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# An Aversion to Intervention: How the Protestant Work Ethic Influences Preferences for Natural Healthcare

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## ABSTRACT

The term “natural” is ubiquitous in advertising and branding, but limited research has investigated how consumers respond and relate to naturalness. Some researchers have documented preferences for natural products, specifically food, but there has been scant investigation of the psychological antecedents of such preferences, especially in the critical, multi-trillion dollar domain of healthcare. Using publicly available country-level data from 41 countries and individual-level experimental and survey data from the lab and online panels, we find converging evidence that consumers do indeed differ in their preferences for relatively natural versus artificial healthcare options. These differences are influenced by the extent to which they subscribe to the Protestant Work Ethic (PWE)—a belief system that influences judgments and behaviors across diverse domains—such that people who subscribe strongly (vs. weakly) to the PWE are more likely to prefer natural healthcare options, because they are more averse to external intervention in general. Further, belief in the PWE makes consumers more sensitive to the intrusiveness of an intervention than to its extent. Theoretical and substantive implications are discussed.

*Keywords:* Protestant Work Ethic, natural, naturalness, healthcare, beliefs

*“Though the doctors treated him, let his blood, and gave him medications to drink, he nevertheless recovered.”*

— Leo Tolstoy, *War and Peace*

Science and technology have substantially changed healthcare in the modern world. While herbal remedies are as old as mankind and are still widely applied today, the modern pharmaceutical industry relies more on chemical synthesis, bioengineering, and computer-aided drug design. Similarly, although natural childbirth remains the choice of most prospective parents, the prevalence of Cesarean section deliveries worldwide has tripled from 1990 to 2021 (World Health Organization, 2021).

Empowered by over-the-counter drugs and private healthcare providers, consumers are increasingly making their own healthcare decisions. In making these decisions, they often have to choose between options that are more versus less natural. However, they may not have the expertise to evaluate the scientific qualities of these different options, and it is unclear what determines their decision making in such contexts. These decisions have crucial consequences, but may often be influenced by psychological factors rather than informed judgment. Little research addresses this multi-trillion dollar question. Indeed, extant research on the preference for naturalness has focused almost exclusively on food (Dickson-Spillmann, Siegrist, and Keller 2011; Rozin et al. 2004; Rozin, Fischler, and Shields-Argelès 2012; Scott, Inbar, and Rozin 2016; Román, Sánchez-Siles, and Siegrist 2017, etc.), with only two studies investigating naturalness preference in healthcare decisions. Scott, Rozin, and Small (2020), found that people prefer natural medicines when the goal is to prevent an illness rather than to cure it because natural medicine is often believed to be safer but less potent. Similarly, Li and Gal (forthcoming)

found that people prefer natural medicines when the goal is to treat psychological rather than physical conditions, because they believe natural drugs are less likely to cause harm in a psychological context.

The goals to prevent, cure, or treat different types of conditions are all *situational* antecedents of a therapy decision, which operate on an *instrumental* mechanism (e.g., concerns for safety, potency, or side effects). In contrast, our research uncovers a *dispositional* antecedent operating on an *ideational* mechanism. An ideational mechanism is one where preferences are expressed and choices made because of how they align or not with symbolic values held by the decision maker, rather than any instrumental features of the options at hand. Researchers have long speculated that the preference for naturalness may be driven more by ideational than instrumental concerns (Rozin et al. 2004; Spranca 1992). For example, participants' strong preference for a natural apple versus a commercially grown apple remained unaffected by the information that both apples tasted exactly the same, were equally healthy, and were in fact chemically identical (Rozin et al. 2004). However, no research has yet identified an ideational construct that engenders such preferences. We propose that the strength of belief in the Protestant Work Ethic ("PWE", Weber 1905) is a key driver of such preference.

Originally introduced to explain the historical rise of capitalism, the PWE is now regarded as a largely secular concept that describes the extent to which a person believes in hard work, asceticism, frugality and self-reliance (Cheng, Mukhopadhyay, and Schrift 2017; Furnham 1984). Consumer psychologists have suggested that the PWE might underlie the results they observed (Keinan and Kivetz 2011, Kivetz and Simonson 2002, Kivetz and Keinan 2006, Raghunathan, Naylor, and Hoyer 2006). Drawing on the literatures on naturalness and the PWE, we propose that people who believe strongly in the PWE also tend to emphasize self-reliance,

making them averse to external intervention in general (Furnham 1983; Moen 1978). Since naturalness represents the absence of external intervention (Rozin et al. 2004; Spranca 1992), increasing strength of belief in the PWE should lead to correspondingly greater preference for natural healthcare options. We test these propositions using country-level survey data and individual-level experimental data.

The rest of this article is organized as follows. We first review the literature on naturalness perceptions and preference to explicate the research gap, and then introduce the PWE construct and review the relevant psychological literature. Building on these literatures, we develop our key hypotheses. We then report five studies that test these hypotheses, and conclude with a discussion of contributions, limitations, and implications of this research.

## **THEORETICAL FRAMEWORK**

### **Naturalness Perception and Preference**

While laypeople usually have ready intuitions regarding perceptions of naturalness, the scientific explication of naturalness as a construct is less intuitive. On November 10, 2015, the US FDA sought public comments on whether it was appropriate to define the term “natural”, and if so, how the agency should define it. Just six weeks later, the FDA decided to extend the comment period until May 10, 2016 due to the overwhelming number of responses. Although naturalness has long been popular in branding and promotion, perceptions of and preferences for naturalness have not been systematically researched until recently with a few salient exceptions (Rozin 2005, 2006; Rozin et al. 2004; Rozin et al. 2012). The extant research has mainly focused



on the domain of food and has found that people generally favor food they believe is natural (Dickson-Spillmann, Siegrist, and Keller 2011; Rozin et al. 2004; Rozin, Fischler and, Shields-Argelès 2012; Scott, Inbar, and Rozin 2016; Román, Sánchez-Siles, and Siegrist 2017). As mentioned, this preference is driven more by concerns that are ideational or moral rather than instrumental (Rozin et al. 2004; Spranca 1992).

*Naturalness Perception.* The idea that the “content” or composition of a given entity is less diagnostic than the “process” that goes into its creation is fundamental in determining perceptions of naturalness. Indeed, Spranca (1992) argued that naturalness represents the absence of human intervention, and Rozin et al. (2005) found supportive evidence for interventions ranging from adding tiny amounts of purified minerals to water and removing fat from milk, to commercial rather than organic/free-range farming, and genetic engineering. Moreover, adding a natural substance to an entity and then removing it reduces the perceived naturalness of the entity even though the content of the entity remains the same (Rozin 2006), and the same effect is observed for the reverse process. Furthermore, an entity that is twice-transformed (i.e., adding something, such as minerals to water, and then removing the same thing, or the reverse process of extraction followed by reintroduction) is rated less natural than one that is once-transformed (i.e., only adding or removing), even though the former may be identical to the original entity in terms of constitution, and the latter is not (Rozin 2006). This is because a twice-transformed entity involves greater external (human) intervention.

*Naturalness Preference.* Whereas an overall preference for natural food has been documented (Rozin et al. 2004; Rozin et al. 2012), little research has empirically investigated the

psychological antecedents of naturalness preference, especially in healthcare decisions. Most relevant research, in the domain of food, has focused on demographic correlates instead of psychological antecedents, and most studies have revealed null effects. For example, research has shown that neither gender nor age systematically influence naturalness preference (Rozin et al. 2004; Rozin et al. 2012). Similarly, although one study showed that continental Europeans opposed Genetically Modified Organisms (GMOs) more than Americans did, another study found that the general preference for naturalness did not differ between any two of these countries (Rozin et al. 2012). Notably, more educated people tended to rate naturalness less positively and were less opposed to GMOs (Rozin et al. 2012).

To date, limited research has examined any antecedents of preferences for natural healthcare. Scott et al. (2020) found that consumers are more likely to prefer natural medicines to synthetic counterparts when the situational purpose is to prevent rather than to cure an illness. When the goal is to prevent, people weigh safety more than potency, leading to a preference for natural medicines as they are perceived to be safer but less potent. When the goal is to cure, however, people care more about potency than safety, leading to a preference for synthetic medicines as they are perceived as being relatively more potent despite being less safe. Li and Gal (forthcoming) found that patients prefer natural medicines to synthetic counterparts when the situational goal is to treat a psychological condition instead of a physical condition, due to concerns about the possible deleterious effects of synthetic drugs on one's psychological constitution (i.e., "true self"). As opposed to such situational antecedents operating via instrumental mechanisms, the current research studies dispositional antecedents operating on an ideational mechanism. Rozin et al. (2004) speculated that the preference for naturalness could be driven by ideational concerns (i.e., what an object is or ought to be) in addition to instrumental

concerns such as efficacy or safety implications to oneself. However, they did not identify any specific ideational construct as a possible antecedent of this preference. Hence, the underlying driver remains unclear.

Conceptually, ideational concerns often stem from belief systems (Furnham 1990a; Sartori 1969). Therefore, we posit that dispositional variables related to a person's ideology or core beliefs should influence their preference for naturalness. Because naturalness represents the absence of external human intervention (Rozin et al. 2004; Spranca 1992) and external human intervention reduces the perceived naturalness of an entity (Rozin 2005, 2006), the more someone dislikes external human intervention, the stronger should be their preference for naturalness. In this research, we propose that belief in the Protestant Work Ethic is associated with a greater general aversion to external intervention, and hence those who believe more strongly in the PWE should have a correspondingly stronger preference for naturalness.

### The Protestant Work Ethic

The Protestant Work Ethic is a rich construct that was originally introduced to explain the historical rise of capitalism (Weber 1905). According to Weber, Protestants had a strong work ethic which facilitated the accumulation of wealth, thereby explaining, at least in part, why capitalism first emerged in Western Europe and North America rather than Mediterranean Europe. The question of whether religion indeed shaped economic history remains hotly debated, but “few have denied the validity and accuracy of Weber's specifications of behavior patterns, goals and values dictated by the PWE” (Furnham 1984). These include hard work, asceticism, frugality, and self-reliance.

In its modern conceptualization, the PWE is agnostic. Rather, it is a self-reinforcing system of mutually supportive beliefs. For example, in order to work hard, one needs to resist worldly temptation, which is the idea of asceticism. One also needs to be frugal and not waste money because otherwise, no matter how hard one works, the money earned by working will disappear. If a person works hard and is frugal, they will accumulate money and resources, thereby becoming self-sufficient and self-reliant. In order to maintain this self-reliance, they need to keep working hard and being frugal. The PWE encapsulates this system of beliefs that support and reinforce each other. This conceptualization is supported by much research during the past century (Blood 1969; Cherrington 1980; Furnham 1984, 1990a, 1990b; Jones 1997; Miller, Woehr, and Hudspeth 2002; Ray 1982; Tang 1993; Weber 1905; Wollack et al. 1971, etc.)

