2510)
Vitamins/Minerals	0.022 (0.0188)	0.561 (0.2450)	–0.113 (0.2500)	0.423 (0.2516)	–0.049 (0.0285)	–0.068 (0.2579)
Aromatherapy	–0.016 (0.0183)	0.173 (0.2487)	–0.276 (0.2495)	–0.016 (0.2486)	–0.028 (0.0275)	–0.204 (0.2527)
Meditation	–0.014 (0.0191)	0.287 (0.2622)	0.083 (0.2617)	0.254 (0.2617)	–0.006 (0.0289)	–0.384 (0.2621)
Therapeutic Massage	–0.002 (0.0184)	0.152 (0.2542)	0.050 (0.2580)	0.096 (0.2542)	0.001 (0.0290)	0.193 (0.2642)

* p < .05

** p < .01

*** p < .001 (Adjusted for multiple comparisons using the Benjamini-Hochberg method)

injection, surgery, and antibiotics), and a positive relationship with one alternative health intervention (i.e., vitamins/minerals). These results are consistent with those found by Clifford and Wendell [9] where priming for disgust showed no change in attitudes to vaccination, but greater sensitivity to disgust as a trait was correlated with anti-vaccination beliefs. They are also consistent with a mediation analysis [16] that showed germ aversion and disgust sensitivity had a two-fold effect on uptake of the flu vaccination. There was an indirect negative effect on the uptake of the flu vaccine via negative attitudes to the flu vaccination (i.e., high disgust sensitivity was associated with reduced vaccine uptake for those with a pre-existing negative attitude to vaccinations) and a direct positive effect on the uptake of the flu vaccination (i.e., overall, high disgust sensitivity was associated with increased uptake of the vaccine even when considering those few who are vaccine hesitant). In 2018, a 24-Nation study of the psychological drivers behind anti-vaccination attitudes (Hornsey et al., 2018) found that in order of importance, conspiratorial thinking, reactance (i.e., low tolerance for perceived infringements on personal freedoms), high levels of disgust towards needles and blood, and hierarchical/individualistic worldviews, were associated with anti-vaccination attitudes. Interestingly, demographic variables such as education had little to no impact on these attitudes. However, there was support for the notion that the primary emotion of disgust is a driver in vaccination attitudes/uptake of vaccinations in those people who have a predisposition to high disgust reactions, and it may explain why some individuals are so resistant to changing their negative attitudes to vaccination [11,22], as it is difficult to intervene or assist individuals in cognitively overriding this basic emotion [15]. However, the failure of this current study to find an effect of priming on health attitudes indicates that temporarily increasing the salience of disgust/contamination or purity will have no impact on health attitudes, which may not be easily amenable to change.

8. Limitations

One limitation of this study is that the primes may have been too weak to evoke a response, leading to type II errors, and that using primes such as olfactory primes may have increased the power of the experiment [5,27]. However, this type of alternative priming has the disadvantage that the experiment would need to be done in-person rather than online, which adds to the cost and potentially introduces experimenter effects. Another limitation was the decision not to use a manipulation check in the experiment, to test the effectiveness of priming for contamination and purity. This was unavoidable as it was important to ensure that participants were not consciously aware of the true nature of the experiment. If the participants were made aware of their “disgust” (via the manipulation check) the experiment would have been foiled; a surreptitious manipulation would have been replaced with a conscious mechanism. A manipulation check was not included at the end of the experiment, as there was too much intervening time between the stimulus materials and the end of the experiment to have such feeling reasonably persist. Using a Qualtrics panel of participants could also have had an impact on the experiment, given they are not representative of the general population, and it is possible that a population representative survey may have had different results. It is also possible that some Qualtrics participants may not pay close attention to the instructions, as they focus on earning more by finishing experiments quickly. However, a study by Roulin and colleagues (2015) found that the data from crowdsourcing samples, including from Qualtrics, was more representative of the general population than for instance using university students.

9. Future research

Future research could examine the size of the impact of disgust sensitivity on vaccine hesitancy in relation to other logistic, economic, and psychological determinants. Research could also investigate why a predisposition to strong disgust reactions impacts a person's attitudes to vaccinations and uptake of vaccinations and what interventions could be developed to assist with overcoming disgust-related barriers to getting vaccinated.

10. Conclusion

This study showed that temporarily increasing the salience of feelings of contamination and purity does not influence attitudes to conventional or alternative health interventions on safety or effectiveness. However, there is support for the notion that a predisposition to strong disgust reactions impacts a person's attitudes to vaccinations, and this may impact interventions aimed at increasing uptake of vaccinations among vaccine hesitant individuals.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.vaccine.2021.09.063>.

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Chapter 7. Discussion and Conclusion

This thesis describes a series of research studies with the goal of exploring unorthodox worldviews that predict vaccine scepticism and use of CAM in order to inform the future development of persuasive strategies to encourage participation in evidence-based interventions, particularly vaccinations. Four studies were conducted which contribute to the goal of the research. The first study deals with a measurement issue identified in the review of the literature, which revealed the absence of a quantifiable measurement tool to assess CAM utilisation. This was important as CAM use is a key focus of this thesis. Studies 2-4 address respectively the areas of individual differences, socio-demographics, and emotional reactions. This chapter provides a summary of the key findings of the program of research, strengths and limitations, implications of the findings, and areas for further investigation.

7.1 Brief Overview of Key Findings

A brief overview of the key findings of the series of chapters in this thesis is provided in bullet points below.

- Initially, a review of the literature supported the need for further research into unorthodox worldviews that predict vaccine scepticism and use of CAM.
- The first study in this thesis developed a brief, summative questionnaire measure of CAM utilisation called the R-I-CAM-Q, to address a gap in previous research which was lacking a psychometrically sound and quantitative measure of CAM utilisation.
- The main findings of the second study, a cross-sectional survey, were that positive attitudes to CAM, rather than use of CAM, best predict vaccination attitudes. Negative attitudes to vaccination and positive attitudes to CAMs, both

- correlate with the presumed antecedents of magical beliefs about health.
- The third area-based (postcode) study revealed that communities with lower rates of vaccination had relatively less disadvantage and had relatively greater education and occupational status. This suggested that privilege may contribute to non-communitarian health behaviours. This finding contrasts with most behavioural health determinants that tend to improve with education and occupational status.
- The final study, a priming experiment, did not find an experimental effect of priming for contamination and purity on subjects' ratings of the safety and effectiveness of conventional and alternative health interventions. However, individual differences in disgust sensitivity are related to their attitudes to vaccination and CAM interventions.

7.2 Detailed Look at Key Findings and Implications

7.2.1 Identifying the Need for Research

Chapter one established the need for this program of research through the provision of a review of the literature on vaccine hesitancy and CAM use, worldview and risk perception, personality and sociocultural factors, emotional reactions to vaccination and CAMs, unorthodox beliefs and unorthodox healthcare choices. In particular, the review focused on unorthodox worldviews which underpin vaccine scepticism and CAM use.

7.2.2 Development of the R-I-CAM-Q

Chapter three outlines the development and evaluation of the R-I-CAM-Q, based on revisions of the I-CAM-Q (Quandt et al., 2009). A subset of items was identified as having an adequate uni-dimensional structure that can be aggregated to yield a scalar

measure of CAM utilisation. The newly developed R-I-CAM-Q (Bryden & Browne, 2016) provides a unitary and aggregate measure of CAM use (see Appendix B). It is the first quantitative and summative measure of general CAM use that has been developed and tested using modern psychometrics.

7.2.3 Pro-CAM Attitudes Predict Vaccination Scepticism, and Anti-vaccination and Pro-CAM Attitudes Both Reflect Magical Beliefs about Health

Chapter four details the results of an analysis of the relationship between CAM use and vaccination scepticism and specifically, whether a person's more general health-related worldview might explain this relationship (Bryden et al., 2018). CAM and vaccine scepticism were found to be linked primarily at the attitudinal level. Interestingly, no evidence was found that this was due to CAM practitioners influencing their clients. A path analytic model showed that health worldview (i.e. holistic health beliefs, magical health beliefs) accounted for a significant proportion (41.3%) of the covariance between CAM and vaccination attitudes. Magical health beliefs (MHB) was by far the strongest predictor of both CAM and vaccination attitudes. Therefore, it was concluded that vaccination scepticism likely reflects part of a broader health worldview that discounts scientific knowledge in favour of magical or superstitious thinking.

