

## Consumers Prefer “Natural” More for Preventatives than for Curatives

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Abstract: Consumers value “naturalness” in some contexts more than others. For example, genetically engineered foods and vaccines are avoided in part due to their perceived unnaturalness, but genetically engineered insulin and synthetic antibiotics are widely accepted. We propose a systematic explanation for variation in the preference for naturalness. Across multiple product categories, we find that natural is more strongly preferred when it is used to prevent a problem than when it is used to cure a problem. This increased preference for natural occurs because natural is perceived as safer and less potent, and when preventing, consumers prefer safer, less potent alternatives. Consistent with this explanation, when natural alternatives are viewed as *more* risky and *more* potent, then natural alternatives are more preferred for curing than for preventing. This research sheds light on when the marketing of “natural” can be most appealing to consumers.

Keywords: Natural products, natural preference, risk preferences, medical decision making

Consumers prefer natural versions of many things, including foods, medicines, personal care products and home products<sup>1</sup>. This preference lies at the heart of many consumer trends and public policy initiatives. “Natural” was the second-most common claim (after “premium”) made by new food and beverage products between 2003 and 2010 (USDA 2011). In fact, the natural label has been attached to so many foods that the public and FDA are now looking at regulating its use (FDA 2016; Levinovitz 2016). Beyond the direct label of natural, consumers strongly prefer GMO-free foods, in part because genetic engineering is perceived as unnatural (Scott, Inbar, and Rozin 2016; Tenbült et al. 2004). Many companies offer GMO-free alternatives (e.g., Chipotle) and some states have passed mandatory GMO food labeling laws (e.g., Vermont; Hopkinson 2016). In the medical domain, a growing segment of consumers avoid synthetic medical interventions (preferring “nature to take its course”). For example, there is a significant anti-vaccination movement—an artificial medical treatment—which has led to record-breaking measles and whooping cough outbreaks (CDC 2016; Salzberg 2012, 2015). There is also a burgeoning natural childbirth movement, with 9% of women now using midwives for childbirth (Hamilton et al. 2015; Cruz 2015). Many women choose natural childbirth to avoid unnatural interventions like early labor induction, IV antibiotics during labor, or caesarian birth (Cruz 2015).

Yet even people who are very devoted to natural products abandon this preference in certain circumstances. For example, most insulin today is genetically engineered, and consumers widely approve of it (Hallman et al. 2002). Similarly, antibiotic treatments are highly unnatural. Nonetheless, even for relatively mild ailments like a minor infection, most consumers accept a synthetic antibiotic treatment.

Thus, anecdotally, the preference for natural products is not universally pervasive. One factor that unites the examples above where the natural preference looms large is that they all occur in the absence of illness so the health impacts are primarily preventative. In this article, we isolate one situational variable: whether a treatment is used as a preventative or as a curative. We demonstrate that consumers exhibit a stronger natural preference when preventing a problem or illness than when treating an existing problem or illness.

### **Inferences about Safety and Potency of Natural Products**

One way to understand why consumers prefer natural in some situations but not others is to look at the inferences they make about natural products. Consumers infer natural things are better on many dimensions, but especially safety (Slovic et al. 2007; Lee et al. 2013; Li and Chapman 2012). Natural things are more familiar and therefore might be lower on the “unknown” dimension of risk perception (Slovic 1987). Consumers believe risks that are caused by nature (as opposed to man) are less dangerous and they are willing to pay less to reduce nature-caused risks (Kahneman et al. 1993; Rudski et al. 2011). Natural products are thought to be safer than conventional counterparts, even when there is little evidence that this is objectively the case (Hughner et al. 2007; Li and Chapman 2012; Smith-Spangler et al. 2012).

Some evidence suggests that while consumers infer natural products to be superior on many dimensions, they nonetheless infer natural products to be inferior on potency. For example, sustainable products—such as environmentally friendly alternatives—are viewed as less effective (Luchs et al. 2010). Similarly, traditional Chinese medicine and Ayurvedic medicine, which may be perceived as more natural, are considered less potent than Western medicine on some dimensions (e.g., slower response efficacy; Wang, Keh, and Bolton 2010). Finally, when

treating hypertension, natural drugs are thought to be less effective than their synthetic counterparts (Meier and Lapas 2016).

### **Importance of Safety and Potency when Preventing versus Curing**

If consumers infer natural alternatives are safer and less potent, then they should prefer natural alternatives to a greater extent in contexts where safety is more important and potency is less important. We suggest that the importance of safety and potency varies depending on whether consumers are preventing or curing an ailment. Specifically, customers care most about safety when preventing ailments, but once an ailment exists they might then prefer a stronger remedy even at the expense of safety.