Psychologists have developed psychometric scales to measure the PWE (e.g., Mirels and Garrett 1971). Its conceptual multi-dimensionality notwithstanding, most empirical research has treated it as a unidimensional construct with scale items loading onto a single factor, and tested its influence on many behaviors that are related to work. For instance, people with stronger belief in PWE spend more time at tedious work (Merrens and Garrett 1975) and are more motivated if a task is labeled as “work” (Tang and Baumeister 1984). Such people are also more likely to work while commuting (Greenberg 1978). However, empirical investigations of the effect of PWE on behaviors *unrelated* to work are scarce – we know of only two. Quinn and Crocker (1999) found that women with higher PWE felt more frustrated if they were obese because they were more likely to assume personal responsibility than were low-PWE women. Cheng et al. (2017) found that people with higher PWE were more likely to choose costlier options (e.g., bitter cough syrup, expensive service provider) in pursuit of superior outcomes, even when higher costs did not objectively guarantee better outcomes. The underlying logic governing both

these demonstrations is that because work constitutes an important part of modern people's identities, a work-related core belief such as the PWE can over-generalize and influence other inferences, judgments, and decisions. Following this logic, we propose that strength of belief in the PWE may play a role in determining the preference for natural healthcare because naturalness represents the absence of external intervention, and belief in the PWE may imply an aversion to external intervention. This proposed association between PWE and a general aversion to external intervention is novel to the PWE literature.

### The Role of the PWE in Naturalness Preference

Why might belief in the PWE lead to an aversion to external intervention? We suggest this may be caused by the fact that people who believe in the PWE tend to value self-reliance (Furnham 1990a; Miller et al. 2002; Weber 1905). According to the original conceptualization of the origin of the PWE, a diagnostic difference between Protestants and Catholics is in how they pursue salvation. Whereas Catholics rely more on an external authority's interpretation of God's messages and mercy, Protestants stress that one should rely on one's own efforts to achieve success and wealth (Weber 1905; Furnham 1990a). This philosophy of self-reliance emphasizes, for example, that one should not rely on someone else's investment in one's business, but instead use the money earned by oneself (Miller et al. 2002). Similarly, people high in PWE tend to oppose taxation that is externally imposed on them (Furnham 1983). Supporting this conceptualization, several researchers using diverse methodologies have established the integral role of self-reliance as a component of the PWE. For example, Furnham (1990b) and Miller et al. (2002) used factor analyses to reveal that self-reliance is an important component of the PWE.

Similarly, Moen's (1978) depth interviews found that elderly Americans, socialized by the PWE, tended to refuse assistance and social welfare, even when they were old, sick, disabled, and poor.

Because the PWE is a core belief, people who hold it strongly tend to protect it and align other cognitions and judgments to be consistent, even in contexts that may be indirectly related (Cheng et al. 2017; Lerner and Miller 1978). This tendency is common to core beliefs. For example, Briley, Morris and Simonson (2000) found that Western participants who believed in the Judeo-Christian tradition that valorizes extreme trade-offs (as exemplified by the story of Abraham's sacrifice of his son Isaac) were less likely to exhibit the compromise effect than were Asian participants from the Buddhist-Confucian tradition of keeping to the mean. As another example, Plaks et al. (2005) found that people who hold an entity (vs. incremental) theory of human traits tend to resist theory-inconsistent information and/or actively scrutinize it. In the domain of the PWE, Cheng et al. (2017) found that those who believe strongly in the PWE value the maxim "hard work pays off", and overgeneralize their belief to work-unrelated contexts thereby preferring bitter cough syrup and expensive couriers because they infer these are more likely to deliver better outcomes. Seeing the world through the lens of core beliefs across different contexts and acting accordingly helps to reinforce them and provide stability to a person's belief system and sense of control.

By this logic, people who subscribe to the PWE may not just be averse to interventions that are external to their specific situations (e.g., "I should be self-reliant"; "I should not be taxed"), but may be averse to external interventions in general. In the current context of healthcare, the absence of external human intervention is equivalent to the concept of naturalness (Rozin et al. 2004; Spranca 1992). Putting these together, strength of belief in the PWE should be correlated with the value one places on naturalness. Consequently, we predict that consumers

with higher PWE should prefer relatively natural healthcare options to those involving interventions, and medications made naturally to those synthesized industrially. Further, if the underlying mechanism is indeed driven by an ideational aversion instead of instrumental concerns, the association of PWE with naturalness preference should hold over and above the expected efficacy or safety of the healthcare options (i.e., instrumental concerns).

It is important to note that this proposed process represents a “symbolic value-alignment” effect. That is, people who believe in the PWE appreciate and prefer things that *conceptually symbolize* self-reliance and absence of external interventions, because these are consistent with their values. These external interventions may pertain to a medicine qua its constituent ingredients or its manufacturing processes, or to a procedure on a patient’s body. Regardless, people who believe strongly in the PWE respond to it based on the extent to which it is symbolically aligned with their core values and beliefs. Such symbolic value alignment is a common psychological process, evident in many other documented effects. For example, a person’s chronic disgust sensitivity is positively correlated with the dislike of Genetically Modified Food (Scott, Inbar, and Rozin, 2016), even though GM foods are not necessarily dirty or disgusting. In this case, GMFs are symbolically misaligned with the purity values held by these people. Similarly, religiosity was found to predict opposition to genetic engineering (Hossain and Onyango, 2004), not because this technology poses any direct threat to religious institutions or their believers, but because what it symbolizes is misaligned with the values held by religious believers.

#### The Extent and Intrusiveness of External Interventions

To understand what aspect of external interventions induce the proposed aversive reactions among those who believe in the PWE, it is necessary to probe these perceptions further. Prior literature has mainly conceptualized and operationalized external human intervention as “human contact” or “human processing” (Rozin 2005; Spranca 1992). However, these usages confound the extent of interaction involved in the intervention with its intrusiveness. We therefore aim to disentangle the perceived intrusiveness of an external intervention from its extent. Although not formally conceptualized, this important distinction was first contemplated by Rozin (2005) who found that genetically engineered plants and animals were rated much more unnatural than domesticated counterparts. Based on these results, Rozin (2006) then elaborated on the possible underlying factors (emphases added):

*“The gene replacement, a process that involves “direct” manipulation of the genome but minimal substantial change, has a much more destructive effect on naturalness than **extensive** selective breeding, which produces a much larger change in both appearance and the genome” ---- Rozin (2006, p92)*

*"Genetically modified organisms ..., almost identical in content to the wild type, are rated less natural than highly domesticated species that are physically very different from their wild progenitors (Rozin, 2005). The prior studies suggest that it is not just “process” but **type of process** that is critical. Domestication involves **a great deal** of human intervention, with selective breeding, but does not involve the **intrusive** process of poking directly into the genome. This seems to be a potent denaturalizing agent, way out of line with its effects in terms of changing the physical appearance, structure, or*



*composition ... of the modified organism.” ---- Rozin (2006, p96)*

Drawing on Rozin’s pioneering insights, we conceptualize the extent and intrusiveness of interventions as formative constructs (Jarvis, Mackenzie and Podsakoff 2003), as follows. A highly extensive intervention usually involves a great amount of human agency and can produce a great amount of change in the physical appearance, structure, or composition of the organism. In contrast, a highly intrusive intervention is usually very direct and aggressive and may alter the organism at a deeper or even fundamental level. Importantly, these two dimensions may often be positively correlated, but are conceptually orthogonal. For example, some interventions are extensive but not intrusive. They are perceived to be gentle, gradual, and facilitative, even though they may involve a lot of human contact. Other interventions may be intrusive but not extensive. They may invade an organism and appear to change its essential component, even though the process itself may be quick and sparse in human contact. Since intrusiveness violates a person’s self-reliance more strongly than the extent of an intervention (for a test of this proposition, please see web appendix A), we propose that a stronger belief in the PWE should be associated with decreased purchase intention of healthcare options involving external interventions that are perceived to be of greater intrusiveness. In contrast, the extent of perceived external intervention should have less of a bearing. Formally:

**H1:** Increasing strength of belief in the Protestant Work Ethic is associated with increasing intention to choose or purchase relatively more natural healthcare options.

- H2:** The greater intention to choose or purchase more natural healthcare options among those who believe strongly (vs. weakly) in the Protestant Work Ethic is driven by a stronger general aversion to external intervention.
- H3a:** A stronger belief in the PWE is more likely to be associated with a decreased purchase intention of healthcare options that represent a higher intrusiveness of external intervention.
- H3b:** A stronger belief in the PWE is no more likely to be associated with a decreased purchase intention of healthcare options that only represent a higher extent of external intervention.

## Overview of Studies

We tested the above hypotheses in five studies using different types of data, different healthcare contexts, and with PWE measured and manipulated. Study 1a used secondary data to test whether countries with higher average belief in the PWE have lower aggregate prevalence of C-section deliveries. Study 1b replicated the observed effect in the same context of childbirth decisions but at the individual level. Studies 2-4 then tested the underlying mechanism involving aversion to external intervention. Study 2 measured aversion to external intervention and demonstrated its mediational effect. Study 3 showed that the underlying mechanism centered on ideational concerns instead of instrumental concerns. Study 4 manipulated the level of external intervention and demonstrated its moderating effect. It also manipulated PWE to establish its causal impact. Finally, study 5 shed light on which aspect of the external intervention (i.e., extent or intrusiveness) is implicated in the effect.

## STUDY 1A: COUNTRY LEVEL PWE AND C-SECTION PREVALENCE

Study 1a tested the basic hypothesis at an aggregate level, investigating whether countries with stronger PWE have lower prevalence of Cesarean-section deliveries. In 2011, C-sections became the most common major operating room procedure performed in the USA (Pfuntner, Wier, and Stocks 2013). Other parts of the world also witness high and increasing C-section prevalence. This trend is worrying because among normal low-risk pregnancies, C-sections are actually associated with higher risk than vaginal deliveries (Lilford et al. 1990). Moreover, the global overuse of C-sections is estimated to have cost US\$ 2.32 billion in 2008 (Gibbons et al. 2010). Therefore, it is important to investigate what factors influence the usage of C-sections. In study 1a, we tested whether PWE plays a role in this important decision.