7.2.4 Postcodes with Highest Level of Socio-economic Advantage have Lowest Rate of Vaccination

Chapter five described a public health focused ecological study into associations between area-level socio-demographic factors and uptake of vaccination among 5-year-old children throughout Australia. The results showed that communities with lower rates of vaccination had relatively less disadvantage and relatively greater education and occupation status. Vaccination rates were lowest in postcodes from the major cities of

Australia, and vaccination rates increased as communities became more remote. When a closer look was taken at postcodes located in major cities, and to the target group of parents/partners in a family with children aged 4-7, it was found that postcodes with lower vaccination rates were characterised as having a relatively greater proportion of people with a high education level; having white-collar jobs as managers; having no religion; having householders in the older age category (50-54) and conversely, being unemployed.

7.2.5 Priming for Disgust and Purity has no Impact on Health Attitudes, but Sensitivity to Disgust is Associated with Lower Confidence in the Effectiveness of MMR Vaccination, Tetanus Injection, Antibiotics, and Surgery

Chapter six describes the last study, a priming experiment designed to assess whether priming for contamination and purity causes a change in attitudes to health interventions, including vaccination and CAMs. The results did not support the main hypotheses that creating a contamination mindset, through priming with images of contamination, causes a negative change in attitudes to vaccination and a positive change in attitudes to CAM. Further, creating a purity/naturalness mindset, through priming with pure/natural images, did not cause a negative change in attitudes to vaccination and a positive change in attitudes to CAM. However, higher levels of sensitivity to disgust were associated with lower ratings of the effectiveness of MMR vaccination, tetanus injection, antibiotics, and surgery; higher levels of sensitivity to disgust were associated with higher ratings of effectiveness of vitamins/ minerals. These null results of the main hypotheses could indicate that it is not possible to prime for disgust or purity, or that the effect was so minimal that it did not impact assessments of health interventions. The finding that individual differences in disgust sensitivity are related to people's attitudes to vaccination

and CAM interventions, may have implications for how evidence-based interventions might be better promoted. However, the failure of this experiment to find an effect of priming on health attitudes indicates that temporarily increasing the salience of contamination/disgust or purity will have no impact on health attitudes, which may not be easily amenable to change.

7.3 Strengths and Limitations

7.3.1 Methodological Approach

A significant strength of these research studies is the varied methodological approaches taken to achieve the goal of exploring unorthodox worldviews that predict vaccine scepticism and use of CAM. These included (1) multivariate analyses of an archived, cross-sectional, online population survey; (2) an ecological, public health focused, methodology, involving the combination of postcode-level socio-demographic variables with postcode-level vaccination data, and (3) an online priming experiment. The use of three methodological approaches provides a more in-depth and comprehensive understanding of these complex issues; different perspectives which would not be available with a narrower focus.

7.3.2 Development of the R-I-CAM-Q.

The main strength of the first study is that the developed R-I-CAM-Q (Bryden & Browne, 2016) is the first quantitative and summative measure of general CAM use, developed using psychometrically sound methods. Previously, research into determinants of CAM usage have been hampered by the lack of a validated, single measure of CAM utilisation. The original I-CAM-Q is comprehensive in nature, covering a broad range of products and practices, but is limited in that it is essentially descriptive in nature, and was not created with the intention of providing a single (or multi-) dimensional quantitative

index of CAM utilisation. Consequently the format is not suitable for quantitative analysis. The R-I-CAM-Q has good psychometric properties, demonstrating that the scale has an adequate uni-dimensional structure that can be aggregated to yield a scalar measure of CAM utilisation. It retains the coverage of the original scale, but offers a briefer, summative and unitary measure of CAM utilisation which is easily incorporated into surveys. The good performance of the R-I-CAM-Q supports the argument that decisions to use particular CAM therapies are not independent of one another, but rather reflect an underlying proclivity to use alternative treatments.

The main limitation involved in the development of the R-I-CAM-Q involves the substantial loss of information that occurs when using the shorter version of the I-CAM-Q including reason for going to a CAM provider, number of visits and helpfulness of providers (Quandt et al., 2009). The original I-CAM-Q was developed to be ‘international’ in nature, and the removal of information and some types of CAM in the shorter version may impact the usefulness of the scale in countries other than Australia. Researchers may wish to include additional questions in their research proformas to tailor the information collected to their country’s use of CAM.

7.3.3 Relationship Between Vaccine Scepticism and CAM Use

The main strength of the second study is that the results clearly demonstrate that positive attitudes to CAM, rather than CAM use, predicts vaccination scepticism. These results support the hypothesis that the relationship between CAM use and vaccination scepticism is best understood at the attitudinal level and as a consequence of a consistent worldview on health, rather than being explained by the health consumer’s use of CAM. This strongly suggests that CAM providers are not overly influential in regard to their

client's attitudes towards vaccination, but rather it is due to the characteristics of the client.

The main limitation of this study is the restricted degree to which causal statements can be made given the correlational nature of the data. Another limitation is the use of questions on intention to vaccinate which are based on attitudes rather than actual behaviour. It is possible that some individuals with little intention to vaccinate could change their mind in the future, for example, when faced with a persuasive doctor or nurse.

7.3.4 Public Health Focused Postcode Study

The majority of studies looking at vaccine hesitancy and refusal, including those factors of an environmental and socio-cultural nature, have focused on individual-level variables rather than area-based factors. The third study in this research program is the first of its kind in Australia to research area-based indicators associated with lower vaccination rates for children throughout the entire country. The research is a type of ecological study which uses the population or community as the unit of analysis, rather than observations taken at the individual level; more specifically, combining postcode-level socio-demographic data from the census with postcode-level vaccination data. One of the major strengths of an area-based approach is the comprehensive coverage of the whole population of Australia and all geographic areas, enhancing the ecological validity of the results.

A limitation of this study, however, is the ecological nature of the methodology. This means that characteristics of one individual cannot be directly linked to their vaccination behaviour, as is the case in survey data where each individual is connected to their own data as one information record. Therefore, any inferences arising from the

results must be applied to groups of people at the postcode-level rather than individuals. The ‘ecological fallacy’ (Sedgwick, 2015) occurs if inferences are incorrectly made at the individual level rather than at the area-based level; since sometimes only a few people in a single post-code closely reflect the median or mean values measured for that postcode.

7.3.5 Priming for Contamination and Purity Experiment

The main strengths of the fourth study in this program of research is the experimental nature of the methodology, which allows for tighter control over variables and statements about cause and effect. The design included four between-subject experimental conditions and two control conditions. Subjects were assigned in a completely randomised design (CRD) to these test and control groups. The inclusion of control groups in this experiment is important in that it allowed the experimental groups to be compared to those participants who were not exposed to priming images. The inclusion of the three recognised types of contamination - biological, chemical, and physical contamination (Rhodehamel, 1992) - ensured comprehensive coverage of the domain of contamination. Finally, the online nature of the experiment ensured that there would be no experimenter effect where those running the experiment inadvertently influence the behaviour of the participants; a problem which has beset priming research in the past (Bower, 2012; Doyen et al., 2012).

One limitation of this study is that the primes may have been too weak to evoke a response, leading to type II errors. Using different types of primes, such as olfactory primes, may have increased the power of the experiment, for example, there is evidence that inducing feelings of disgust via olfactory primes (e.g. smell of a rotten egg) produces a stronger priming effect than photographs (Braun et al., 2016; Smeets & Dijksterhuis, 2014). However, this type of alternative priming has the disadvantage that the experiment

would need to be done in-person rather than online, which adds to the cost and potentially introduces experimenter effects. Another limitation was the decision not to use a manipulation check in the experiment, to test the effectiveness of priming for contamination and purity. This was unavoidable as it was important to ensure that participants were not consciously aware of the true nature of the experiment. Using a Qualtrics' panel of participants could also have had an impact on the experiment, given they are not representative of the general population, and it is possible that a population representative survey may have had different results. It is also possible that some Qualtrics' participants may not pay close attention to the instructions, as they focus on earning more by finishing experiments quickly. However, a study by Roulin and colleagues (2015) found that data from crowdsourcing samples, including Qualtrics, was more representative of the general population than, for instance, using university students.

7.4 Implications of Findings

The studies in this thesis broadly contribute to the overall goal to explore unorthodox worldviews that predict vaccine scepticism and use of CAM, in order to inform the future development of persuasive strategies to encourage participation in evidence-based interventions. Study 1 stands apart from the other studies, in that it addresses an important and related measurement issue regarding the quantification of CAM use. Study 2 to study 4 explore the underpinnings of vaccine hesitancy and use of CAM in the different traditions of individual differences (inclusive of personality, attitudes and beliefs), socio-demographics, and emotional reactions to vaccination and CAMs. This thesis consolidates and extends on previous research with a focus on unorthodox psychological, socio-cultural, and emotional worldviews of those who are vaccine hesitant and who embrace CAMs. A comprehensive understanding of these

worldviews can inform the future development of tailored, and persuasive health promotion strategies to encourage participation in evidence-based healthcare, particularly vaccination programs.