While these predictions have not explicitly been tested to our knowledge, they are consistent with multiple theories. According to regulatory focus theory, a prevention orientation involves focusing on losses and avoidance of losses. This prevention focus induces a greater preference for safety (Higgins 1998). According to prospect theory, risk-seeking occurs in the domain of losses. If one assumes the loss domain when an ailment occurs, then one would expect reduced safety concerns and increased risk-seeking behavior in this curing context (Kahneman and Tversky 1979; Novemsky and Kahneman 2005). Thus, a consumer would place higher importance on safety relative to potency when preventing versus curing.

### **The Present Research**

The prior theoretical and empirical work suggests that a) natural products are inferred to be safer and less potent, and b) consumers will prefer safer, less potent alternatives more when preventing versus curing an ailment. Therefore, consumers should prefer natural more for preventatives than for curatives. Furthermore, the increased preference for natural when preventing versus curing should be contingent on inferences about risks and potency. If the

inferences about a natural product's risks and potency reverse, we predict a reversal of the effect. Specifically, when the natural option is the *more* risky and *more* potent one (the reverse of the usual inference), it will be preferred more for curing than for preventing an ailment.

Beyond anecdotal evidence, the hypothesis that natural is more preferred for preventing than for curing is supported by survey data. In the supplementary materials, we report detailed analysis from a large, nationally representative survey conducted by the Centers for Disease Control/National Center for Health Statistics (CDC/NCHS, National Health Interview Survey 2012). In this survey, people emphasize the importance of naturalness more when trying to prevent illness. However, because alternate accounts might exist to explain this association in observational data, we experimentally manipulate treatment purpose (prevent vs. cure) in laboratory studies to isolate the effect and its mechanism holding all else constant.

We present seven studies examining the preference for natural products as a function of whether the consumer's goal is to prevent an ailment or to cure it. Studies 1A-C demonstrate the central hypothesis: natural products are more strongly preferred when preventing than when curing an ailment. The effect is robust across different product categories, and occurs for both within-subjects and between-subjects manipulations of preventing versus curing. Studies 2-4 examine the mechanism. Study 2A tests inferences about natural medicines and finds natural medicines are viewed as safer and less potent. Study 2B tests the effect of treatment purpose on safety and potency preferences and finds that consumers prefer safer, less potent medicines when preventing as compared to curing ailments. Study 3 presents a mediation model of the proposed psychological process: the increased preference for natural when preventing versus curing is mediated by increased importance in safety relative to potency of a treatment. Finally, study 4 tests a moderator of the effect and provides further support for the mechanism. If natural is more

preferred when preventing versus curing because of inferences about safety and potency, then manipulating inferences about safety and potency should change the effect. We find that if the natural alternative is the *more* potent and *more* risky alternative (the opposite of the intuitive inference), then the effect of treatment purpose reverses: Natural is more preferred when curing as compared to preventing. Together, these studies provide an organizing principle for understanding when the natural preference is strong and when it is not and offers a mechanism for this principle.

### *STUDY 1*

Study 1 investigates the central hypothesis, that there is a stronger preference for natural products when preventing than when curing. Study 1A investigates this hypothesis in the domain of medicines using a within-subjects manipulation of preventing versus curing. Study 1B investigates this hypothesis for non-medical products using a within-subjects manipulation of preventing versus curing. Study 1C replicates the effects of studies 1A and 1B using a between-subjects manipulation of preventing versus curing.

#### *Study 1A*

Study 1A investigates whether there is a stronger preference for a natural medicine when the medicine is used as a preventative as opposed to a curative.

#### *Methods*

*Participants.* Two hundred and seven U.S. participants from Amazon's Mechanical Turk completed an online survey in exchange for monetary compensation ( $M_{\text{age}} = 36.1$ ,  $SD = 12.9$ , 36.2% female).

*Scenarios.* The survey consisted of three different scenarios highlighting different target ailments. Each scenario described two cases: one for preventing and one for curing. The study thus consisted of a 2 (Treatment Purpose: Prevent, Cure) x 3 (Target Ailment: Vitamin B Deficiency, Scurvy/Vitamin C Deficiency, Common Cold) within-subjects design. Vitamin B deficiency, scurvy, and common cold were chosen as ailments because individuals can use the same medicine to prevent and to cure these ailments.

The scenario about vitamin B deficiency read as follows:

*Imagine the following two cases. In case A, you are susceptible to hypcobalaminemia, a vitamin B12 deficiency, and your doctor prescribes a preventative medicine, vitamin B12. In case B, you already have hypcobalaminemia, and your doctor prescribes the exact same medicine, vitamin B12, in the exact same dose.*

*In both case A and case B, you will take vitamin B12 once a day for 3 weeks.*

*Suppose there are synthetic forms of vitamin B12 (generated in a lab) and natural forms of vitamin B12 (extracted from soybean plants).*

The scenarios for the other two ailments were similar; the synthetic medicine was “generated in a lab” and the natural medicine was extracted from a plant (allicin extracted from garlic for the cold and vitamin C extracted from oranges for scurvy). In all cases, preventing and curing illnesses involved medicines prescribed by doctors and taken in the same doses for the same amount of time. After each scenario, participants responded to two questions on scales

ranging from 1 = strongly prefer synthetic, to 7 = strongly prefer natural, with a midpoint of 4 = indifferent. For example, participants answered the following two questions for the vitamin B scenario (emphasis in original): “For [case A, preventing hypcobalaminemia/case B, curing hypcobalaminemia], would you prefer the natural or the synthetic medicine?” Scenarios were presented in randomized order, and participants were randomly assigned to either see questions about preventing before questions about curing or vice versa.