### Method

We used thirteen questions ( $\alpha = .88$ ) from the *World Values Survey* wave 5: 2005-2009 (Inglehart et al. 2014) to measure PWE (Cheng et al. 2017; Giorgi and Marsh 1990; Norris and Inglehart 2004). The PWE data for France, the Netherlands, and Great Britain were missing from the *World Values Survey* and were therefore obtained from its sister survey the *European Values Study* (wave 4: 2008-2010). Sample questions include: V6. *Important in life: Leisure time*. V8. *Important in life: Work (1 = Very important...4 = Not at all important)*. V51. *It is humiliating to receive money without working for it*. V54. *Work should always come first, even if it means less free time (1 = Strongly agree, 5 = Strongly disagree)*. Web appendix B contains the full list of the questions used. We averaged responses by survey takers from each country to generate

country-level responses to each question, and then standardized and averaged these across the thirteen questions to create an aggregate PWE score for each country. Data on country-level C-section prevalence (2005-2009) were obtained from UNICEF *The State of the World's Children (SOWC) Reports 2011*. Missing data for Sweden, Slovenia, and Cyprus were obtained from the World Health Organization *European Health for All Database*, averaged across 2005 to 2009, and for Japan and Argentina from the WHO World Health Report (Gibbons et al. 2010). Because C-sections are generally more expensive than natural deliveries and require additional medical facilities, the prevalence of C-section deliveries in a country may be affected by its wealth and access to medical facilities. Therefore, we obtained GDP per capita from the World Bank database and hospital bed density from the CIA World Factbook to use as covariates. Because PWE was originally conceived based on Weber's analysis of religions, and previous research has suggested that PWE may be correlated with education level (Giorgi and Marsh 1990), we also measured education level, religiosity, and religious affiliation as covariates, using questions V238, V187, and V185 from the *World Values Survey* (see web appendix B). Finally, the preference between the two childbirth methods could be influenced by family pressure and women's rights in a country, as women's personal preferences may run counter to tradition. To further control for these alternative explanations, women's rights were measured using the four questions V60-V63 ( $\alpha = .82$ ). Family influence was measured using question V89. We reverse-coded V187 and V89, then separately averaged responses to each question across respondents from each country, and standardized these country-level responses for subsequent analyses.

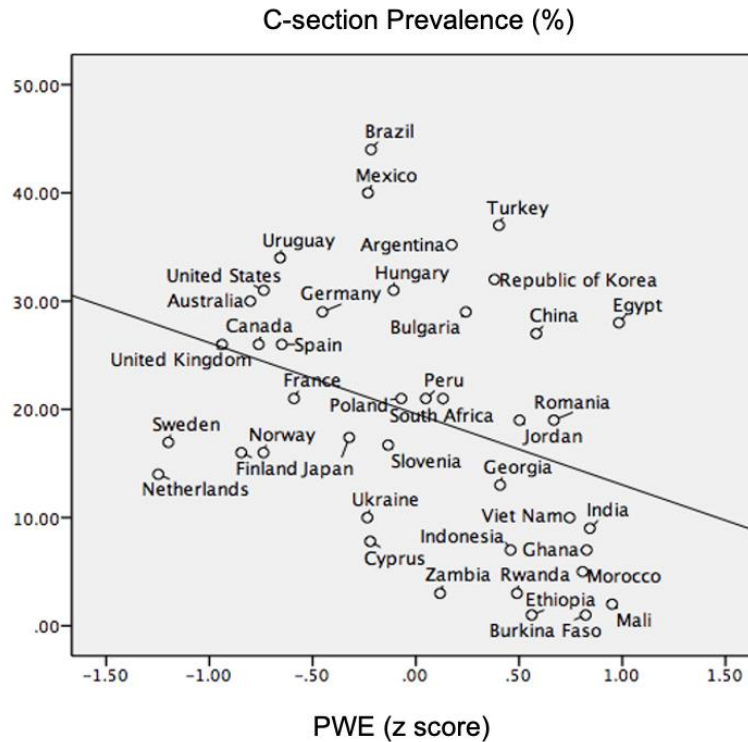
## Results

We matched the PWE data with C-section data by country, resulting in 41 countries with no missing data on both sides. As predicted, countries with higher PWE have significantly lower C-section prevalence ( $r(39) = -.36, p = .020$ ; see figure 1). Partial correlation analysis showed that the effect of PWE held robustly when GDP per capita, hospital bed density, educational level, religiosity, women's rights ( $\alpha = .82$ ), and family influence were all statistically controlled for ( $r(33) = -.40, p = .018$ ), suggesting that this finding cannot be alternatively explained by the differences in these factors across countries. Furthermore, multiple regression analysis showed that PWE was not only a significant predictor of C-section prevalence ( $\beta = -.82, t(33) = -2.49, p = .018$ ) but also a better predictor than GDP per capita ( $\beta = -.37, t(33) = -1.31, p = .201$ ), hospital bed density ( $\beta = .20, t(33) = .91, p = .372$ ), education level ( $\beta = -.09, t(33) = -.40, p = .694$ ), religiosity ( $\beta = -.36, t(33) = -1.54, p = .134$ ), women's rights ( $\beta = -.14, t(33) = -.59, p = .563$ ), and family influence ( $\beta = .37, t(33) = 1.20, p = .241$ ).

As discussed earlier, the modern conceptualization of the PWE is detached from its religious origin. However, one may still wonder if any specific religious affiliations might account for the observed relationship. To test this, we converted question V185 into country-level percentage of participants who belong to a specific religious denomination. Among these major religions, only the prevalence of Roman Catholicism in a country was correlated with its C-section prevalence ( $r(39) = .35, p = .027$ ). When C-section prevalence was regressed on both predictors, they both appeared to have parallel effects ( $\beta_{\text{PWE}} = -.30, t(38) = -2.02, p = .051$ ;  $\beta_{\text{RomanCatholicism}} = .28, t(38) = 1.89, p = .067$ ).

## FIGURE 1

COUNTRY-LEVEL CESAREAN-SECTION PREVALENCE AS A FUNCTION OF PWE



## Discussion

These results provide initial support for our hypothesis that higher PWE is associated with stronger preference for natural healthcare options, as evidenced by lower C-section prevalence. This study also provides ecological validity for the issue of interest, namely the real-world use of natural versus artificial healthcare options and its psychological antecedents. Some may wonder why traditionally Protestant countries (e.g., the UK) have lower PWE than non-Protestant countries (e.g., India). There are several possible reasons for this. First, as mentioned, the contemporary conceptualization of PWE is largely secular, and several religions and cultures advocate for similar work ethics (see Niles 1999 for a comprehensive discussion). Secondly, Cheng et al. (2017) suggested that belief in the PWE might strengthen during the industrialization process when an economy grows rapidly but its social welfare system is

underdeveloped. People in such developing countries have to work hard and rely on themselves—conditions that foster beliefs consistent with the PWE. Notably, several Western Protestant countries used to be developing countries that had industrialized rapidly at the time when Weber (1905) proposed his thesis. Nowadays, these countries are highly developed with societies that focus on quality of life as much as on economic growth. Consistent with Inglehart's (1997) analysis, this change in socio-economic conditions can reverse the rise of the PWE.

Due to the correlational nature of this study, there might be alternative explanations to this finding such as unobservable country differences that incidentally correlated with both the PWE and C-section prevalence. Our data argue against seven such possibilities, namely, wealth, educational level, religiosity, religious affiliation, access to medical facilities, women's rights, and family influence. We now turn to studies that test our hypotheses at the individual level. Because participants in each of the remaining studies came from a single country (a different country in study 4 than in the other studies), unobservable country differences should not be responsible for any observed effect of PWE.

### **STUDY 1B: NEW MOTHERS' PWE AND CHILDBIRTH DECISIONS**

Study 1b had two objectives. First, it was designed to test the country-level findings of study 1a with individual-level decisions, thereby addressing the issue of unobservable country differences as confounds. Second, study 1a could not distinguish between elective C-sections and medically necessary C-sections. Decisions to perform medically necessary C-sections are often made by doctors and should be less influenced by mothers' beliefs. Study 1b thus restricts the investigation to C-sections and natural deliveries that were both willingly made. We expect to

find that mothers who willingly chose natural deliveries over C-sections hold significantly stronger belief in the PWE.

## Method

We commissioned a panel data company named Pureprofile to recruit 80 American mothers who willingly chose natural deliveries and another 80 American mothers who willingly chose C-sections to give birth, to their most recent (or only) child, in the past three years. We restricted the time limit to three years and the sample to women under 40 years old to increase sample homogeneity. Older women may have had more limited access to C-sections, and if we did not restrict the age, the C-section mothers in our sample might on average be younger than those who had natural deliveries. We were careful to exclude mothers who could not freely choose the childbirth method, namely those (1) for whom C-sections were deemed medically necessary due to pre-existing health conditions of either the mother or the fetus, (2) who had had C-sections before and believed they needed to have C-sections again, and (3) who had to perform an unexpected emergency C-section when going into labor, as well as natural delivery mothers who had originally planned to have C-sections but the labor came too fast and took place outside of a hospital. Eligible mothers first confirmed their most recent childbirth method (0 = vaginal delivery, 1 = Cesarean section) and then completed a 19-item PWE scale (Mirels and Garrett 1971). They reported in which country they had given birth to their youngest child, their current country of residency, how many children they had before their most recent childbirth, and whether they had used Cesarean sections to previously deliver their older child/children (*1 = No/ I have only one child; 2 = Yes. I had used Cesarean section before. As a result, I could not use*



vaginal delivery for my youngest child; 3 = Yes. I had used Cesarean section before. However, my doctor/midwife told me I could still use vaginal delivery for my youngest child.<sup>1</sup>) Finally, they reported pre-pandemic household income, religion (1 = Catholic, 2 = Protestant, 3 = Orthodox, 4 = Jewish, 5 = Islamic, 6 = Hindu, 7 = Buddhist, 8 = Irreligion & Atheism, 9 = Other), and education level (1 = No formal education, 2 = Incomplete primary school ... 10 = Post-graduate level education, without degree, 11 = Post-graduate level education, with degree). Web appendix C contains the full list of the questions used.