7.4.1 The R-I-CAM-Q

Previous research into CAM has been complex and contradictory, most likely due to the lack of a standardised, quantitative measure of CAM utilisation. The R-I-CAM-Q (Bryden & Browne, 2016) developed in the first study in this thesis, is the first quantitative and summative measure of general CAM use. It will be particularly useful for researchers who wish to explore why some people use CAM more than others, without necessarily delving into the complex specifics of each individual practice, and can be easily incorporated into online surveys. It was originally intended that the R-I-CAM-Q be used as a unitary measure of CAM use in the second study. However, instead the I-CAM-Q was quantified into three sub-scales: provisions of CAM services, use of CAM products, and self-help practices. This was done in this context to reduce loss of valuable information.

7.4.2 Unorthodox Worldviews Predict Vaccine Scepticism and Use of CAM

The second study looked at individual differences (inclusive of personality, attitudes and beliefs) underpinning both vaccine scepticism and CAM use. Our finding that pro-CAM attitudes predicted vaccination scepticism to a far greater degree than CAM use, supports the hypothesis that the relationship between CAM use and vaccination scepticism is best understood at the attitudinal level and as a consequence of a consistent worldview on health, rather than being explained by the health consumer's use of CAM. Therefore, it is unlikely that CAM providers are a primary influence on the vaccination views of their clients. The most significant finding of this study is that

magical health beliefs (MHBs) were the most influential variable in explaining the relationship between vaccination scepticism and pro-CAM attitudes, followed by belief in holistic health. These MHBs are indicated by agreement with items such as ‘By massaging a diseased organ surrogate in the sole of the foot, the organ will be restored’, and reflect a way of thinking about health characterised by confusions of core knowledge about how the world works, that is, ontological confusions. This study provides an important step in understanding how these non-evidence based, alternative health beliefs may influence both vaccination scepticism and positive attitudes to CAMs.

Aarnio and Lindeman’s (2004) study into magical food and health (MFH) beliefs reported that a person with MFH beliefs was likely to be female, vegetarian, an intuitive thinker, have some symptoms of an eating disorder and a positive attitude to alternative medicine. MFH believers self-reported that these beliefs served a value-expressive function (e.g. ‘my beliefs reflect my personal values’), as well as providing self-esteem, and a sense of competence and control. They hypothesise that magical beliefs not only stem from cognitive errors (Lindeman et al., 2000; Aarnio & Lindeman, 2004), but also affective processes and consequent judgements. Interestingly, the authors Aarnio & Lindeman, (2004) propose that what unites vegetarianism, eating-disordered thinking and pro-CAM attitudes, is an affective avoidance of certain substances. Vegetarians avoid meat for health reasons, ecological reasons, ethics and disgust (Beardsworth & Keil, 1992; Fessler et al., 2003); people with eating disorders avoid many foods because of calories, fear and disgust (Griffiths & Troop, 2006; Harvey et al., 2002), and people who are pro-CAM avoid unnatural substances, preservatives, and toxins (Gullion et al., 2008; Sobo, 2015). They conclude that ‘unfounded food and health beliefs are adopted and held in the realm of emotions, intuition, approach-avoidance behaviour values, and identity.’

7.4.3 The Privilege Paradox: Geographic Areas with Highest Socio-economic Advantage have the Lowest Rates of Vaccination

The third study looked at socio-demographic indicators at the area (postcode) level, in order to investigate if unorthodox healthcare choices, in this instance vaccine hesitancy, are influenced by factors that extend beyond the person, and incorporate the environment in which they live and make their health-based choices. The WHO (Larson et al., 2014) has highlighted the importance of regional-level factors in the analysis of vaccine hesitancy and refusal, but most studies focus on individual-level variables rather than area-based factors. The third study in this thesis (Bryden et al., 2019) analysed postcode-level socio-demographic data from the 2016 Census of Australia (ABS, 2017a) with postcode-level vaccination data. Postcodes with lower vaccination rates were characterised by indicators of high socio-economic status, such as high levels of education and white-collar occupations, and lower levels of indicators of disadvantage as measured by the SEIFA (ABS, 2018) Index of Relative Disadvantage, as well as not being Aboriginal. Not identifying with formal religion was also associated with postcodes having lower rates of vaccination. Vaccination rates clearly decreased as communities became more urban, with major cities having the lowest vaccination rates.

Generally, area-level deprivation is associated with adverse health behaviours and health outcomes (Mulholland et al., 2008; Sánchez-Santos et al., 2013), but this is not apparent with vaccine hesitancy and refusal. This study aligns with previous research that showed indicators of high socio-economic status were associated with lower rates of vaccination (Henry et al., 2017; Jain et al., 2017; Smith et al., 2004). The fact that major cities had lower rates of vaccination than in rural and remote areas of Australia points to non-access related issues being important, such as the spread of vaccine scepticism via

parenting and social networks, socio-cultural norms, and potentially language and other barriers among ethnic minorities who often live in the cities (Henry et al., 2017; Warner et al., 2017). Also of significance, local areas with a larger proportion of the community having no religion had relatively lower rates of vaccination. It is possible that worldviews that embrace beliefs in spirituality, rather than formal religion, may be key to these results. Previous research has shown that people who do not identify with major religions, may have a belief in spiritual and metaphysical ideas which lie outside formal religions (Browne et al., 2014). It has also been shown that psychosocial factors including endorsement of spirituality as a source of knowledge predicts negative attitudes to vaccination (Browne et al., 2015). The results of this postcode-level study across Australia provide important evidence to inform public health interventions to increase participation in the Australian National Immunisation Program in local areas with lower rates of vaccination. The under-vaccination of clusters of children in affluent neighbourhoods is a significant issue that can impact herd immunity, result in outbreaks of vaccine preventable diseases and undermine public health policy. It is also of concern that less privileged communities in Australia are shouldering a disproportionate burden of responsibility for reducing vaccine preventable diseases at the population or public health level.

7.4.4 Sensitivity to Disgust is Associated with Lower Confidence in the Effectiveness of MMR vaccination, Tetanus Injection, Antibiotics, and Surgery

The fourth and final study looked at whether the emotional reactions of disgust and fear of contamination, could cause a change in attitudes to conventional and alternative healthcare. This study was a contamination and purity priming experiment which did not support the hypotheses that creating a contamination mindset, through

priming with images of contamination, causes a negative change in attitudes to vaccination and a positive change in attitudes to CAM. Further, creating a purity/naturalness mindset, through priming with pure/natural images, did not cause a negative change in attitudes to vaccination and a positive change in attitudes to CAM. The failure of this experiment to find an effect of priming on health attitudes indicates that temporarily increasing the salience of disgust/contamination or purity will have no impact on health attitudes, which may not be easily amenable to change. The failure of this experiment to find an effect of priming on health attitudes indicates that temporarily increasing the salience of disgust/contamination or purity will have no impact on health attitudes, which may not be easily amenable to change.

However, the results do support the idea that a person's general sensitivity to disgust is associated with lower confidence in the effectiveness of MMR vaccination, tetanus injection, antibiotics, and surgery. In support of our research, a 24-Nation study (Hornsey et al., 2018) of the psychological drivers behind anti-vaccination attitudes found that, in order of importance, conspiratorial thinking, reactance (i.e. low tolerance for perceived infringements on personal freedoms), high levels of disgust towards needles and blood and hierarchical/individualistic worldviews, were associated with anti-vaccination attitudes. This research is important because propensity to disgust sensitivity is a primary emotion that is not easily amenable to change without psychological intervention (Ludvik et al., 2015). It also provides one explanation of why some people are so resistant to changing their negative attitudes to vaccination (Luo & Yu, 2015).

7.4.5 An Unorthodox Worldview is Key

The findings from the studies in this thesis, along with findings from previous research as outlined in the overview of the literature (see Chapter 1), provide an

understanding of the unorthodox or alternative worldviews of individuals who are vaccine sceptics and people who embrace CAMs. These studies have broadly covered individual differences (inclusive of personality, attitudes and beliefs) that underpin both vaccine scepticism and CAM use; as well as socio-demographics indicators at the local postcode level across Australia, and emotional reactions (particularly disgust and fear of contamination), to vaccinations and CAMs. Details about these worldviews are outlined below.