*Ancillary Measures.* Participants answered eight questions about how beneficial and risky different medicines were in general (see Supplementary Materials for measures and results).

*Individual Differences and Demographics.* Additionally, participants completed fifteen items about general tendencies to prefer natural products (“trait natural preference”) and completed demographic measures (gender, age, income, political orientation, ethnicity, whether they grew up in a rural, suburban, or urban neighborhood, religion, and religiosity). In this and subsequent studies, the analyses do not include trait natural preference or demographic variables. It is always the case that individuals with higher trait natural preference prefer natural products more, and older individuals and women sometimes prefer natural products more. However, none of these variables speak directly to our predictions nor do they reliably interact with key variables.

### *Results*

In a 3 (Target Ailment: Vitamin B Deficiency, Scurvy, Common Cold) x 2 (Treatment Purpose: Prevent, Cure) repeated measures ANOVA on ratings of preference for the natural medicine, participants preferred natural to a greater extent for preventing than for curing ( $F(1, 206) = 44.97, P < .001, \text{partial } \eta^2 = .18$ ). Additionally, participants exhibited stronger natural

preference for certain target ailments ( $F(2, 205) = 6.65, P = .002$ , partial  $\eta^2 = .06$ ) and there was no interaction between target ailment and treatment purpose ( $F(2, 205) = .70, P > .25$ ).

In paired t-tests, preferences for natural medicines significantly increased when preventing versus curing each of the three diseases (all  $P$ s  $< .001$  and effect sizes ranged from  $d = .36$  to  $d = .43$ ; see Figure S1). The effect of treatment purpose (prevent versus cure) holds when only examining the first scenario presented (see Supplementary Materials). However, it is worth noting that even when curing ailments, participants preferred the natural medicine, albeit more weakly than when preventing.

### *Study 1B*

Study 1B explores whether the increased preference for natural products when preventing versus curing generalizes to domains other than medicine and to products that are not directly applied to the human body. Beyond medicines, there are many products used for both prevention and treatment. Moreover, many of these products are marketed as “natural”. We expect that beliefs about and preferences for non-medical natural products are similar to those for natural medicines. Thus, again we predict a stronger natural preference for preventatives than for curatives.

### *Methods*

Two hundred two U.S. participants from Amazon’s Mechanical Turk completed an online survey in exchange for monetary compensation ( $M_{\text{age}} = 36.5, SD = 14.0, 60.4\%$  female).

The survey consisted of six different scenarios about non-medical products. Each scenario described one case for preventing a target problem and one case for fixing that target problem. Thus, the study consisted of a 6 (Target Problem: House Mold, Mouth Bacteria, Metal Stains, Wood Stains, Clothing Stains, Pipe Leaks) x 2 (Treatment Purpose: Prevent, Cure)

within-subjects design. The study followed the exact same procedures as study 1A, except that ancillary risk/benefit measures were excluded. For example, the scenario for household mold was as follows.

*Imagine the following two cases. In case A, you are preventing mold from growing in your home. In case B, you are removing mold that is already growing in your home.*

*In both case A and case B, you plan to use an anti-mold solution. Suppose there are synthetic forms of anti-mold solution and natural forms of anti-mold solution.*

After each scenario, participants were presented with questions about preferring natural products (adapted from study 1A). In addition, participants completed the same trait natural preference measures and demographic measures from study 1A.

### *Results*

In a 6 (Target Problem: House Mold, Mouth Bacteria, Metal Stains, Wood Stains, Clothing Stains, Pipe Leaks) x 2 (Treatment Purpose: Prevent, Cure) repeated measures ANOVA on ratings of preference for the natural products, participants preferred natural products more for preventing than for curing ( $F(1,201) = 13.85, P < .001, \text{partial } \eta^2 = .06$ ). Natural preference also varied across target problems ( $F(5,197) = 20.54, P < .001, \text{partial } \eta^2 = .34$ ) and there was an interaction between target problem and treatment purpose ( $F(5,197) = 12.77, P < .001, \text{partial } \eta^2 = .25$ ).

Paired t-tests revealed the nature of this interaction. Natural was preferred significantly more when preventing as opposed to curing for four of the six target problems—house mold,

mouth bacteria, metal stains, and clothing stains. Effects for wood stains and pipe leaks were not significant, but were directionally consistent (see Figure S2; effect sizes range from  $d = .07$  to  $d = .45$ , with average effect of  $d = .23$ ). The effect of treatment purpose (prevent versus cure) holds when only examining the first scenario (see Supplementary Materials). Additionally, as in study 1A, for most target problems (except pipe leaks), the natural product was preferred even when curing the problem, albeit more weakly than when preventing that problem.