## Results

The 19 PWE items were averaged after reverse-coding wherever appropriate ( $\alpha = .77$ ). Consistent with our hypothesis, an independent samples t-test found that mothers who chose natural delivery believed more strongly in the PWE than mothers who chose C-sections ( $M_{\text{natural delivery}} = 4.50$ ,  $SD = .66$ ,  $M_{\text{C-section}} = 4.18$ ,  $SD = .76$ ,  $t(158) = 2.85$ ,  $p = .005$ , Cohen's  $d = .45$ ). Checking whether these mothers differed in other aspects, we found they were of similar age ( $M_{\text{natural delivery}} = 33.94$ ,  $M_{\text{C-section}} = 33.56$ ,  $t(158) = .53$ ,  $p = .596$ ) and educational level ( $M_{\text{natural delivery}} = 7.99$ ,  $M_{\text{C-section}} = 7.70$ ,  $t(158) = .68$ ,  $p = .501$ ) but the former were marginally wealthier ( $M_{\text{natural delivery}} = 28.84$ ,  $M_{\text{C-section}} = 24.29$ ,  $t(158) = 1.80$ ,  $p = .074$ ). They had similar number of children before their most recent childbirth ( $M_{\text{natural delivery}} = .96$ ,  $M_{\text{C-section}} = 1.05$ ,  $t(157) = .61$ ,  $p = .543$ ). Mothers who had used a C-section before were more likely to use a C-section again than

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<sup>1</sup> Because mothers who had had C-sections before and thus believed they needed to have C-sections again were excluded, none of the 160 eligible participants selected answer 2 for this question. Responses to this question were then recoded as a dummy variable called C-section history (0 = No, 1 = Yes) and used as a covariate in the binary logistic regression analysis.

first-time mothers (82.5% vs. 32.0%,  $\chi^2(1) = 37.31, p < .001$ ). Notably, the fact that mothers who used C-sections were marginally less wealthy suggests that the observed effect was unlikely to have been caused by C-sections being chosen by mothers who were richer, better employed or more likely to have private health insurance.

We used binary logistic regression to regress childbirth method (0 = vaginal delivery, 1 = Cesarean section) on PWE, age, income, educational level, number of older children, C-section history (0 = No, 1 = Yes), and eight dummy variables each representing one religion other than the category “Other” which served as the comparison baseline. Results showed that stronger belief in the PWE was associated with reduced likelihood of choosing C-sections ( $B = -.84, SE = .34, Wald(1) = 6.08, p = .014$ ), even after controlling for age ( $B = -.06, SE = .05, Wald(1) = 1.56, p = .212$ ), income ( $B = -.01, SE = .02, Wald(1) = .50, p = .481$ ), education level ( $B = .04, SE = .09, Wald(1) = .15, p = .701$ ), number of older children ( $B = -.12, SE = .23, Wald(1) = .27, p = .606$ ), C-section history ( $B = 2.88, SE = .54, Wald(1) = 28.24, p < .001$ ), and each religion dummy ( $Wald(1)'s < .77, p's > .379$ ).

## Discussion

Studies 1a and 1b provided real-world evidence that stronger belief in the PWE is associated with increased likelihood of choosing natural childbirth over C-sections. The effect manifested with country-level C-section prevalence data from UNICEF (study 1a) and individual mothers' recent childbirth decisions (study 1b). We also ruled out potential confounds including age, wealth, educational level, religiosity, religious affiliation, access to medical facilities, childbirth history, and C-section history. In the next few studies, we aim to manipulate the

naturalness of healthcare options more directly and inspect the underlying mechanism.

## **STUDY 2: THE MEDIATING EFFECT OF GENERAL AVERSION TO EXTERNAL INTERVENTION**

Studies 1a and 1b provided support for the basic effect, in the domain of childbirth, using cross-national as well as individual-level data. Study 2 aimed at answering two more questions. Firstly, to check whether this effect generalizes to other healthcare related decisions, we presented participants with either a natural or a synthetic medicine, between-subjects. Secondly, why do people higher in PWE prefer naturalness to a greater extent? As discussed earlier, we predict this is due to their general aversion to external intervention. To test this mechanism, we measured aversion to external intervention and tested whether it mediates the effect of PWE on the preference for natural healthcare. Finally, we aimed at ruling out self-construal, disgust, and contamination as alternative explanations. Similar to the PWE, self-construal is a dispositional variable that tends to vary across cultures. Disgust has been shown to influence responses to genetically modified food, although its role in healthcare products is less clear (Scott et al. 2016).

### **Method**

American participants on Prolific ( $N = 400$ , 43.8% female,  $M_{\text{age}} = 35.42$ ) participated in a 2 (Naturalness: natural vs. synthetic)  $\times$  PWE experiment in which naturalness was manipulated between-subjects and PWE was measured. All participants were asked to imagine that they had got stomach flu and were experiencing symptoms including diarrhea and abdominal pain. There

were available over-the-counter medicines to treat stomach flu. Some of these medicines were synthetic (i.e., made with chemicals in the lab) and others were natural (i.e., made with extracts from plants). They were of the same price. Participants in the natural (vs. synthetic) condition read that they happened to walk by a pharmacy and saw the natural (vs. synthetic) medicine, and indicated how likely they were to purchase this medicine and whether they preferred to buy this medicine or look for the other type of medicine. These two questions ( $r(398) = .74, p < .001$ ) were averaged to form an index of purchase intention. Because we propose that PWE has an ideational impact above and beyond instrumental concerns, we measured the perceived efficacy of the medicine (1 = very ineffective, 7 = very effective). Next, as manipulation checks, participants rated how natural, disgusting, and contaminated they perceived the medicine to be, as well as how much external human intervention was involved in producing it, all on 7-point scales. Participants continued to a 4-item scale measuring general aversion to external intervention (“*Any external intervention to an organism is not good, even if it does not change the nature of the organism*”, “*Any external intervention to an organism is not good, even if it enhances the organism in certain ways*”, “*Any external intervention to a natural process is not good, even if it enhances the process*”, “*Any external intervention to a natural process is not good, even if it produces a better outcome*” 1 = strongly disagree, 7 = strongly agree), the same PWE scale used in study 1b, and an adapted self-construal scale (Singelis 1994). Three items from the original self-construal scale with references to students were not included as they were not relevant to the current sample demographics. Finally, all participants reported gender, age, income, and whether they had had stomach flu before (17.8% “Never”, 74% “I had it but it was long ago”, 8.3% “I had it recently”). Please see web appendix D for the stimuli.

## Results

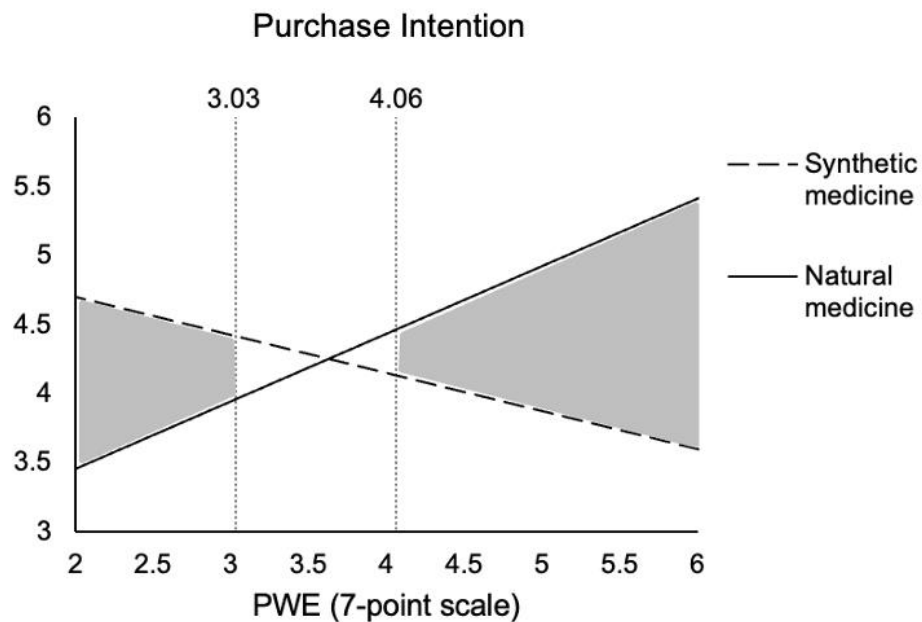
*Manipulation Check.* The PWE scale again showed good internal consistency ( $\alpha = .88$ ), and hence was averaged and standardized for analysis. Participants indeed perceived the natural medicine to be more natural than the synthetic one ( $M_{\text{natural}} = 5.48$ ,  $SD = 1.30$ ,  $N = 203$ ,  $M_{\text{synthetic}} = 2.54$ ,  $SD = 1.41$ ,  $N = 197$ ,  $t(398) = 21.72$ ,  $p < .001$ , Cohen's  $d = 2.17$ ), and this effect was not moderated by PWE ( $B = .06$ ,  $SE = .07$ ,  $t = .86$ ,  $p = .389$ ). They also perceived the production of natural (vs. synthetic) medicine as involving lower external human intervention ( $M_{\text{natural}} = 4.41$ ,  $SD = 1.43$ ,  $M_{\text{synthetic}} = 5.88$ ,  $SD = 1.27$ ,  $t(398) = 10.85$ ,  $p < .001$ , Cohen's  $d = 1.09$ ). Naturalness manipulation did not influence PWE ( $M_{\text{natural}} = 3.93$ ,  $M_{\text{synthetic}} = 3.96$ ,  $t(398) = .22$ ,  $p = .827$ ). The natural and synthetic medicines were rated as equally (non)disgusting ( $M_{\text{natural}} = 2.48$ ,  $M_{\text{synthetic}} = 2.70$ ,  $t(398) = 1.45$ ,  $p = .149$ ) and (un)contaminated ( $M_{\text{natural}} = 2.24$ ,  $M_{\text{synthetic}} = 2.30$ ,  $t(398) = .47$ ,  $p = .639$ ), and both were lower than the mid-point of the scale (disgust,  $t(399) = -18.71$ ,  $p < .001$ ; contaminated  $t(399) = -25.66$ ,  $p < .001$ ).

*Main Analyses.* We regressed purchase intention on naturalness ( $-1 = \text{synthetic}$ ,  $1 = \text{natural}$ ), standardized PWE, and their interaction using PROCESS Model 1. There was no main effect of either naturalness ( $B = .12$ ,  $SE = .08$ ,  $t = 1.44$ ,  $p = .151$ ) or PWE ( $B = .10$ ,  $SE = .08$ ,  $t = 1.22$ ,  $p = .223$ ), but a significant interaction ( $B = .37$ ,  $SE = .08$ ,  $t = 4.36$ ,  $p < .0001$ , 95% CI [.20, .53]). Slopes analyses revealed, as hypothesized, that stronger belief in the PWE was associated with greater intention to purchase the natural medicine ( $B = .47$ ,  $SE = .12$ ,  $t = 3.92$ ,  $p = .0001$ , 95% CI [.23, .70]), and reduced intention to purchase the synthetic medicine ( $B = -.26$ ,  $SE = .12$ ,  $t = -2.24$ ,  $p = .026$ , 95% CI [-.49, -.03]). We also inspected the interaction from another angle by

performing floodlight analysis. Participants were significantly more likely to purchase the medicine if it was natural versus synthetic when their belief in the PWE was above 4.06 on the 7-point scale. The effect reversed for people whose belief score was below 3.03; they stated a significantly greater intention to purchase the synthetic medicine (figure 2). The interactive effect of PWE and naturalness ( $B = .20$ ,  $SE = .06$ ,  $t = 3.09$ ,  $p = .002$ ) and the simple effects of PWE for natural ( $B = .24$ ,  $SE = .09$ ,  $t = 2.59$ ,  $p = .010$ ) and synthetic medicine ( $B = -.16$ ,  $SE = .09$ ,  $t = -1.79$ ,  $p = .074$ ) held even after statistically controlling for perceived efficacy. This suggests that the impact of PWE extends beyond instrumental concerns and is possibly ideational.