7.4.5.1 Vaccine scepticism

Vaccine sceptics have a worldview where there is distrust of government, authorities, scientists, medical professionals and pharmaceutical companies (Salmon et al., 2005), along with a tendency to reject advice from the establishment (Larson et al., 2011). This can merge into the realm of conspiracy theories (Jolley & Douglas, 2014; Goldberg & Richey, 2020). Vaccine scepticism is predicted by support for natural, alternative, and holistic healthcare, conspiracy ideation, an emphasis on civil liberties and parental rights (Bean, 2011; Briones et al., 2012; Kata, 2010; Lewandowsky et al., 2013; Yaqub et al., 2014). These contribute to beliefs that vaccines are unsafe and ineffective and that medical professionals and experts cannot be trusted (Furnham & Beard, 1995; Gust et al., 2004). The anti-vaccination movement values holistic and spiritual aspects of healthcare; a valuing of the natural over the artificial, and an individualistic postmodern worldview in which patients have personal power, and the legitimacy of science and experts is questioned (Kata, 2010). Parents' affective responses (i.e. negative emotion to vaccination) are of importance, along with an intuitive thinking style, in the uptake and refusal of vaccinations (Tomljenovic et al., 2020). A negative attitude to vaccination has been associated with an 'alternative living' lifestyle and a natural living philosophy (e.g.

use of natural healing remedies, veganism, vegetarianism, chiropractic, homeopathy, organic gardening, natural childbirth, breastfeeding), and varying degrees of distrust in the medical community (Gullion et al., 2008). The personality factor of ‘openness to experience’ is related to less favourable attitudes towards vaccination (Browne et al., 2015). Openness to experience has been associated with creativity, intelligence, fantasy and spirituality. In relation to cognitive style, individuals who tend toward an intuitive style of thinking are more prone to cognitive biases and to use heuristics or mental shortcuts in their decision making, when compared to people with a more analytic style of thinking. Heuristics and cognitive biases have been found to be involved in decision making related to vaccinations (Chapman & Coups, 2006; Luz et al., 2020, Niccolai & Pettigrew, 2016; Seethaler, 2006; Voinson et al., 2015).

7.4.5.2 Embracing CAM

Previous research has shown that people who are attracted to CAM have a postmodern worldview, holistic orientation to healthcare, embrace spirituality, and value self-expression and personal growth (Astin, 1998). There is a congruence between CAM and their values, beliefs, and philosophical or cultural orientation toward healthcare in general (Coulier & Willis, 2007), and they find holistic healthcare empowering and accessible (Barrett et al., 2003). CAM users are more likely to be employed, middle-aged, females, with a higher household income, greater education, poorer health status and chronic health problems (Thomson et al., 2014). Belief in the paranormal has been found to be related to CAMs, and a ‘less scientific worldview’ predicts positive attitudes to CAM. Healthcare consumers whose belief systems encompass spirituality or mysticism are often attracted to CAMs (Thomson et al., 2014) and spiritual aetiologies and treatments are fundamental to many CAM practices.

7.4.5.3 Vaccine scepticism and a positive attitude to CAM

This thesis has the goal of exploring unorthodox worldviews that predict vaccine scepticism and use of CAM in order to inform the future development of persuasive strategies to encourage participation in evidence-based interventions. It is clear from previous research that there is much overlap between the factors that predict vaccine scepticism and those that predict a positive attitude to CAM. The research in this thesis supports the notion that it is a shared worldview which underpins both vaccine scepticism and use of CAM. That vaccination scepticism and use of CAM reflects part of a broader health worldview, discounting scientific knowledge in favour of magical or superstitious thinking. It is an orientation which aligns with spirituality, intuitive thinking, conspiratorial thinking, and holistic health. People with this worldview are most often creative, intelligent, drawn to fantasy, with a need to examine and enlarge upon experiences and are attracted to spirituality. They often embrace an organic, natural living philosophy, with a holistic approach to healthcare and they seek the pure and natural, while eschewing all things perceived disgusting - the contaminated and toxic.

7.4.5.4 Birds of a feather flock together

Factors relating to vaccination scepticism and cultural values, parental attitudes, and religious/traditional beliefs are usually region or country specific (Rainey et al., 2011). A systematic review of determinants of vaccine hesitancy identified that they were complex and context-specific, varying across vaccines, place, and time (Larson et al, 2014). The third study in this thesis (Bryden et al., 2019) revealed that areas of privilege, including those with the highest socioeconomic advantage had the lowest rates of vaccination. The reasons for this are complex but the theory of ‘cultural cognition of risk’ (Kahan et al., 2010), as outlined in Chapter 1, may provide one possible explanation. The

theory posits that people are processing information in a motivated and biased way in line with their cultural worldview. People may oppose scientific evidence because they would rather follow the belief of their ‘tribe’ or peers; that people seek out and filter information about an issue through the lens of their ‘tribe’, ignoring information that contradicts their tribal view and absorbing information supportive of these views. People with a similar worldview often live within close proximity to each other, choosing schools and activities that match their values and cultural orientation. People enjoy the sense of community that comes with associating with likeminded people (Jolanki & Vilkkio, 2015). It is likely that vaccination scepticism and use of CAM emanates from a congregation of individuals, both physically (i.e. geographically) and online, with similar worldviews.

7.4.5.4 Sensitivity to disgust can influence attitudes to vaccination and CAMs

Previous research has shown that a person’s emotional reactions, in particular disgust (and fear of contamination) are drivers of reactions to vaccinations and CAMs. The assumption is that, in addition to individual differences and socio-demographic influences, people can have visceral emotional reactions to medical treatments (e.g. needles, pain) that put these treatments at a disadvantage to CAM treatments that are often more pleasant (Luz et al., 2019; Hornsey et al., 2020; Tomljenovic et al., 2020; Majid & Ahmad, 2020; Reuben et al., 2020; Roulin, 2015). Having a high sensitivity to disgust, for example in relation to blood, needles, or pathogens, can sway people away from vaccinations and toward CAMs (Luz et al., 2019; Hornsey et al., 2020; Tomljenovic et al., 2020; Majid & Ahmad, 2020; Reuben et al., 2020; Roulin, 2015). The experiment (study 4) failed to show that attitudes to health interventions can be influenced by a temporary increase in the salience of feelings of contamination or purity. However, there was support for the notion that a pre-disposition to strong disgust reactions impacts a

person's attitudes to vaccinations and CAMs, and this may impact interventions aimed at increasing uptake of vaccinations among vaccine hesitant individuals.

7.4.6 Application of this research to public health policy and practice

The four studies in this thesis advance knowledge of people who embrace CAMs and are sceptical about vaccinations. But more importantly, this research can be translated into or applied directly to public health policy and practice. Understanding the individual differences (inclusive of personality, attitudes and beliefs), socio-demographics, and emotional reactions that underpin unorthodox beliefs and unorthodox healthcare choices can inform the development of persuasive and tailored health promotion strategies to encourage evidence-based healthcare choices, particularly vaccination. The research outlined in this thesis can inform these types of strategies and campaigns. A chief finding is that a person's values and worldview are crucial in their choices of unorthodox healthcare, both vaccination and use of CAM. This is a worldview that prioritises magical or superstitious beliefs in health and a belief in holistic health. A worldview based on ontological confusions about how the world works; one which values alternative health and a natural approach to health interventions, and one which considers the totality of body, mind, and spiritual aspects of a person. Another important aspect to inform campaigns is the privilege paradox: where geographic areas with highest socio-economic advantage have the lowest rates of vaccination. Strategies will need to be developed and tailored to well-resourced and well-educated populations, who may consider that questioning vaccine safety is an expression of their personal agency, and reflects their intuitive knowledge about what is best for themselves and their children, and a way to achieve optimal health or wellness (Browne, 2018). The final discovery which needs to

be taken into consideration is that of disgust sensitivity and how a propensity to high levels of disgust can influence vaccination attitudes and behaviour and use of CAMs.

This research can be applied directly to the development of future health initiatives tailored to vaccine sceptics and people who embrace CAMs, many who may have a deep set of beliefs about health and wellbeing that is not based on scientific evidence. This research has revealed that these individuals often have an alternative worldview, one where unorthodox beliefs, including magical health and holistic health beliefs, are foundational. Generally, health promotion and education campaigns have been based on distributing or sharing evidence-based information, or facts from an expert. This has been the case for campaigns around food and nutrition (e.g. information on the percentage of fat, sugar and protein in a food item, number of calories) and has been the case for campaigns around vaccination (e.g. pamphlets with facts and figures about efficacy and effectiveness, TV advertisements with experts telling the viewer that they recommend vaccines because they work and are safe). These are an important component of awareness campaigns but may not be effective for a vaccine sceptic whose values and identity eschew an evidence-based approach. It is highly likely that an affective/emotions-based approach to these health campaigns would be more persuasive for this group of vaccine sceptics; one that aligns with their values, morals, identities, and worldview.