### *Study 1C*

Study 1C addresses two possible limitations of studies 1A and 1B. First, it could be argued that studies 1A and 1B's effects occur because of demand characteristics. Because participants consider both preventing and curing ailments in a within-subjects design, participants may infer that they should respond differently when preventing versus curing. Study 1C investigates whether this pattern remains when participants only consider either preventing or curing in a between-subjects design. Second, in studies 1A and 1B, the prices of the products were not specified. Study 1C and all subsequent studies specify that the prices of natural and synthetic products are equal, so preferences for natural versus synthetic products are not due to inferences about relative affordability of the two products.

### *Methods*

One thousand four U.S. participants from Amazon's Mechanical Turk completed an online survey in exchange for monetary compensation ( $M_{\text{age}} = 36.4$ ,  $SD = 12.1$ , 48.5% female).

Through random assignment, half of participants viewed scenarios about preventing problems and half viewed scenarios about curing problems. All participants viewed a total of nine scenarios—both the three medicine scenarios from study 1A and the six non-medical product scenarios from study 1B. Scenario presentation order was manipulated through random

assignment. Half of participants viewed the three medicine scenarios first (in randomized order) followed by the six non-medical product scenarios (in randomized order). The other half of participants viewed the six non-medical product scenarios first (in randomized order) followed by the three medicine scenarios (in randomized order). Each section was prefaced with a set of general instructions. Instructions informed participants they would view a set of scenarios about preventing or curing problems (e.g., for medicine scenarios in preventing condition, “*In part one of this study, we will ask you to imagine three possible scenarios. In each scenario, you are completely healthy and have no symptoms of illness. You are choosing a treatment to prevent an illness.*”)

The scenarios were adapted as necessary for a between-subjects presentation. For example, the preventing vitamin B deficiency scenario read as follows (with curing version in brackets):

*Imagine the following:*

*You are currently healthy [ill with hypcobalaminemia, a vitamin B12 deficiency].*

*You have absolutely none of the symptoms of hypcobalaminemia, a vitamin B12 deficiency (such as fatigue and numbness) [have symptoms of hypcobalaminemia (such as fatigue and numbness)].*

*You decide to take a treatment, vitamin B12, to prevent [cure] hypcobalaminemia. Suppose there are synthetic forms of vitamin B12 (generated in a lab) and natural forms of vitamin B12 (extracted from soybean plants). Assume the synthetic and natural forms are the same price and you plan to take vitamin B12 once a day for a month.*

As in studies 1A and 1B, participants indicated preference for natural alternatives on a seven-point Likert scale for each scenario. After responding to questions about all scenarios, participants indicated what the previous scenarios were about (preventing illnesses and other problems, curing illnesses and fixing other problems, or don't know/unsure) in a multiple choice manipulation check. In addition, participants completed the same trait natural preference measures and demographic measures from study 1A.

### *Results*

The majority of participants (95.3%) passed the manipulation check. Patterns and statistical significance of results are the same when participants who failed the manipulation check are excluded. Additionally, order did not interact with treatment purpose (prevent versus cure). Therefore, we collapse across order.

In a 2 (Treatment Purpose: Prevent, Cure) X 9 (Target Problem: Vitamin B Deficiency, Scurvy, Common Cold, House Mold, Mouth Bacteria, Metal Stains, Wood Stains, Clothing Stains, Pipe Leaks) mixed ANOVA, natural options were more strongly preferred for preventing than for curing ( $F(1, 1000) = 35.20, p < .001, \eta_p^2 = .04$ ). In addition, natural options were more strongly preferred for certain target problems ( $F(8, 995) = 72.52, p < .001, \eta_p^2 = .37$ ) and there was no interaction between treatment purpose and target problem ( $F(8, 995) = 1.65, p = .107$ ). In pairwise comparisons, the natural product was significantly more preferred for preventing than for curing in all nine scenarios (see Figure 1; across scenarios, effect sizes ranged from  $d = .20$  to  $d = .34$  and average  $d = .27$ ). Preventing as compared to curing a problem significantly increased natural preference even when only the first scenario presented was examined (see Supplementary Materials).

INSERT FIGURE 1 ABOUT HERE

### *Discussion*

Studies 1A-C demonstrate that consumers prefer natural alternatives more when preventing than when curing. Study 1A finds that individuals more strongly prefer natural (versus synthetic) medicines when preventing diseases, across a number of different diseases. In real world medical contexts, preventing and curing may differ in a number of ways. For one, consumers may use curatives targeted toward very specific diseases but use preventative treatments for general wellness. Relatedly, prevention may involve a more abstract goal (cf. Trope and Liberman 2003). Additionally, preventative medicines might be taken in smaller doses or for longer periods of time. Finally, it is possible that doctors are more likely to prescribe curative medicines. In study 1A, we controlled for each of these potential confounds by varying only whether the medicine was used to prevent or to cure a particular illness.