**FIGURE 2**

PURCHASE INTENTION OF THE MEDICINE AS A FUNCTION OF ITS NATURALNESS  
AND BELIEF IN THE PWE



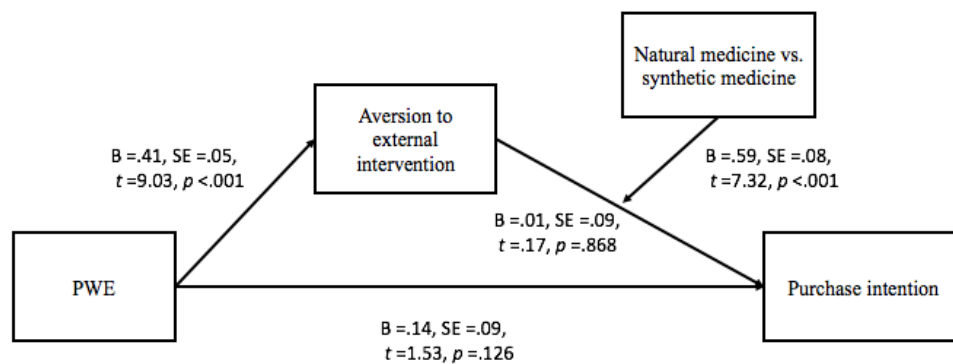
*Alternative Explanations.* The items measuring interdependent self-construal were reverse-coded and averaged with the independent self-construal items, forming an index of self-construal with higher scores indicating relatively higher independent and lower interdependent self-construal. The interaction between PWE and naturalness on purchase intention ( $B = .32$ ,  $SE = .08$ ,  $t = 3.89$ ,  $p = .0001$ , 95% CI [.16, .48]) and the simple effects of PWE for natural ( $B = .46$ ,  $SE = .12$ ,  $t = 3.93$ ,  $p = .0001$ , 95% CI [.23, .70]) and synthetic medicines ( $B = -.17$ ,  $SE = .12$ ,  $t = -1.49$ ,  $p = .136$ , 95% CI [-.40, .06]) generally held after statistically controlling for self-construal ( $B = .01$ ,  $SE = .15$ ,  $t = .10$ ,  $p = .921$ ), perceived disgust ( $B = -.22$ ,  $SE = .06$ ,  $t = -3.50$ ,  $p = .0005$ ), perceived contamination ( $B = -.13$ ,  $SE = .07$ ,  $t = -1.74$ ,  $p = .083$ ), gender ( $B = -.02$ ,  $SE = .17$ ,  $t = -.14$ ,  $p = .887$ ), age ( $B = .01$ ,  $SE = .01$ ,  $t = 1.29$ ,  $p = .197$ ), and income ( $B = .004$ ,  $SE = .01$ ,  $t = .79$ ,  $p = .429$ ). Further, replacing PWE with self-construal did not generate a naturalness  $\times$  self-construal interaction on purchase intention ( $B = .12$ ,  $SE = .09$ ,  $t = 1.40$ ,  $p = .163$ ).

*Moderated Mediation.* The four items measuring general aversion to external intervention loaded onto a single factor explaining 89.93% of the total variance, and were averaged to represent this construct ( $\alpha = .96$ ). Participants with a stronger belief in the PWE were more averse to external intervention ( $B = .63$ ,  $SE = .07$ ,  $t = 9.01$ ,  $p < .0001$ ) regardless of which medicine they evaluated ( $B = -.11$ ,  $SE = .07$ ,  $t = -1.55$ ,  $p = .123$ ). To test whether aversion to external intervention did indeed mediate the observed effect, we conducted PROCESS (Hayes 2022) Model 14 with purchase intention (Y) as the dependent variable, and PWE (X), aversion to external intervention (M), and naturalness (W) as predictors. As expected, there was a significant moderated mediation (Index = .49,  $SE = .10$ , 95% CI [.31, .69]; see figure 3). Specifically, the indirect effect of PWE on purchase intention via aversion to external intervention was

significantly positive for natural medicine ( $B = .25$ ,  $SE = .06$ , 95% CI [.14, .38]) and significantly negative for synthetic medicine ( $B = -.24$ ,  $SE = .06$ , 95% CI [-.37, -.12]). The same moderated mediation effect held (Index = .37,  $SE = .09$ , 95% CI [.21, .55]) if gender, age, income, perceived disgust, perceived contamination, and self-construal were statistically controlled for.

**FIGURE 3**

**MODERATED MEDIATION BY AVERSION TO EXTERNAL INTERVENTION**



## Discussion

Using a between-participants design, study 2 manipulated the naturalness of the healthcare product and tested how purchase intentions varied by belief in the PWE. The results aligned with the previous two studies. A stronger belief in the PWE predicted higher purchase intention for the natural medicine and lower purchase intention for the synthetic medicine. As predicted, aversion to external intervention, associated with higher PWE, mediated the effect. Importantly, this study is the first in the literature to show that higher PWE is associated with a stronger general aversion to external intervention. This aversion is general because the questions



we used were context- and product-independent. Therefore, these results not only shed light on the psychological mechanism underlying the current research but also contribute to the PWE literature by discovering a new general inclination associated with the PWE. Study 2 also ruled out disgust, contamination, and self-construal as alternative explanations, along with gender, age, and income. An additional pre-registered post-test (see web appendix E) used the exact same manipulation and asked American participants from Prolific ( $N = 200$ , 48.5% female, 1.5% Non-binary, 0.5% Prefer not to disclose,  $M_{\text{age}} = 35.35$ ) to rate the medicine on three aspects (*To what extent does this medicine symbolize a violation of self-reliance? 1 = None, 7 = A great extent; How much hard work would it be to take this medicine? 1 = No hard work at all, 7 = A lot of hard work; How much effort would you need to treat the disease with this medicine? 1 = Very little effort, 7 = A lot of effort*). Results showed that participants perceived the synthetic medicine to symbolize a violation of self-reliance to a greater extent than the natural medicine ( $M_{\text{natural}} = 2.14$ ,  $SD = 1.26$ ;  $M_{\text{synthetic}} = 2.64$ ,  $SD = 1.73$ ,  $t(198) = 2.33$ ,  $p = .021$ ), lending support to the symbolic value-alignment effect elaborated earlier. Moreover, participants perceived both medicines to require equal levels of hard work to take ( $M_{\text{natural}} = 2.06$ ,  $SD = 1.52$ ;  $M_{\text{synthetic}} = 2.10$ ,  $SD = 1.40$ ,  $t(198) = .19$ ,  $p = .847$ ). Importantly, treating the disease with either medicine would require equal effort from the patients ( $M_{\text{natural}} = 2.80$ ,  $SD = 1.66$ ;  $M_{\text{synthetic}} = 2.46$ ,  $SD = 1.40$ ,  $t(198) = 1.57$ ,  $p = .119$ ). Therefore, preference for hard work or effort could not explain the effect of the PWE on naturalness preference.

### STUDY 3: IDEOLOGICAL INFLUENCE OF PWE

Rozin et al. (2004) speculated that the preference for natural food is more driven by

ideational than instrumental concerns. We propose that the PWE could be such an ideational construct because it is developed during a person's socialization process and serves as a core belief system (Cheng et al. 2017). If the preference for natural healthcare among people who subscribe to the PWE is indeed driven by a general aversion to external intervention (i.e., ideational concern) as shown in study 2, this preference should remain even if the unnatural option is as effective as the natural counterpart (i.e., instrumental concern). To test this, we manipulated efficacy information between-subjects and asked participants to indicate their relative preference between a natural and a synthetic medicine. This study was pre-registered; please see web appendix F for the stimuli and pre-registration.

## Method

We recruited 400 American participants (51.7% female,  $M_{\text{age}} = 33.95$ ) on Prolific each for a £0.63 compensation. As per the pre-registration protocol, there were three attention-checking questions and participants were immediately excluded if they failed any. Data collection ceased after 400 participants had completed the study in full.

Participants were assigned across two between-participants conditions (medicine efficacy: control vs. equal efficacy) and their PWE was measured. They read a scenario identical to that in study 2, excluding the last sentence regarding walking by a pharmacy and seeing only one option. Instead, in this study, both the natural and the synthetic medicines were available to the participants for them to indicate a preference. In the control condition, the scenario ended with “*They are of the same price.*” In the equal efficacy condition, the scenario ended with “*They are of the same price and equally effective in treating stomach flu.*” Participants indicated which

medicine they preferred to buy (1 = I strongly prefer to buy the synthetic medicine, 7 = I strongly prefer to buy the natural medicine) and responded to a binary manipulation-check question for the efficacy manipulation (“*On the last page, what was said about the efficacy of the stomach flu medicines?*” 1 = There was no information regarding the relative efficacy of the two medicines; 2 = The two medicines were said to be equally effective). All participants selected the correct option according to their assigned efficacy manipulation. We again measured disgust as an alternative explanation by asking participants which medicine was more disgusting (1 = the synthetic medicine is more disgusting, 7 = The natural medicine is more disgusting), and contaminated (1 = the synthetic medicine is more contaminated, 7 = the natural medicine is more contaminated). Finally, participants completed the PWE scale ( $\alpha = .87$ ) and reported their gender, age, income, religious affiliation, and history of stomach flu (11.5% “Never”, 78.3% “I had it but it was long ago”, 10% “I had it recently”, 0.3% missing response), all using the same questions as before.

## Results

*Main Analyses.* We regressed the relative preference for the natural medicine on standardized PWE, efficacy (-1 = control, 1 = equally effective), and their interaction using PROCESS Model 1. The analysis revealed two significant main effects and no interaction ( $B = -.13$ ,  $SE = .09$ ,  $t = -1.52$ ,  $p = .130$ , 95% CI  $[-.31, .04]$ ). Regardless of perceived efficacy, participants who believed strongly in the PWE preferred to buy the natural medicine instead of the synthetic one ( $B = .34$ ,  $SE = .09$ ,  $t = 3.81$ ,  $p = .0002$ , 95% CI  $[.16, .51]$ ). Participants also preferred the natural medicine more if both were stated to be equally effective ( $M_{\text{control}} = 4.30$ ,

SD = 1.97,  $N = 199$ ,  $M_{\text{equally effective}} = 5.13$ , SD = 1.56,  $N = 201$ ,  $t(398) = 4.68$ ,  $p < .001$ , Cohen's  $d = .47$ ), possibly because natural medicine is often assumed to be less potent than synthetic medicine unless stated otherwise (Scott et al. 2020).