It is clear from the literature on persuasive communication (Cooper et al, 2015) that when beliefs and attitudes are strongly linked to lifestyles or overarching values, then those beliefs and attitudes will be very strong and particularly difficult to change (Blankenship & Wegener, 2008). Anti-vaccination websites are adept at using persuasive strategies to influence their audience. A content analysis of anti-vaccination websites

(Moran, 2015), through the lens of persuasion theory, found emotional anecdotal evidence appeals to parents' values and lifestyles and were frequently used. They concluded that similar tactics could be used to promote vaccinations. Social marketing is another example of an approach which can be used to increase rates of vaccination (Opel et al., 2009). This approach 'applies traditional marketing principles and techniques to influence target audience behaviours that benefit society as well as the individual' (Lee & Kotler, 2011). Both social marketing and theory from the psychology of behaviour can assist with addressing the problem of vaccine hesitancy and refusal. The first stage of a social marketing campaign would be the comprehensive identification and understanding of different groups of healthcare consumers, that is 'market segments' in social marketing terminology. The research outlined in this thesis has identified a group or 'market segment' of individuals, who are not easily persuaded by evidence-based products or techniques, with a worldview that has a grounding in magical and holistic beliefs and values, and which embraces the natural world and avoids contamination and toxicity. The next stage would be marketing to this segment using strategies such as the right messenger, a message that can arouse the audience emotionally, and one which is congruent with their worldviews (Cialdini, 1991).

These types of strategies can also be used within healthcare services, through general practitioners and other healthcare professionals. Indeed, 'A practitioner's guide to the principles of COVID-19 vaccine communications' has been recently developed (Brunson et al., 2020) which includes 'work within worldviews, identities, and moral values' as a key principle for building trust. The guide discusses connecting with healthcare consumers by finding the common ground between what matters to them and what the GP is hoping to achieve. Another key principle they include is to 'use the right

messengers for your audience’. They discuss how healthcare consumers have a need to trust the messenger, their motivations, and the message, before they will agree to vaccination. Also, the importance of activating the right emotions, rather than invoking shame and fear; there is a need to focus on positive emotions such as hope and the desire to protect loved ones. Finally, the guide talks about changing social norms. They acknowledge that we are strongly affected by the choices and behaviour of people in our networks and that we should examine vaccine hesitancy through the ‘lens of social norms’.

7.5 Areas for Further Investigation

It is important to note that the results of this research are important in the field of public health, but translation of this knowledge into practical applications is required. Ideally, this translation of knowledge into practical interventions (Dagenais et al., 2009) will improve the health of the public by increasing vaccination uptake and reducing use of ineffective health interventions. Further research will be required to assess the impact of any developed interventions. Generally, there is a need for systematic research into vaccine hesitancy and refusal. The onset of the global COVID-19 pandemic provides both opportunities and challenges in regard to achieving adequate vaccine uptake. A survey in the USA found that 31% of people did not intend to get vaccinated against COVID-19 when the vaccine was made available (Reiter et al., 2020). Social media has been a predominant source of misinformation about COVID-19, including the promulgation of conspiracy theories about the so called ‘pandemic’, and misinformation and conspiracy theories about the vaccine (Oleksy et al., 2021; Romer & Jamieson, 2020; Shahsavari et al., 2020). YouTube accounts such as ‘JP Sears’ (Sears, 2021) combine anti-government and anti-establishment conspiracy theories with holistic and spiritual

health messaging. These new trends highlight the confluence of anti-establishment and libertarian thinking with more long-standing anti-vaccination attitudes grounded in spirituality and naturalness. Social media can also be leveraged to public health advantage in the promotion of vaccination, particularly the COVID-19 vaccination. One area for future research would be into the use of social media to promote vaccination. In particular, study of the impact of celebrities and online ‘influencers’ who have magical health and holistic health beliefs (but who are still pro-vaccination), sharing their experience of getting the COVID-19 vaccination. Another area for investigation would be the development and evaluation of a health promotion campaign on the COVID-19 vaccination based on the principles of persuasion and social marketing as outlined in this thesis.

7.6 Conclusion

Vaccination scepticism and use of CAM reflects part of a broader health worldview that often discounts scientific knowledge in favour of magical or superstitious thinking. This is a worldview which aligns with spirituality, intuitive thinking, and holistic health. Vaccine sceptics often embrace an organic, natural living philosophy with a holistic approach to healthcare. They seek the pure and natural, while eschewing things perceived disgusting - the contaminated and toxic. Local communities with lower rates of childhood vaccination are located in the major urban areas of Australia, are relatively less disadvantaged, and have greater education and occupation status. Understanding these communities and the unorthodox or alternative worldviews of vaccine sceptics and CAM users can directly inform the future development of tailored and persuasive health promotion strategies, which encourage the uptake of vaccination and participation in evidence-based healthcare via messaging that is congruent with worldviews.

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Appendices

Appendix A: Health Belief Survey

Health Beliefs Survey

Please read the information below and click on the hyperlink to begin the survey.

About the Survey

A growing body of psychological research has shown that cognitive, personality and social/cultural factors help to explain individual differences in health-related attitudes. This survey addresses a broad range of attitudes, beliefs and behaviours which are relevant to health. It includes questions about personality and life experiences, problem solving, political and scientific beliefs, paranormal beliefs, spiritual beliefs, complementary and alternative health beliefs, and views toward vaccinations. This is the first survey to adopt more than a purely descriptive approach to understanding health-related beliefs, by including cognitive, personality and sociocultural factors. Applying findings on the relationship of these psychological factors to beliefs in other domains, the study will be the first to attempt a theoretical explanation for the formation and maintenance of various health beliefs.

We understand that these questions may be sensitive for some people. If you are concerned with this topic you may decide not to participate, or to end the survey at any time. In the event that you experience any discomfort due to completing this questionnaire, please do not hesitate to contact Lifeline on 13 11 14.

The information that you provide is bound by strict confidentiality and ethical procedures. Identifying information is not linked to the information that you provide and all survey data is completely anonymous.

Expected Length

The current survey should take you approximately 20-25 minutes to complete. Most questions are pre-coded or "tick box" items which are not difficult to answer. Whilst we encourage you to take the time to consider your responses it is important to realise that the survey is not a test! Survey questions are usually general in nature; therefore there may be times when you feel that the responses provided don't exactly match what you would like to say. If this happens it is best to pick the response that comes closest to matching how you feel and *move on*, rather than spend a large amount of time on any given question. If you need to you can leave the survey and return to complete it later using your AHSS password.

Completing the Survey

In order to access the survey, you will need your unique password, which was sent to you in your invitation email. If you have problems with your password please consult the help section of the website or contact us for assistance. Participation in the survey is voluntary and your responses will remain anonymous. If you have enabled cookies on your computer you can leave the survey at any time, and return to the point that you left simply by using the survey login link again and entering your password. The survey will close on Monday, 6 January 2015. We encourage you to complete the survey as soon as possible so that we can include your views.

All survey data will be completely anonymous. The data we collect will be securely stored for five (5) years in accordance with CQUniversity policy. Findings from this research may be published in scientific journals or other relevant publications and may be presented at research conferences. It will not be possible for anyone to identify

you as a result of publication or presentation of these findings. This project has been approved by the Human Research Ethics Committee.

Start the Survey Now

Thank you, we greatly appreciate your support!

If the link above does not work please type the following address into your browser:

<http://ssiweb.cqu.edu.au/ahss15/login.html>

Questions or concerns

If you have any questions, difficulties or concerns regarding this survey, please feel free to contact:

Christine Hanley, AHSS Project Manager CQUniversity Australia

P: (07) 4930 6335 E: c.hanley@cqu.edu.au

In addition, you can contact the CQU Office of Research Ethics and Compliance Officer (Tel: 07 4923 2607 or e-mail: ethics@cqu.edu.au) should there be any concerns about the nature and/or conduct of this research project.

CQUniversity Australian Health and Social Science (AHSS) Project: Health Beliefs Survey

Cognitive, personality and social/cultural factors can help to explain individual differences in health-related attitudes. This survey addresses a broad range of attitudes, beliefs and behaviours which are relevant to health. It includes questions about personality and life experiences, problem solving, political and scientific beliefs, paranormal beliefs, spiritual beliefs, complementary and alternative health beliefs, and views toward vaccinations.