Study 1B extends the effects from study 1A to a non-medical products. Finally, study 1C rules out potential alternative explanations by replicating effects from study 1A and 1B with a between-subjects manipulation of preventing versus curing and controlling for price. In what follows, we examine beliefs about natural and synthetic medicines and the relative importance of product attributes across preventing and curing contexts.

### *STUDY 2*

In study 2, we begin to examine why the difference between preventing and curing contexts exists. We hypothesize that natural alternatives will be viewed as less risky and less

potent than synthetic alternatives and that less risky, less potent alternatives will be more strongly preferred for preventing than for curing. We examine beliefs about natural and synthetic alternatives in study 2A, and we examine the importance of risk and potency in study 2B.

### *Study 2A*

Study 2A examines what consumers believe about the risk and potency of natural as compared to synthetic treatments.

### *Methods*

Two hundred two U.S. participants from Amazon's mechanical Turk completed an online survey in exchange for monetary compensation ( $M_{\text{age}} = 32.9$ ,  $SD = 10.4$ , 33.7% female).

The question of interest is about beliefs about natural/synthetic products independent of treatment purpose (prevent versus cure). We did *not* predict that these beliefs would differ across treatment purposes, because a product's content is independent whether it is used to prevent or to cure an ailment. However, we examined beliefs across both preventing and curing to explore if treatment purpose matters. Based on random assignment, half of participants were told "We are interested in your views about prevention of illnesses" and the other half were told "We are interested in your views about treatment of illnesses." Participants rated whether natural medicines a) are stronger, b) are more potent, c) are more powerful, d) are riskier, e) are more dangerous, and f) have more severe side effects than synthetic medicines. The six items were presented in randomized order. Through random assignment, half of participants saw comparisons in one scale order (e.g., "Generally, how strong are natural versus synthetic medicines? 1 = natural medicines are much stronger, 4 = natural and synthetic medicines are equally strong, 7 = synthetic medicines are much stronger) and half of participants saw comparisons in the reverse response scale order (e.g., "Generally, how strong are synthetic

versus natural medicines? 1 = synthetic medicines are much stronger, 4 = synthetic and natural medicines are equally strong, 7 = natural medicines are much stronger). Then, participants answered a manipulation check: “Which of the following was this study about? (a) Prevention of illnesses, (b) Treatment of illnesses”. Finally, participants completed demographic measures (same as study 1A).

### *Results*

The majority of participants (83.2%) passed the manipulation check. Patterns and statistical significance of results are the same when participants who failed the manipulation check are excluded. We reverse scored one response scale order, so that ratings above the midpoint always indicate synthetic medicines are more risky or more potent. Response scale order did not reliably affect ratings on the six comparison items<sup>2</sup> and so we collapse across order. Additionally, as expected, thinking about medicines in the context of preventing versus curing diseases had no effects on the six comparison items, so we collapse across the treatment purpose experimental manipulation.

A principal components analysis with a varimax rotation on the six comparison ratings yielded a two factor solution. Accordingly, we averaged items for stronger, more potent, and more powerful into a composite potency score (Cronbach’s  $\alpha = .89$ ), and we averaged items for riskier, more dangerous, and having more severe side effects into a composite risk score (Cronbach’s  $\alpha = .84$ ). Both composite scores significantly differed from the midpoint of four, such that synthetic medicines were perceived as more potent and riskier ( $M_{\text{potency}} = 5.07$ ,  $SD = 1.24$ ,  $t(201) = 12.22$ ,  $P < .001$ ,  $d = 1.67$ ;  $M_{\text{risk}} = 4.82$ ,  $SD = 1.25$ ,  $t(201) = 9.37$ ,  $P < .001$ ,  $d = 1.28$ ).

### *Study 2B*

Study 2B examines preferences for potency and tolerance of risks and side effects when preventing versus curing.

### *Methods*

Two hundred two U.S. participants from Amazon's Mechanical Turk completed an online survey in exchange for monetary compensation ( $M_{\text{age}} = 34.9$ ,  $SD = 10.7$ , 45.0% female). In addition to manipulating treatment purpose, we manipulated severity to explore whether severity interacts with treatment purpose. For example, consumers might always prefer extremely safe medicines for preventing and curing very mild ailments, such as a slight cough; In contrast, they might always prefer extremely potent medicines for preventing and curing very severe ailments, such as cancer. Participants were instructed to imagine scenarios either involving preventing or curing diseases that were a) not severe, b) moderately severe, or c) extremely severe. Thus, the study consisted of a 2 (Treatment Purpose: Prevent, Cure) by 3 (Disease Severity: Low, Medium, High) fully within-subjects design. Scenarios followed the format (emphasis in original): "Your doctor informs you that you [are at risk for/already have] a disease that is [**not severe/moderately severe/extremely severe**]."