*Alternative Explanations.* As expected, the main effect of PWE ( $B = .19$ ,  $SE = .08$ ,  $t = 2.33$ ,  $p = .020$ , 95% CI [.03, .36]) and the lack of moderation by efficacy information ( $B = -.12$ ,  $SE = .08$ ,  $t = -1.56$ ,  $p = .119$ , 95% CI [-.28, .03]) held after controlling for disgust ( $B = -.33$ ,  $SE = .08$ ,  $t = -4.21$ ,  $p < .0001$ ), contamination ( $B = -.40$ ,  $SE = .07$ ,  $t = -5.68$ ,  $p < .0001$ ), gender ( $B = -.12$ ,  $SE = .16$ ,  $t = -.76$ ,  $p = .445$ ), age ( $B = .02$ ,  $SE = .01$ ,  $t = 2.58$ ,  $p = .010$ ), and income ( $B = -.01$ ,  $SE = .01$ ,  $t = -1.38$ ,  $p = .168$ ). Among the 400 participants, 42.8% were irreligious or atheist; 22.3% were Catholic; 14% were Protestant; 15.8% chose “other”. Each of the remaining religious denominations (i.e., Buddhist, Islamic, Hindu, Jewish) had fewer than 2.5% representation. Hence, we created three dummy variables representing the largest three groups — irreligious and atheist people, the Catholics, and the Protestants, with the remaining participants grouped together as the comparison reference. The main effect of PWE ( $B = .16$ ,  $SE = .08$ ,  $t = 1.95$ ,  $p = .052$ ) and the lack of moderation by efficacy information ( $B = -.11$ ,  $SE = .08$ ,  $t = -1.41$ ,  $p = .159$ ) continued to hold when the three religion dummies were included.

## Discussion

Echoing the mediational role of aversion to external intervention in study 2, study 3 provided further evidence that the stronger preference for natural healthcare associated with higher PWE is likely driven by an ideational mechanism, instead of instrumental mechanisms

such as concerns for potency examined by prior research (Scott et al. 2020). In the next study, we use yet another paradigm to test the underlying mechanism. We also manipulate PWE, instead of measuring it, to rigorously test causality.

#### **STUDY 4: MANIPULATED PWE AND MODERATION BY EXTERNAL INTERVENTION**

In the previous studies, we measured PWE using the Mirels and Garrett (1971) scale, which is the most frequently used and most reliable scale for measuring PWE. The primary aim of this study was to directly test the causal effect of PWE by manipulating it. To this end, we used Cheng et al.'s (2017) manipulation of PWE, in which participants read an actual historical letter, either one written by Benjamin Franklin or one written by Charles Bukowski. The Franklin letter emphasizes ideas central to PWE whereas the Bukowski letter advocates for the opposite. Cheng et al. (2017) found that this manipulation influenced participants' PWE but had no effect on mood, locus of control, or belief in entity versus incremental theories, and hence we adopted the same method to manipulate PWE in this experiment.

A second objective of this study was to examine the underlying mechanism using a moderation-of-process paradigm (Spencer, Zanna, and Fong 2005). If high-PWE consumers' dislike of unnatural medicine is indeed driven by their aversion to external intervention as shown in study 2, describing a synthetic medicine as involving minimal (vs. substantial) external intervention should mitigate the effect. In this study, participants evaluated Paclitaxel, a top-selling chemotherapy medicine with annual international sales of US\$ 115 million in 2021.

## Method

Undergraduate students ( $N = 233$ , 72.1% female,  $M_{\text{age}} = 20.24$ ) from the Hong Kong University of Science and Technology participated in this study for course credit. Fifteen students failed an attention-checking question at the beginning of the study asking them not to click any answer and were excluded from the analyses. The study followed a  $2$  (PWE: high vs. low)  $\times 2$  (External intervention: high vs. low) between-participants design. Participants first read either the Franklin letter (high PWE condition) or the Bukowski letter (low PWE condition), and responded to questions assessing reading comprehension. After a filler, they proceeded to an ostensibly different task named “Evaluation of Medicine”. All participants read about Paclitaxel which could be either derived from tree bark or synthesized in the lab, and were asked to answer a few questions regarding the synthesized Paclitaxel. To manipulate external intervention, synthesizing Paclitaxel in the lab was described as involving either high or low external intervention. In the high intervention condition, participants read, “***Synthesizing paclitaxel in the lab involves much processing. The synthesis starts with a precursor molecule, which is partially the same as paclitaxel and partially different. Chemical engineering is conducted to convert the dissimilar part of a precursor molecule to the right one. Chemical engineers perform a series of heating, cooling, acidic workup, isolation, merging, etc. These processings trigger multiple chemical reactions that alter the chemical structure of the molecule. After 40 steps of processing, paclitaxel is produced. At least five well-trained chemical engineers are required to work together and monitor the whole process for up to 48 hours.***” In the low intervention condition, participants read, “***Synthesizing paclitaxel in the lab involves minimal processing. The synthesis starts with a precursor molecule, which is partially the same as paclitaxel and partially different.***”

*The whole process is just to replace the dissimilar part of a precursor molecule with the right one. A chemical engineer sets up suitable environment and prepares proper starting materials. Then a series of chemical reactions take place all by themselves without any human intervention. After 40 steps of chemical reactions, paclitaxel is produced. Because the process requires little human intervention, one well-trained chemical engineer is enough to monitor the whole process.*” Having read this description, participants imagined buying Paclitaxel for chemotherapy use and indicated their preference for the synthetic Paclitaxel (*To what extent do you prefer synthesized Paclitaxel for chemotherapy? 1 = I don’t prefer synthesized Paclitaxel at all; 9 = I prefer synthesized Paclitaxel very much*). They then completed a manipulation check for external intervention (*How much human intervention is involved in synthesizing Paclitaxel? How much alteration to nature is involved in synthesizing Paclitaxel? How much processing is involved in synthesizing Paclitaxel? 1 = None; 9 = A lot*), indicated their knowledge about Paclitaxel, and responded to demographic questions (see web appendix G).

## Results and Discussion

*Manipulation Check.* The three manipulation check questions loaded on a single factor and showed reasonable internal consistency ( $\alpha = .68$ ), hence were averaged to form an index of perceived external intervention. As expected, participants across conditions perceived different levels of external intervention for synthesizing Paclitaxel ( $M_{\text{high-intervention}} = 6.79$ ,  $SD = 1.43$ ,  $N = 109$ ,  $M_{\text{low-intervention}} = 4.74$ ,  $SD = 1.53$ ,  $N = 109$ ,  $t(216) = 10.22$ ,  $p < .001$ , Cohen’s  $d = 1.38$ ). A manipulation check using only the first question, that directly used the term “intervention”, was also successful ( $M_{\text{high-intervention}} = 6.85$ ,  $SD = 2.02$ ,  $M_{\text{low-intervention}} = 3.44$ ,  $SD = 2.20$ ,  $t(216) = 11.94$ ,

$p < .001$ , Cohen's  $d = 1.55$ ). Reassuringly, the PWE manipulation neither influenced the amount of perceived external intervention ( $M_{\text{High-PWE}} = 5.63$ ,  $SD = 1.76$ ,  $N = 111$ ,  $M_{\text{Low-PWE}} = 5.89$ ,  $SD = 1.84$ ,  $N = 107$ ,  $t(216) = 1.07$ ,  $p = .29$ , Cohen's  $d = .14$ ) nor moderated the effect of the intervention manipulation on the perceived external intervention ( $F(1, 214) = 2.15$ ,  $p = .144$ , partial  $\eta^2 = .01$ ).

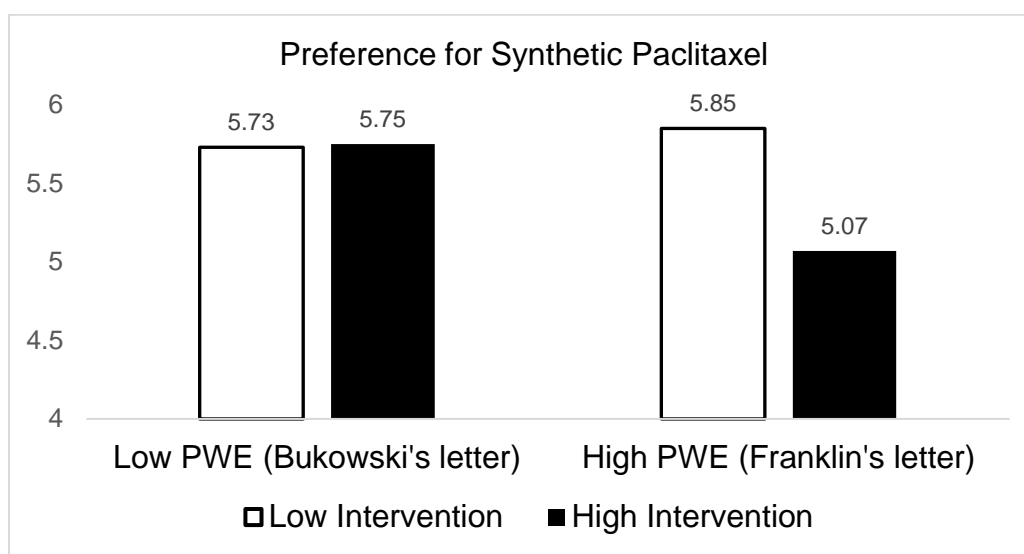
*Preference.* A 2 (manipulated PWE)  $\times$  2 (external intervention) ANOVA on the preference for the synthetic Paclitaxel revealed a significant effect of external intervention ( $M_{\text{high-intervention}} = 5.39$ ,  $SD = 1.49$ ,  $M_{\text{low-intervention}} = 5.79$ ,  $SD = 1.40$ ,  $F(1, 214) = 3.92$ ,  $p = .049$ , partial  $\eta^2 = .02$ ), no main effect of PWE ( $M_{\text{high-PWE}} = 5.44$ ,  $SD = 1.52$ ,  $M_{\text{low-PWE}} = 5.74$ ,  $SD = 1.38$ ,  $F(1, 214) = 2.08$ ,  $p = .151$ , partial  $\eta^2 = .01$ ), and a significant interaction ( $F(1, 214) = 4.18$ ,  $p = .042$ , partial  $\eta^2 = .02$ ; see figure 4). Follow-up contrasts revealed that when the process involved high external intervention, participants primed with high PWE preferred synthesized Paclitaxel less than those primed with low PWE ( $M_{\text{high-PWE}} = 5.07$ ,  $M_{\text{low-PWE}} = 5.75$ ,  $F(1, 214) = 6.07$ ,  $p = .015$ , partial  $\eta^2 = .03$ ). However, when synthesizing involved minimal human intervention, priming PWE did not influence preference ( $M_{\text{high-PWE}} = 5.85$ ,  $M_{\text{low-PWE}} = 5.73$ ,  $F(1, 214) = .18$ ,  $p = .670$ , partial  $\eta^2 = .001$ ). Examining the same interaction the other way, when participants were primed with high PWE, higher external intervention during the manufacturing process led to lower preference for synthesized Paclitaxel ( $M_{\text{high-intervention}} = 5.07$ ,  $M_{\text{low-intervention}} = 5.85$ ,  $F(1, 214) = 8.25$ ,  $p = .004$ , partial  $\eta^2 = .04$ ). However, when participants were primed with low PWE, external intervention did not influence preferences ( $M_{\text{high-intervention}} = 5.75$ ,  $M_{\text{low-intervention}} = 5.73$ ,  $F(1, 214) = .002$ ,  $p = .963$ , partial  $\eta^2 < .001$ ). ANCOVA showed that the interaction ( $F(1, 210) = 3.78$ ,  $p = .053$ , partial  $\eta^2 = .02$ ) and the simple effects of PWE ( $F(1, 210) = 5.36$ ,  $p = .022$ , partial