Section 1: Personality and life experiences

The following statements describe personal characteristics.

Q1: Please select how accurately each of these statements applies to you using the scale provided.

- 1 I have a vivid imagination
- 2 I enjoy wild flights of fantasy
- 3 I love to daydream
- 4 I like to get lost in thought
- 5 I indulge in my fantasies
- 6 I spend time reflecting on things
- 7 I seldom daydream
- 8 I do not have a good imagination
- 9 I seldom get lost in thought
- 10 I have difficulty imagining things
- 11 I experience my emotions intensely
- 12 I feel others' emotions
- 13 I am passionate about causes
- 14 I enjoy examining myself and my life
- 15 I try to understand myself
- 16 I seldom get emotional
- 17 I am not easily affected by my emotions
- 18 I rarely notice my emotional reactions.
- 19 I experience very few emotional highs and lows
- 20 I don't understand people who get emotional
- 21 I prefer variety to routine
- 22 I like to visit new places

- 23 I am interested in many things
- 24 I like to begin new things
- 25 I prefer to stick with things that I know
- 26 I dislike changes
- 27 I don't like the idea of change
- 28 I am a creature of habit
- 29 I dislike new foods
- 30 I am attached to conventional ways

SCALE

- 1 Very inaccurate
- 2 Moderately inaccurate
- 3 Moderately accurate
- 4 Very accurate

Section 2: Brain Teasers

Next we have some brain-teasers that can be solved in different ways. Some people find them easy and others find them quite tricky. Record your answer for each question. If you feel that you can't answer the question within a minute or two just leave it blank and move onto the next one.

Q2a: A bat and a ball cost \$1.10 in total. The bat costs a dollar more than the ball. How much does the ball cost?

Q2b: If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?

Q2c: In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?

Q2d: If John can drink one barrel of water in 6 days, and Mary can drink one barrel of water in 12 days, how long would it take them to drink one barrel of water together?

Q2e: Jerry received both the 15th highest and the 15th lowest mark in the class. How many students are in the class?

Q2f: A man buys a pig for \$60, sells it for \$70, buys it back for \$80, and sells it finally for \$90. How much has he made?

Q2g: Simon decided to invest \$8,000 in the stock market one day early in 2008. Six months after he invested, on July 17, the stocks he had purchased were down 50%. Fortunately, for Simon, from July 17 to October 17, the stocks he had purchased went up 75%. At this point, Simon has:

- 1 broken even in the stock market
- 2 is ahead of where he began
- 3 has lost money

At the end of the survey we will provide a link for you to find out the correct answers!

Section 3: Conspiracy, Politics and Science

People have a wide variety of opinions about events, politics and science. We're interested in what you think.

Q3: Please select how true you consider each of the following statements to be.

- 1 The government is involved in the murder of innocent citizens and/or well-known public figures and keeps this a secret.

- 2 The government permits or perpetrates acts of terrorism on its own soil, disguising its involvement.
- 3 The government uses people as patsies to hide its involvement in criminal activity.
- 4 The power held by heads of state is second to that of small, unknown groups who really control world politics.
- 5 A small, secret group of people is responsible for making all major world decisions, such as going to war.
- 6 Certain significant events have been the result of the activity of a small group who secretly manipulate world events.
- 7 Secret organizations communicate with extraterrestrials, but keep this fact from the public.
- 8 Evidence of alien contact is being concealed from the public.
- 9 Some UFO sightings and rumours are planned or staged in order to distract the public from real alien contact.
- 10 The spread of certain viruses and/or diseases is the result of the deliberate, concealed efforts of some organization.
- 11 Technology with mind-control capacities is used on people without their knowledge.
- 12 Experiments involving new drugs or technologies are routinely carried out on the public without their knowledge or consent.
- 13 Groups of scientists manipulate, fabricate, or suppress evidence in order to deceive the public.

- 14 New and advanced technology, which would harm current industry, is being suppressed.
- 15 A lot of important information is deliberately concealed from the public out of self-interest.

SCALE

- 1 Definitely not true
- 2 Probably not true
- 3 Probably true
- 4 Definitely true

Section 4: Paranormal Beliefs

People have a wide variety of opinions regarding aspects of the spiritual and the paranormal.

Q4: Please select the degree to which you agree with each of the following statements.

- 1 Some individuals are able to levitate (lift) objects through mental forces.
- 2 Psychokinesis, the movement of objects through psychic powers, does exist.
- 3 A person's thoughts can influence the movement of a physical object.
- 4 Mind reading is not possible.
- 5 Your mind or soul can leave your body and travel (astral projection).
- 6 During altered states, such as sleep or trances, the spirit can leave the body.
- 7 Reincarnation does occur.
- 8 It is possible to communicate with the dead.
- 9 Astrology is a way to accurately predict the future.
- 10 The horoscope accurately tells a person's future.
- 11 Some psychics can accurately predict the future.

- 12 Some people have an unexplained ability to predict the future.

SCALE

- 1 Strongly disagree
- 2 Somewhat disagree
- 3 Somewhat agree
- 4 Strongly agree

Section 5: Spiritual Beliefs

The following items are about how you experience the world.

Q5: Please select the degree to which each statement applies to you.

- 1 The beauty of nature moves me.
- 2 When I am in nature, I feel a strong sense of connection.
- 3 I have had experiences during which the nature of reality became apparent to me.
- 4 I have had experiences in which I seem to merge with a power or forces greater than myself.
- 5 I have had experiences in which all things seemed to be a part of a greater whole.
- 6 I have had experiences where everything seemed perfect.
- 7 I have had experiences where I seemed to rise above myself.
- 8 I feel that the most important knowledge comes from spiritual experiences.
- 9 There is a God or higher power in my life that gives me guidance.
- 10 I talk about spiritual themes with others (themes such as the meaning of life, death or religion).
- 11 I meditate or pray, or take time in other ways to find inner peace.
- 12 I attend sessions, workshops, etc. that are focused on spirituality or religion.

SCALE

- 1 Not at all
- 2 A little bit
- 3 Quite a bit
- 4 To a very high degree

Section 6: Alternate Health Beliefs

The following sentences describe various views on keeping the body in a state of health and certain types of health care.

Q6: Please select the degree to which you agree with these statements.

- 1 An imbalance between energy currents lies behind many illnesses.
- 2 Colours change the organism's energy vibration in a direction that is beneficial to health.
- 3 Plants are living beings whose energy potentials can be transmitted to human beings.
- 4 By massaging a diseased organs surrogate in the sole of the foot, the organ will be restored.
- 5 An incorrect diet makes food rot in the body.
- 6 If we don't somehow clean our bodies, unhealthy toxins remain in them.
- 7 It is good to detoxify one's body every now and then with a fast.
- 8 An illness should be treated with a medicine that has properties similar to those of the illness.
- 9 Since our bodies are 70 percent water, we should be eating a diet that has an approximate water content of 70 percent.
- 10 The statement that red drinks improve haemoglobin is probably valid.

SCALE

- 1 Strongly disagree
- 2 Somewhat disagree
- 3 Somewhat agree
- 4 Strongly agree

Section 7: Holistic Health Beliefs

The following statements describe various views on how the mind and body are related.

Q7: Please select the degree to which you agree with each statement.

- 1 Positive thinking can help you fight off a minor illness.
- 2 When people are stressed it is important that they are careful about other aspects of their lifestyles as their body already has enough to cope with.
- 3 The symptoms of an illness can be made worse by depression.
- 4 If a person experiences a series of stressful life events they are more likely to become ill.
- 5 It is important to find a balance between work and relaxation in order to stay healthy.

SCALE

- 1 Strongly disagree
- 2 Somewhat disagree
- 3 Somewhat agree
- 4 Strongly agree

Section 8: Complementary Medicine

Complementary therapies are becoming very popular in Australia as a way of maintaining good health. These include homeopathy, naturopathy, chiropractic, energy medicine, various forms of acupuncture, Chinese medicine and faith healing. Attitudes towards the use of complementary medicine vary and we are interested in your opinion.

Q8: Please select the degree to which you agree with each statement.

- 1 Complementary medicine should be subject to more scientific testing before it can be accepted by conventional doctors.
- 2 Complementary medicine can be dangerous in that it may prevent people getting proper treatment.
- 3 Complementary medicine should only be used as a last resort when conventional medicine has nothing to offer.
- 4 It is worthwhile trying complementary medicine before going to the doctor.
- 5 Complementary medicine should only be used in minor ailments and not in the treatment of more serious illness.
- 6 Complementary medicine builds up the body's own defences, so leading to a permanent cure.