For each scenario, participants responded to four questions on scales ranging from 1 = not at all, to 7 = extremely. The questions read as follows (emphasis in original).

- 1) To [**prevent/cure**] this disease, how powerful would you prefer your medicine to be?
- 2) To [**prevent/cure**] this disease, how strong would you prefer your medicine to be?
- 3) To [**prevent/cure**] this disease, how willing would you be to tolerate risks to your health as a result of the medicine?

4) To [**prevent/cure**] this disease, how willing would you be to tolerate uncomfortable side effects of the medicine?

All scenarios were presented in randomized order, and the four questions were randomized for each scenario. Finally, participants completed the same demographic measures as in study 1A.

### *Results*

For each scenario, we first created a composite potency preference measure by averaging ratings about preferred strength and power (average  $r = .87$ ) and a composite risk tolerance measure by averaging ratings about risk tolerance and side effects tolerance (average  $r = .76$ ). Then, we conducted a 2 (Treatment Purpose: Prevent, Cure) by 3 (Disease Severity: Low, Medium, High) repeated measures ANOVA on potency preference. There were two main effects, such that people preferred more potent medicines when curing diseases ( $F(1, 201) = 35.88, P < .001$ , partial  $\eta^2 = .15$ ) and when diseases were more severe ( $F(2, 200) = 309.16, P < .001$ , partial  $\eta^2 = .76$ ). The interaction between treatment purpose and disease severity was not significant ( $F(2, 200) = .09, P > .25$ ). Similarly, in a 2 x 3 repeated measures ANOVA on risk tolerance, people tolerated more risk/side effects when curing diseases ( $F(1, 201) = 44.45, P < .001, \eta_p^2 = .18$ ) and when diseases were more severe ( $F(2, 200) = 361.93, P < .001, \eta_p^2 = .78$ ). There was no interaction between treatment purpose and disease severity ( $F(2, 200) = 1.73, P = .18$ ). At every level of disease severity, preventing (versus curing) diseases reduced the preference for potency (in paired t-tests,  $P_s < .001$ , effect sizes between  $d = .26$  and  $d = .34$ ) and tolerance of risks (in paired t-tests, all  $P_s < .01$ , effect sizes between  $d = .21$  and  $d = .39$ ).

### *Discussion*

Study 2 finds that consumers believe natural medicines are less risky and less potent (study 2A). Moreover, no matter the severity of the ailment, they prefer less risky and less potent medicines when preventing versus when curing illnesses (study 2B).

### *STUDY 3*

Study 2 demonstrated that consumers (a) view natural as less risky and less potent and (b) prefer less risky, less potent alternatives when preventing. These results imply that one reason why people prefer natural when preventing is that the relative importance of potency and safety changes across contexts: When consumers are preventing (as opposed to curing), they place relatively more importance on safety and less on potency. Therefore, when consumers are preventing, the natural alternative becomes more appealing. In study 3, we tested whether the increased preference for natural treatments when preventing (versus curing) is mediated by changes in the relative importance of the treatment's safety and potency.

### *Methods*

Two hundred five U.S. participants from Amazon's Mechanical Turk completed an online survey in exchange for monetary compensation ( $M_{\text{age}} = 34.9$ ,  $SD = 11.7$ , 41.5% female).

Each participant viewed one scenario. Each scenario instructed participants to consider two cases—one where they were preventing an ailment and another where they were curing the same ailment. Through random assignment, participants considered one of three different ailments: common cold, vitamin B deficiency, or scurvy. The scenarios were identical to those in study 1A, except that we added one additional sentence at the end of every scenario instructing

participants to assume natural and synthetic medicines were the same price. Participants completed the questions about preference for natural medicines when preventing and when curing from study 1A.

Additionally, all participants indicated the importance of both safety and potency when preventing and curing the ailment. Specifically, participants filled out two importance measures—one for preventing and one for curing. In each case, participants specified how important they considered safety and potency of the medicine on a 0 to 100 constant sum scale. For the first attribute measure, participants saw the following explanation (adapted appropriately for each ailment):

*Two features of treatments that consumers often care about are potency and safety. We are interested in how important these features are to you when you are preventing the common cold.*

*Potency refers to how strong and powerful the treatment is.*

*Safety refers to the degree of risk and the extent of side effects that the treatment might entail.*

*Please tell us how important each of these are to you personally by allocating 100 points between them. For example, if you thought potency and safety were equally important, you should allocate 50 points to each. If you thought potency was the only important feature and safety was not important at all, you should allocate all 100 points to potency and no points to safety.*

*In case A, where you are preventing the common cold, how important are safety and potency of the treatment?*

The survey software required importance of safety and potency to add to 100 before the participant could move forward. Through random assignment, half of participants completed importance questions before preference questions and half completed them after preference

questions. Furthermore, through random assignment, half of participants considered curing before preventing and half considered preventing before curing. In addition, participants completed the same trait natural preference measures and demographic measures from study 1A.