$\eta^2 = .03$  under high intervention;  $F(1, 210) = .20, p = .656$  under low intervention, partial  $\eta^2 < .001$ ) generally held when gender ( $F(1, 210) < .001, p = .990$ ), age ( $F(1, 210) < .001, p = .997$ ), income ( $F(1, 210) = .45, p = .503$ ) and knowledge of Paclitaxel ( $F(1, 210) = .40, p = .529$ ) were statistically controlled for.

**FIGURE 4**

PREFERENCE FOR SYNTHETIC PACLITAXEL AS A FUNCTION OF MANIPULATED  
PWE AND THE LEVEL OF EXTERNAL INTERVENTION



### STUDY 5: EXTENT VERSUS INTRUSIVENESS OF EXTERNAL INTERVENTION

Studies 2 and 4 showed that people who believed strongly in the PWE preferred natural healthcare due to their aversion to external intervention, using mediation and moderation-of-process paradigms respectively. However, which aspect of the external intervention are they particularly averse to? Do they respond to the extent of the intervention or its intrusiveness? Study 5 aimed to tease apart these factors to shed further light on the underlying mechanism.

Moreover, we tested whether safety of the medicine and complexity of the production process alternatively explain the effect.

## Method

*Manipulation Pre-test.* One hundred and fifty American participants (50.7% female,  $M_{\text{age}} = 34.59$ ) completed a manipulation pre-test on Prolific for £0.22. Participants were randomly assigned to one of the three intervention conditions (low extent low intrusiveness vs. high extent low intrusiveness vs. low extent high intrusiveness) following a between-participants design. They imagined having stomach flu and experiencing symptoms. Over-the-counter medicines were available to treat them. Participants read about one of such medicines made from a type of wild plant. Building on Rozin (2005; 2006), in the high-extent low-intrusiveness condition, pharmacologists used domestication to gradually select and breed the plants for many generations, and the process took years. In the low-extent high-intrusiveness condition, pharmacologists used genome editing to directly alter a single gene of the plant, and the process took a few days. In the low-extent low-intrusiveness condition, the pharmacologist rinsed, dried, and ground the plants to produce the medicine. The process took one hour. Detailed stimuli are presented in web appendix H.

Next, participants read the definitions of extensive and intrusive intervention. Specifically, they read, “*The scientific intervention involved in producing medicines can be either extensive, intrusive, or both. A **highly extensive intervention** usually involves a great amount of human agency and produces a great amount of change in the physical appearance, structure, or composition of the organism. A **highly intrusive intervention** is usually very direct*

and aggressive and alters the organism at the fundamental level. **Some interventions are extensive but not intrusive.** They are gentle, gradual, and facilitative even though they involve a lot of work. **Some interventions are intrusive but not extensive.** They invade the organism and change its essential component even though the process can be quick and does not involve much work". Participants then answered questions that measured the intrusiveness of the intervention (How intrusive is the external intervention involved in producing this medicine? 1 = Not intrusive at all; 7 = Extremely intrusive), the extent of intervention (How extensive is the external intervention involved in the production of this medicine? 1 = Not extensive at all; 7 = Extremely extensive), perceived safety (How safe is this medicine? 1 = Very unsafe; 7 = Very safe), and perceived complexity (Consider the entire procedure of making this medicine from the beginning to the end. How complex is it? 1 = Very simple, 7 = Very complex). ANOVAs revealed significant omnibus effects on all measures ( $F_s(2, 147) > 10.97, p_s < .001, \eta^2_s > .13$ ) except for perceived safety. As predicted, participants perceived the medicine made by domestication ( $M_{\text{domestication}} = 5.63, SD = 1.36$ ) as involving more external intervention than the medicine in the control condition ( $M_{\text{control}} = 4.30, SD = 1.59, t(147) = 4.15, p < .001$ , Cohen's  $d = .83$ ) and that made through genome editing ( $M_{\text{gene-editing}} = 4.00, SD = 1.85, t(147) = 5.06, p < .001$ , Cohen's  $d = 1.01$ ). The latter two were not different ( $t(147) = .93, p = .355$ ). Participants also perceived genome editing ( $M_{\text{gene-editing}} = 4.76, SD = 1.54$ ) as involving greater intrusiveness of external intervention than domestication ( $M_{\text{domestication}} = 3.49, SD = 1.58, t(147) = 3.73, p < .001$ , Cohen's  $d = .75$ ) or in the control condition ( $M_{\text{control}} = 3.28, SD = 1.94, t(147) = 4.33, p < .001$ , Cohen's  $d = .87$ ). The latter two were not different ( $t(147) = .62, p = .534$ ). The three medicines were rated equally safe ( $M_{\text{gene-editing}} = 5.00, SD = 1.10, M_{\text{domestication}} = 5.14, SD = 1.20, M_{\text{control}} = 4.90, SD = 1.07, F(2, 147) = .57, p = .570$ ). The procedures involving domestication

and genome editing were rated as equally complex ( $M_{\text{domestication}} = 5.67$ ,  $SD = 1.16$ ,  $M_{\text{gene-editing}} = 5.63$ ,  $SD = 1.25$ ,  $t(147) = .12$ ,  $p = .905$ ) and both were more complex than in the control condition ( $M_{\text{control}} = 4.93$ ,  $SD = 1.74$ ,  $t_s(147) > 7.43$ ,  $ps < .001$ , Cohen's  $ds > 1.06$ ). Hence, the manipulation was successful.

*Main Study.* Six hundred and one Americans (50.2% female,  $M_{\text{age}} = 34.99$ ) were recruited on Prolific for £0.45. The study followed a 3 (Types of intervention: low-extent low-intrusiveness vs. high-extent low-intrusiveness vs. low-extent high-intrusiveness)  $\times$  PWE design with the first factor manipulated between-subjects and PWE measured. Participants saw the same stimuli as in the pretest depending on their assigned condition, and indicated their purchase intention for the stomach flu medicine ( $1 = \text{very unlikely}$ ,  $7 = \text{very likely}$ ). They then completed the PWE scale ( $\alpha = .87$ ) and reported gender, age, income, and history of stomach flu (14% “Never”, 77% “I had it but it was long ago”, 9% “I had it recently”). Detailed stimuli are available in web appendix I.

## Results

We used multi-categorical PROCESS Model 1 to regress purchase intention on standardized PWE, type of intervention, and their interactions. As a multi-categorical variable, type of intervention was converted into two indicator variables, Domestication (1 = yes; 0 = otherwise) and Gene-editing (1 = yes; 0 = otherwise), while the control condition served as the comparison reference. The analyses revealed a significant PWE  $\times$  Gene-editing interaction ( $B = -.39$ ,  $SE = .18$ ,  $t = -2.11$ ,  $p = .035$ , 95% CI  $[-.75, -.03]$ ) but no PWE  $\times$  Domestication interaction

( $B = -.22$ ,  $SE = .18$ ,  $t = -1.23$ ,  $p = .221$ , 95% CI  $[-.58, .13]$ ), supporting H3. Slopes analyses revealed that higher PWE was associated with marginally lower purchase intention for medicine made by gene-editing ( $B = -.25$ ,  $SE = .13$ ,  $t = -1.89$ ,  $p = .060$ , 95% CI  $[-.50, .01]$ ), but not with purchase intentions for medicines made by domestication ( $B = -.08$ ,  $SE = .13$ ,  $t = -.62$ ,  $p = .535$ , 95% CI  $[-.32, .17]$ ) or in the control condition ( $B = .14$ ,  $SE = .13$ ,  $t = 1.10$ ,  $p = .271$ , 95% CI  $[-.11, .40]$ ). When gender, age, and income were statistically controlled for, the PWE  $\times$  Gene-editing interaction ( $B = -.43$ ,  $SE = .19$ ,  $t = -2.31$ ,  $p = .021$ , 95% CI  $[-.80, -.06]$ ) and the PWE  $\times$  Domestication interaction ( $B = -.24$ ,  $SE = .18$ ,  $t = -1.29$ ,  $p = .196$ , 95% CI  $[-.59, .12]$ ) remained unchanged. The negative effect of PWE for gene-edited medicine became significant ( $B = -.30$ ,  $SE = .13$ ,  $t = -2.25$ ,  $p = .025$ , 95% CI  $[-.56, -.04]$ ) while the effects of PWE for the domestication ( $B = -.11$ ,  $SE = .13$ ,  $t = -.84$ ,  $p = .401$ , 95% CI  $[-.36, .14]$ ) and control condition ( $B = .13$ ,  $SE = .13$ ,  $t = .98$ ,  $p = .327$ , 95% CI  $[-.13, .39]$ ) remained non-significant.

## Discussion

Domestication involves extensive but non-intrusive intervention while gene-editing involves inextensive but intrusive intervention. Study 5 found that stronger belief in the PWE was associated with decreased purchase intention for medicine made through gene-editing but not domestication, suggesting that the effect of the PWE is more sensitive to the intrusiveness of the intervention rather than its extent, which is consistent with Rozin's (2005; 2006) earlier work and discussion. Because domestication and gene-editing were perceived as equally safe and complex, concerns for safety or perceived complexity of the manufacturing process do not account for the observed differential effects of the PWE on purchase intentions.

Notably, the medicine in the control condition was not equivalent to the natural medicine in study 2. This medicine was relatively lower in extent and intrusiveness compared to those in the other conditions, but, unlike the medicine in study 2, was not described as “natural”. As a result, the manipulation checks of extent and intrusiveness lay closer to the mid-points of the scales instead of the lower ends, and participants did not see this medicine as clearly natural. This is probably why a stronger belief in the PWE only directionally increased the purchase intention for this medicine.