SCALE

- 1 Strongly disagree
- 2 Somewhat disagree
- 3 Somewhat agree
- 4 Strongly agree

There are a variety of alternative medicines available to treat different health problems and ailments. The following questions ask you about the sorts of treatments you have tried.

Q9: Which of the following complementary providers have you personally used the services of?

- 1 Homeopath
- 2 Acupuncturist
- 3 Herbalist
- 4 Spiritual Healer
- 5 Chiropractor
- 6 Naturopath
- 7 Traditional Medicine or Spiritual Healer
- 8 Hypnotherapist
- 9 Body manipulation therapies, such as Bowen Therapy or Reiki (excluding massage or physiotherapy)
- 10 Therapeutic massage
- 11 Other (please specify)

RESPONSES

- 1 No
- 2 Yes, but not in the last 12 months
- 3 Yes, in the last 12 months

Q10: Which of these products have you personally used?

- 1 Herbs/herbal medicine

- 2 Vitamins/minerals
- 3 Homeopathic remedies
- 4 Home weight loss equipment
- 5 Magnetic bracelets or rings
- 6 Non-fluoridated or non-chlorinated distilled water for health purposes
- 7 Other supplements (please specify)

RESPONSES

- 1 No
- 2 Yes, but not in the last 12 months
- 3 Yes, in the last 12 months

Q11: What forms of self-help practices have you used?

- 1 Meditation
- 2 Yoga or Tai Chi
- 3 Detox or cleansing diet
- 4 Prayer for your own health
- 5 Relaxation techniques or visualization
- 6 Aromatherapy
- 7 Any form of traditional or spiritual healing ceremony

RESPONSES

- 1 No
- 2 Yes, but not in the last 12 months
- 3 Yes, in the last 12 months

Section 9: Vaccination Intentions

The following items relate to your intentions to be vaccinated or to have a child vaccinated if you had a child in your care. If you do not have a child, just imagine that you had the responsibility of making a decision to vaccinate a child in your care.

Q12: Please select how much you agree with the following statements.

- 1 Immunizations sometimes overload/weaken the body's natural defences.
- 2 If I had a child to care for, I would ensure that they received all scheduled vaccinations.
- 3 If I had a child to care for, I would want them to receive the annual influenza (flu) vaccine, even though it is not 100% effective.
- 4 If it was free, and convenient, I would prefer to receive the annual influenza (flu) vaccine.
- 5 I would worry about having my child or a child in my care vaccinated.
- 6 Having my child vaccinated would stop them from getting diseases.
- 7 With regard to having my child vaccinated, I want to do what health care professionals at my practice think I should.
- 8 Having my child vaccinated is important to help prevent disease from spreading in the community.
- 9 There is some uncertainty about whether vaccination is truly the best option for preventing disease.

SCALE

- 1 Strongly disagree
- 2 Somewhat disagree
- 3 Somewhat agree

- 4 Strongly agree

Section 10: Demographics

We will end the survey with a few general questions about you.

Q13: What is your gender?

- 1 Male
2 Female

Q14: What is your current age?

Q15: What is your present marital status?

- 1 Single (never married)
2 Widowed
3 Divorced/Separated
4 Married
5 De facto
6 Other (please specify)

Q16: In which country were you born?

- 1 Australia
2 Other (please specify)

Q17: Do you identify yourself as Aboriginal and/or Torres Strait Islander?

- 1 Yes
2 No

Q18a: What is the highest level of education you have completed?

- 1 No schooling
2 Year 8/equivalent or below
3 Year 9/equivalent

- 4 Year 10/equivalent
- 5 Year 11/equivalent
- 6 Year 12/equivalent
- 7 Technical studies, Trade Certificate, etc.
- 8 Tertiary studies, Diploma, Advanced Diploma
- 9 Tertiary studies, Bachelor degree
- 10 Tertiary studies, Graduate Diploma, Diploma
- 11 Tertiary studies, Postgraduate including Masters, PhD

Q18b: If you undertook post-secondary school education, was your field of study most closely related to:

- 1 Natural and physical sciences, mathematics, or technology
- 2 Arts, humanities or social sciences

Q19: What is your current MAIN employment status?

- 1 Employed full-time
- 2 Employed part-time
- 3 Employed casual
- 4 Self-employed (full-time equivalent)
- 5 Self-employed (part-time equivalent)
- 6 Self-employed (casual equivalent)
- 7 Unemployed
- 8 Home duties
- 9 Student
- 10 Retired

11 Pensioner

Q20: What is your approximate personal income level? Not including the income of a spouse, partner or family member (include income from all sources before taxes and any spending).

- 1 Negative/Nil income
- 2 \$1-\$199 weekly (\$1-\$10,399 per year)
- 3 \$200-\$299 weekly (\$10,400-\$15,599 per year)
- 4 \$300-\$399 weekly (\$15,600-\$20,799 per year)
- 5 \$400-\$599 weekly (\$20,800-\$31,199 per year)
- 6 \$600-\$799 weekly (\$31,200-\$41,599 per year)
- 7 \$800-\$999 weekly (\$41,600-\$51,999 per year)
- 8 \$1,000-\$1,249 weekly (\$52,000-\$64,999 per year)
- 9 \$1,250-\$1,499 weekly (\$65,000-\$77,999 per year)
- 10 \$1,500-\$1,999 weekly (\$78,000-\$103,999 per year)
- 11 \$2,000-\$2,499 weekly (\$104,000-\$129,999 per year)
- 12 \$2,500-\$2,999 weekly (\$130,000-\$155,999 per year)
- 13 \$3,000-\$3,499 weekly (\$156,000-\$181,999 per year)
- 14 \$3,500-\$3,999 weekly (\$182,000-\$207,999 per year)
- 15 \$4,000-\$4,999 weekly (\$208,000-\$259,999 per year)
- 16 \$5,000 or more weekly (\$260,000 or more per year)

Q21: What is the total income level of ALL people living in your household? Including any other household member (include income from all sources before taxes and any spending).

- 1 Negative/Nil income

- 2 \$1-\$199 weekly (\$1-\$10,399 per year)
- 3 \$200-\$299 weekly (\$10,400-\$15,599 per year)
- 4 \$300-\$399 weekly (\$15,600-\$20,799 per year)
- 5 \$400-\$599 weekly (\$20,800-\$31,199 per year)
- 6 \$600-\$799 weekly (\$31,200-\$41,599 per year)
- 7 \$800-\$999 weekly (\$41,600-\$51,999 per year)
- 8 \$1,000-\$1,249 weekly (\$52,000-\$64,999 per year)
- 9 \$1,250-\$1,499 weekly (\$65,000-\$77,999 per year)
- 10 \$1,500-\$1,999 weekly (\$78,000-\$103,999 per year)
- 11 \$2,000-\$2,499 weekly (\$104,000-\$129,999 per year)
- 12 \$2,500-\$2,999 weekly (\$130,000-\$155,999 per year)
- 13 \$3,000-\$3,499 weekly (\$156,000-\$181,999 per year)
- 14 \$3,500-\$3,999 weekly (\$182,000-\$207,999 per year)
- 15 \$4,000-\$4,999 weekly (\$208,000-\$259,999 per year)
- 16 \$5,000 or more weekly (\$260,000 or more per year)

This question is about your political orientation. When we use the term "progressive" we are referring to what is sometimes described as "left-wing" views. The term "conservative" is sometimes described as "right-wing" views.

Q22: How would you describe your political orientation?

- 1 On Social Issues
- 2 On Fiscal (economic) Issues

SCALE

- 1 Very progressive
- 2 Progressive

- 3 Moderate
- 4 Conservative
- 5 Very conservative

Q23: Do you currently live in an urban area (major city), a regional town/city or a rural area?

- 1 Urban
- 2 Regional town or city
- 3 Rural

That brings us to the end of the survey. If you would like to add any comments please do so below.

Appendix B: The R-I-CAM-Q

There are a variety of complementary and alternative medicines (CAM) available to treat different health problems and ailments. The following questions ask you about the sorts of treatments you have tried.