### *Results*

There were no main effects or interactions with order of questions (all  $ps > .10$ ) so we collapse across order. Additionally, there were no main effects or interactions with the type of ailment participants considered, except one main effect where the overall preference for a natural medicine (both when preventing and curing) was higher for scurvy. Therefore, we collapse across ailments.

Participants preferred natural medicines more when they were preventing an ailment than curing it ( $M_{\text{Prevent}} = 5.52$ ,  $SD = 1.43$ ,  $M_{\text{Cure}} = 5.15$ ,  $SD = 1.68$ ,  $t(204) = 4.09$ ,  $p < .001$ ,  $d = .29$ ; See Figure 2B). Participants also indicated higher importance for safety of the treatment when preventing ailments ( $M_{\text{Prevent}} = 62.6$ ,  $SD = 16.8$ ,  $M_{\text{Cure}} = 51.0$ ,  $SD = 19.2$ ,  $t(204) = 10.66$ ,  $p < .001$ ,  $d = .75$ ; See Figure 2A). (In other words, participants indicated lower importance for potency when preventing; statistical tests are identical because safety and potency's importance ratings were required to sum to 100.)

INSERT FIGURE 2 ABOUT HERE

In a (within-subjects) mediation analysis, we assessed the indirect effect of treatment purpose on preference for natural medicine through relative importance of safety versus potency. Because our experimental design was within-subjects, we used *MEMORE* in SPSS (Montoya and Hayes 2015). *MEMORE* uses a path-analytic framework to estimate indirect and direct

effects with bootstrap confidence intervals. This analysis revealed a significant indirect effect of the relative importance of safety versus potency (indirect effect = .32, 95% CI [.14, .52]).

Preventing (versus curing) an ailment increased the importance of safety relative to potency ( $a = 11.63$ ), and increasing the importance of safety relative to potency increased the natural preference ( $b = .03^3$ ). After including relative importance in the model, the effect of treatment purpose became non-significant ( $c = .37, p < .001; c' = .05, p = .63$ ). Thus, we see evidence for complete mediation; the change in preferences for natural when preventing (as opposed to curing) is mediated by changes in relative importance of safety versus potency.

### *Discussion*

Study 3 finds that when preventing (as opposed to curing) consumers place relatively more importance on safety and less on potency. This change in relative importance mediates the effect of prevention contexts on preference for natural products.

## STUDY 4

In studies 2 and 3, we found evidence that natural medicines are more strongly preferred when preventing because they are judged to be less risky and less potent than synthetic medicines. In study 4, we test whether providing information that reverses these judgments of risk and potency will change when natural is more preferred. In other words, when natural medicines are viewed as *more* risky and *more* potent, then natural medicines should be more preferred in curing contexts than in preventing contexts.

### *Methods*

One thousand five hundred five U.S. participants from Amazon's Mechanical Turk completed an online survey in exchange for monetary compensation ( $M_{\text{age}} = 34.8$ ,  $SD = 11.6$ , 50.4% female).

Participants were randomly assigned to one of six conditions in a 2 (Treatment Purpose: Prevent, Cure) X 3 (Attribute Information: Natural More Potent/Risky, Unspecified, Natural Less Potent/Risky) between-subjects design. All participants viewed one scenario about an infectious disease with symptoms of fever, fatigue, and diarrhea. Half of participants were randomly assigned to consider preventing this disease, and half considered curing it.

In the Unspecified condition, the scenario followed the same format as study 1C where the risk and potency of the medicines are left unspecified. In the Natural More Potent/Risky scenarios, the following table of relative risk/potency information was appended to each scenario.

*Here is some information on your choices:*

<i>Natural Drug</i>	<i>Synthetic Drug</i>
<i>Stronger</i>	<i>Less Strong</i>
<i>More side effects/more risk</i> <i>(e.g., more chance of nausea and allergic reactions)</i>	<i>Fewer side effects/Less risk</i> <i>(e.g., less chance of nausea and allergic reactions)</i>

In the Natural Less Potent/Risky scenarios, participants saw the same table but the information was reversed for the two drugs: the natural drug was described as less strong and fewer side effects/less risk (e.g., less chance of nausea and allergic reactions) and the synthetic

drug was described as stronger and with more side effects/more risk (e.g., more chance of nausea and allergic reactions). After reading the scenario, participants indicated whether they preferred the natural or synthetic drug on the 7-point Likert scale adapted from study 1C.

After indicating their preference for the natural versus synthetic drug, participants completed three manipulation checks. In a multiple choice manipulation check of treatment purpose, participants indicated if the scenario was about preventing a disease, curing a disease, or they didn't know/were unsure. Then in manipulation checks on attribute information, participants indicated on two 7-point likert scales the relative strength and the relative risk of the natural (versus synthetic) drugs. These scales followed the same format as in study 2A, where the midpoint of 4 indicated that natural and synthetic drugs were equally strong/risky, and higher scores indicated natural drugs were stronger/riskier. Finally, participants completed the same trait natural preference measures and demographic measures from study 1A.