## **GENERAL DISCUSSION**

### **Summary of Findings**

This research investigates how the extent to which consumers believe in the Protestant Work Ethic influences their responses to natural versus artificial healthcare options. Across six studies using country-level survey data and individual level experimental data, we consistently found that consumers (and societies) who subscribe more (vs. less) strongly to the PWE have stronger preferences for relatively natural healthcare options. We also found that this effect was due to the stronger aversion to external intervention associated with higher PWE.

In study 1a, we analyzed publicly available data and found that countries with higher levels of PWE have lower prevalence of Cesarean Section deliveries. This association could not be alternatively explained by country-level differences in wealth, educational level, religiosity, religious denomination, or access to medical facilities. Study 1b replicated the country-level finding with individual mothers’ decisions for their most recent deliveries. The remaining studies

extended the findings from childbirth to medication, and tested the underlying mechanism. In study 2, a general aversion to external intervention mediated the positive (vs. negative) effect of PWE on the purchase intention of natural (vs. synthetic) medicine. In study 3, the positive influence of PWE on the preference for natural medicine held regardless of whether both medicines were stated to be equally effective or not. This further indicates that the underlying mechanism is an ideational aversion rather than instrumental concerns. Study 4 helped establish the causal nature of the effect by manipulating level of belief in the PWE. Thus, both chronic belief in the PWE and temporary accessibility of the PWE generated similar effects. This study further supported the underlying role of aversion to external intervention using a moderation-of-process paradigm. Specifically, high-PWE participants' dislike of synthetic medicine was evident (vs. was eliminated) when the medicine was described as involving high (vs. low) external intervention. Study 5 disentangled different aspects of external interventions and revealed that PWE was associated with more sensitive responses to the intrusiveness of the intervention rather than the mere extent of the intervention. Across studies, we ruled out many alternative explanations, including gender, age, income, educational level, religiosity, religious affiliation, disgust, contamination, self-construal, perceived efficacy, safety, and complexity.

### Theoretical Contributions

This research makes several theoretical contributions to both literatures—naturalness and PWE. Extant research on naturalness preference has focused almost exclusively on the domain of food. The scant research on the preference for natural healthcare has identified *situational* antecedents (e.g., to cure vs. to prevent, Scott et al. 2020; to treat psychological vs. physical

conditions, Li and Gal, forthcoming) operating on *instrumental* mechanisms (e.g., concerns about safety and potency, Scott et al. 2020; concerns about psychological side-effects, Li and Gal, forthcoming). Extending this line of research, our study uncovers a *dispositional* antecedent (i.e., PWE) that operates on an *ideational* mechanism (here, aversion to external intervention). In so doing, we also uncover that a general aversion to external intervention associated with PWE is responsible for the effect. This finding is also novel to the PWE literature as no one has previously proposed or established a link between PWE and a general aversion to external intervention. Finally, our research sheds some light on the finer dimensions of external intervention. We find that the influence of the PWE on naturalness preference is driven more by the aversion to intrusive external intervention rather than the mere extent of the intervention. This again contributes to the naturalness literature, which has mostly defined and operationalized external human intervention somewhat imprecisely, as human contact or human processing, without unpacking its different dimensions. Only Rozin (2005; 2006) contemplated the different dimensions but no one has attempted to tease them apart conceptually and empirically. Last but not the least, most of the items studied earlier were ingestibles (e.g., food) because extant research mainly builds on contagion theory and the emotion of disgust (Scott et al. 2020 being a notable exception). The current research extends the investigation of naturalness to healthcare decisions (e.g., childbirth method, chemotherapy), which not only complements existing findings in food but also suggests that the mechanism is aversion to external intervention, a novel contribution in and of itself.

#### Possible Correlates and Alternative Explanations



The current research rules out several demographic and social-economic correlates and self-construal as alternative explanations. Can other individual difference variables account for the effect of PWE? Previous literature has found that belief in the PWE is positively correlated with conservatism (Cheng et al. 2017), which may explain why people who believe in the PWE prefer natural options, because these options are sometimes, although not always, more traditional. However, conservatism cannot explain the moderating effect of external intervention in study 4 and the moderating effect of intrusiveness in study 5, because the traditional method remains traditional regardless of the degree of external intervention or intrusiveness, a framing we imposed externally. If conservatism was responsible for the observed effect, we should have observed main effects of PWE rather than interactions. Another related concept is Locus of Control, although its correlation with the PWE is at most moderate according to prior research ( $r = .20 \sim .41$ , Cheng et al. 2017; Furnham 1984). Locus of Control refers to whether an individual believes that his/her fate is determined internally or externally. It is unclear why Locus of Control would predict naturalness preference. Moreover, the PWE manipulation used in study 4 influences neither Locus of Control nor entity-incremental theories (Cheng et al. 2017).

### Limitations and Future Research

Perceived naturalness is a key construct in this research, and psychological research on perceptions and judgments of naturalness has only emerged in recent decades. Rozin and colleagues theorized and found empirical support for the propositions that naturalness represents the absence of external human intervention/ processing, and that a higher level of external human intervention/processing is associated with lower perceived naturalness (Rozin et al. 2004;

Spranca 2012). We follow this line of thinking and adopt “absence of external intervention” as our working definition of naturalness, but other definitions do exist. According to Siipi’s (2008) comprehensive conceptual discussion, naturalness manifests in three different forms: history-based, property-based, and relational. Much of her conceptualization overlaps with the notion that naturalness represents the lack of human intervention. However, one unique aspect stands out. According to Siipi, naturalness may be interpreted using the lens of familiarity. If an object is more (vs. less) familiar, it feels more (vs. less) natural. For example, an alien in a science fiction movie looks unnatural simply because we are not familiar with its body configuration, which is independent of the presence or absence of any external intervention. This definition suggests that PWE may lead to a preference for naturalness because of a preference for familiarity. However, there is no direct evidence in the literature that people who subscribe to the PWE prefer familiarity (although they may be more conservative, an alternative explanation ruled out above). Secondly, because synthesizing paclitaxel usually involves more human intervention than deriving it from plants, framing it as involving more interventions matches participants’ knowledge and should make the products/processes more familiar. Yet we found that high-PWE participants did not prefer them more in this than in the low intervention condition (study 4). This suggests that preference for familiarity was unlikely to have been driving our findings.

One important consideration regarding naturalness pertains to technology. Intuitively, it might appear as if the greater the use of technology in the manufacture of a product, the less natural it is. However, this intuition might alter, or even reverse, if brought to bear on the constructs of extent and intrusiveness, particularly in the domain of healthcare. For example, technological advances such as FMRI and laparoscopy have actually reduced the invasiveness of

diagnosis and surgery. Evidently, the relationship between technology, interventions, and perceptions of naturalness is complex and therefore potentially fruitful for much research.

The current research focuses on natural healthcare instead of natural food because there has already been some research on naturalness in the food domain – far more than in the important domain of healthcare. We believe that our central findings should apply to food as well. Future research may study whether higher PWE leads to stronger preference for natural food, and whether this effect would be attenuated if the artificial food option is described as involving minimal external human intervention. The current research, for the first time, identifies an important dispositional antecedent of naturalness preference. We do not suggest that the PWE is the only psychological antecedent. Future research should explore other possible antecedents to further our understanding of the preference for naturalness.

Finally, some may wonder why stronger PWE predicted decreased preference for the option associated with high effort (e.g., medicine made with high external intervention involves much effort). This appears to contradict Cheng et al. (2017), where a stronger PWE led to an increased preference for the option representing high effort. A close look reveals important difference between these two studies. Here, we suggest that when the effort is taken by providers (e.g., the manufacturer), it is interpreted as an “intervention” in the eyes of the users. Conversely, when the effort is taken by users themselves as in Cheng et al. (2017), it is more likely to be classified as “hard work”. Future research is warranted to systematically examine the implication of one’s own effort versus others’ effort, particularly in relation to PWE and naturalness.

## Substantive Implications

Healthcare is a huge industry. In 2020, the U.S. healthcare expenditure hit \$ 4.1 trillion and is projected to grow at over 5% per year (NHE Fact Sheet 2020). Moreover, as the COVID-19 pandemic has driven home, healthcare decisions are crucially related to consumer welfare but healthcare decision makers, consumers and policymakers, are heavily influenced by psychological factors. For example, the prevalence of elective C-sections has been growing around the world even though these procedures are often riskier than vaginal deliveries for normal pregnancies (Lilford et al. 1990). Their overuse worldwide has been estimated to have cost US\$ 2.32 billion in 2008 (Gibbons et al. 2010). Given these contexts, it is important to identify antecedents of consumer healthcare decisions so that consumers may be influenced or nudged in a transformative way. For example, we found that higher PWE is associated with greater preference for vaginal deliveries. As an implication, one may recommend an abbreviated PWE measure be included in maternal health screening instruments to help identify and caution low-PWE mothers about the potential risks of elective C-sections. At a global level, governments and international healthcare organizations may similarly be advised to invest more effort in popularizing natural deliveries in low-PWE countries. In the business sector, pharmaceutical companies may leverage the findings of studies 2-5 in their marketing practices. For example, firms that manufacture natural medicine or emphasize natural manufacturing process may be advised to target high-PWE consumers, whereas firms that exploit modern artificial methods (e.g., synthesis or gene technology) should target low-PWE consumers. Apart from measuring PWE using scales, previous research has suggested alternative methods to identify customers of high versus low PWE, such as by observing how “hard-working” a person looks, and by allowing self-selection into different promotional programs (Cheng et al. 2017). Healthcare firms may leverage such tactics in their targeting and positioning. PWE can be primed in a few

different ways (Cheng et al. 2017) and study 4 demonstrated one such method. Marketers or government agencies could potentially integrate messages representing PWE values into their marketing communications to situationally influence consumers' preference for natural healthcare.

## **DATA COLLECTION STATEMENT**

The first author obtained the data for study 1a from public sources specified in the web appendix B in the spring and summer of 2014. The first and second authors commissioned panel data company Pureprofile to collect data for study 1b in the autumn of 2020. The first author collected the data on Prolific for study 2 in the winter of 2020-2021, for the post-test of study 2 in the winter of 2023-2024, and for study 3 in the spring of 2021. The first author collected the data for study 4 at the behavioral lab of the Hong Kong University of Science and Technology in the spring of 2017. The first author collected the data on Prolific for study 5 and its pre-test in the winter of 2021-2022. The first author collected the data on Prolific for the study reported in web appendix A in the autumn of 2023. The first author analyzed all the data. The data are currently stored in a project directory on the Open Science Framework.

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