Which of the following providers have you personally used the services of? (Circle one relevant number for each category)			
PROVIDERS	NO	YES (Not in last 12 mths)	YES (In last 12 mths)
Naturopath and/or Homeopath	0	1	2
Herbalist	0	1	2
Spiritual healer/traditional medicine or spiritual healer	0	1	2
Body manipulation therapies (e.g. Bowen Therapy/Reiki/ therapeutic massage)	0	1	2
Which of these products have you personally used? (Tick relevant boxes)			
PRODUCTS	No	YES (Not in last 12 mths)	YES (In last 12 mths)
Herbs/herbal medicine	0	1	2
Vitamins/minerals	0	1	2
Homeopathic remedies	0	1	2
What forms of CAM self-help practices have you used? (Tick relevant boxes)			
SELF-HELP PRACTICES	NO	YES (Not in last 12 mths)	YES (In last 12 mths)
Meditation/Relaxation Techniques/Visualization/Yoga or Tai Chi	0	1	2
Detoxification or cleansing diet	0	1	2
Aromatherapy	0	1	2

Appendix C: Photographic and Iconographic Images in Experimental Order

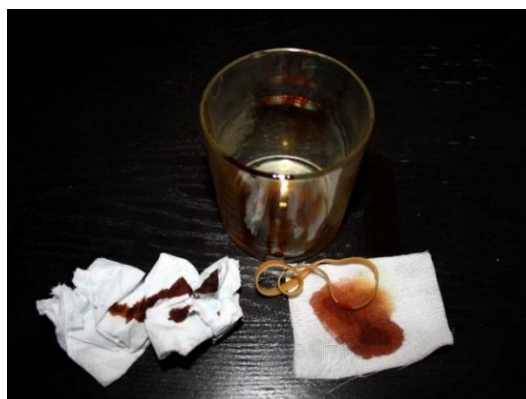
1. Experimental Condition - Priming for Contamination (Biological)



Neutral (N): Coloured Boxes



Neutral (N): Cotton Reels



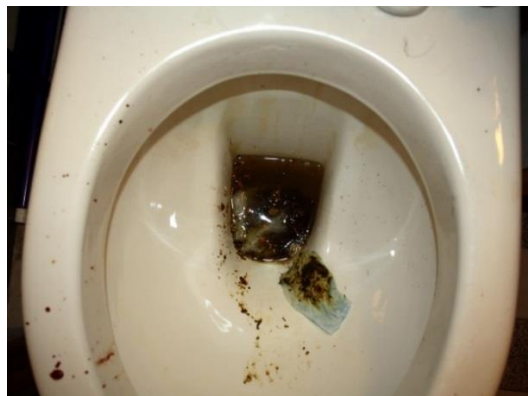
Prime (P): Medical Waste/Blood



Neutral (N): Metal Fence



Prime (P): Cockroach



Prime (P): Dirty Toilet

2. Experimental Condition - Priming for Contamination (Chemical)



Neutral (N): Coloured Boxes



Neutral (N): Cotton Reels



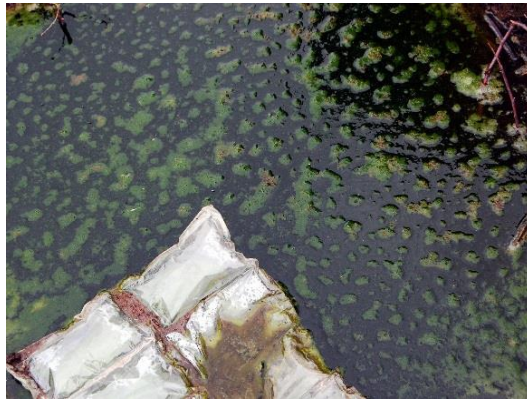
Prime (P): Coal-fired Power Station



Neutral (N): Metal Fence



Prime (P): Two People in Hazmat Suits



Prime (P): Polluted Water

3. Experimental Condition - Priming for Contamination (Physical)



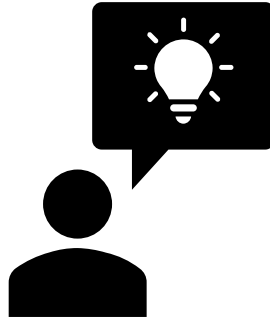
Neutral (N): Cogs in Head



Neutral (N): Hitchhiker



Prime (P): Arm Crushed in Gears



Neutral (N): Lightbulb over a Person



Prime (P): Person being Crushed



Prime (P): Fingers Cut Off

4. Experimental Condition - Priming for Naturalness/Purity



Neutral (N): Coloured Boxes



Neutral (N): Cotton Reels



Prime (P): Oranges



Neutral (N): Metal Fence



Prime (P): Leaf on Snow



Prime (P): Pristine Lake, Forest, and Mountains

5. Control Condition – Exposure to Neutral Images



Neutral (N): Coloured Boxes



Neutral (N): Cotton Reels



Neutral (N): Lined Writing Paper



Neutral (N): Metal Fence



Neutral (N): Stapler, Pens, Phone



Neutral (N): Paperclip

Appendix D: Ratings of Health Interventions

You will now be asked to rate statements for 10 health interventions. Please consider whether you agree or disagree with the statements which look at both:

- A. Effectiveness (how effective is the intervention in curing illness and/or maintaining wellness?); and
- B. Safety (some health interventions have side-effects, can cause illness, or make an existing illness worse – how safe is the intervention?).

1. Antibiotics



Antibiotics are **effective**

Strongly Disagree	Disagree	Disagree a little	Agree a little	Agree	Strongly Agree
----------------------	----------	----------------------	----------------	-------	-------------------

Antibiotics are **safe**

Strongly Disagree	Disagree	Disagree a little	Agree a little	Agree	Strongly Agree
----------------------	----------	----------------------	----------------	-------	-------------------

2. Herbal medicine



Herbal medicine is **effective**

Strongly Disagree	Disagree	Disagree a little	Agree a little	Agree	Strongly Agree
----------------------	----------	----------------------	----------------	-------	-------------------

Herbal medicine is **safe**

Strongly Disagree	Disagree	Disagree a little	Agree a little	Agree	Strongly Agree
----------------------	----------	----------------------	----------------	-------	-------------------

3. Flu Vaccination



Flu vaccination is **effective**

Strongly Disagree	Disagree	Disagree a little	Agree a little	Agree	Strongly Agree
----------------------	----------	----------------------	----------------	-------	-------------------

Flu vaccination is **safe**

Strongly Disagree	Disagree	Disagree a little	Agree a little	Agree	Strongly Agree
----------------------	----------	----------------------	----------------	-------	-------------------

4. Vitamins/Minerals



Vitamin/minerals are **effective**

Strongly Disagree	Disagree	Disagree a little	Agree a little	Agree	Strongly Agree
----------------------	----------	----------------------	----------------	-------	-------------------

Vitamin/minerals are **safe**

Strongly Disagree	Disagree	Disagree a little	Agree a little	Agree	Strongly Agree
----------------------	----------	----------------------	----------------	-------	-------------------

5. Surgery



Surgery is **effective**

Strongly Disagree	Disagree	Disagree a little	Agree a little	Agree	Strongly Agree
----------------------	----------	----------------------	----------------	-------	-------------------

Surgery is **safe**

Strongly	Disagree	Disagree a	Agree a little	Agree	Strongly
----------	----------	------------	----------------	-------	----------

Disagree

little

Agree

6. MeditationMeditation is **effective**Strongly
Disagree

Disagree

Disagree a
little

Agree a little

Agree

Strongly
AgreeMeditation is **safe**Strongly
Disagree

Disagree

Disagree a
little

Agree a little

Agree

Strongly
Agree**7. Tetanus Injection**Tetanus injection is **effective**Strongly
Disagree

Disagree

Disagree a
little

Agree a little

Agree

Strongly
AgreeTetanus injection is **safe**Strongly
Disagree

Disagree

Disagree a
little

Agree a little

Agree

Strongly
Agree**8. Aromatherapy**Aromatherapy is **effective**Strongly
Disagree

Disagree

Disagree a
little

Agree a little

Agree

Strongly
AgreeAromatherapy is **safe**Strongly
Disagree

Disagree

Disagree a
little

Agree a little

Agree

Strongly
Agree

9. Measles/Mumps/Rubella (MMR) Vaccination



Measles/Mumps/Rubella (MMR) is **effective**

Strongly Disagree	Disagree	Disagree a little	Agree a little	Agree	Strongly Agree
----------------------	----------	----------------------	----------------	-------	-------------------

Measles/Mumps/Rubella (MMR) is **safe**

Strongly Disagree	Disagree	Disagree a little	Agree a little	Agree	Strongly Agree
----------------------	----------	----------------------	----------------	-------	-------------------

10. Therapeutic Massage



Therapeutic massage is **effective**

Strongly Disagree	Disagree	Disagree a little	Agree a little	Agree	Strongly Agree
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Therapeutic massage is **safe**

Strongly Disagree	Disagree	Disagree a little	Agree a little	Agree	Strongly Agree
----------------------	----------	----------------------	----------------	-------	-------------------