### *Results*

The majority of participants (96.1%) passed the manipulation check about treatment purpose. We next examined the manipulation checks of attribute information (i.e., the 7-point scales on risk/potency of natural v. synthetic drugs). Using one sample t-tests, we compared mean ratings of risk and of potency to the midpoint of four (which indicated natural and synthetic equally risky/potent). The attribute information manipulation was successful. In the Natural More Potent/Risky condition, natural medicines were rated as more potent ( $M = 5.86$ ,  $S.D. = 1.53$ ,  $t(501) = 27.23$ ,  $p < .001$ ,  $d = 1.22$ ) and riskier ( $M = 5.86$ ,  $S.D. = 1.49$ ,  $t(501) = 28.03$ ,  $p < .001$ ,  $d = 1.26$ ). In the Unspecified condition, natural medicines were rated as equally potent as synthetic medicines ( $M = 4.00$ ,  $S.D. = .59$ ,  $t(496) = .15$ ,  $p > .25$ ) and safer ( $M = 3.88$ ,  $S.D. = .66$ ,  $t(496) = 4.03$ ,  $p < .001$ ,  $d = .18$ ). In the Natural Less Potent/Risky condition, natural

medicines were rated as less potent ( $M = 1.99, S.D. = 1.34, t(505) = -33.32, p < .001, d = 1.48$ ) and less risky ( $M = 1.99, S.D. = 1.15, t(505) = -39.28, p < .001, d = 1.75$ ).

In a 2 (Treatment Purpose: Prevent, Cure) X 3 (Attribute Information: Natural More Potent/Risky, Unspecified, Natural Less Potent/Risky) ANOVA on the preference for the natural drug, there was a main effect of treatment purpose such that consumers preferred natural more, on average, when preventing than when curing ( $F(1, 1499) = 12.98, p < .001, \eta_p^2 = .01$ ). There was also a main effect of attribute information, such that consumers preferred *synthetic* medicines, on average, when natural medicines were more potent/riskier but preferred natural medicines on average when natural medicines were less potent/less risky or when risk/potency was unspecified ( $F(2, 1499) = 100.96, p < .001, \eta_p^2 = .12$ ). As predicted, the main effect of treatment purpose was qualified by an interaction between treatment purpose and attribute information ( $F(2, 1499) = 22.20, p < .001, \eta_p^2 = .03$ ).

Independent sample t-tests comparing prevent and cure conditions at each level of attribute information revealed the nature of this interaction (see Figure 3). In the Unspecified condition, we replicate the effects in studies 1A-C: the natural alternative is more preferred for preventing than for curing ( $M_{\text{prevent}} = 5.25, S.D. = 1.66, M_{\text{cure}} = 4.89, S.D. = 1.88, t(495) = 2.32, p = .021, d = .20$ ). Similarly, in the Natural Less Potent/Risky condition, natural is more preferred for preventing than for curing ( $M_{\text{prevent}} = 5.58, S.D. = 1.66, M_{\text{cure}} = 4.48, S.D. = 1.95, t(504) = 6.80, p < .001, d = .61$ ). However, when natural is specified as more risky and more potent, the effect of treatment purpose reverses: natural medicines are more preferred for curing than for preventing ( $M_{\text{prevent}} = 3.40, S.D. = 1.90, M_{\text{cure}} = 3.85, S.D. = 1.92, t(500) = 2.60, p = .010, d = -.24$ ).

INSERT FIGURE 3 ABOUT HERE

Additionally, the condition for which natural is specified as more risky and more potent demonstrates the rare case where the synthetic product is preferred to the natural product. When natural products are made to look like synthetic products in terms of their risks and potency (in the Natural More Potent/Risky condition), natural products are no longer preferred overall (in one-sample t-tests comparing means to midpoint of 4/indifference,  $M_{\text{prevent}} = 3.40$ ,  $S.D. = 1.90$ ,  $t(255) = -5.04$ ,  $p < .001$ ,  $d = .32$ ;  $M_{\text{cure}} = 3.85$ ,  $SD = 1.92$ ,  $t(245) = -1.26$ ,  $p = .21$ ).

### *Discussion*

In study 4, we examine what happens when we reverse the intuitive inference by informing participants that the natural drug is more risky and more potent than the synthetic drug. In this case, natural becomes more preferred for curing than preventing. This evidence further supports the important role of risk and potency beliefs in driving the greater preference for natural alternatives in preventative contexts.

## *GENERAL DISCUSSION*

Natural products are widely prevalent and desired by consumers. In this article, we demonstrate that the preference for natural is stronger when consumers are preventing problems or illnesses than when they are curing the same problems or illnesses. Studies 1A-C show that the exact same natural product is more strongly preferred when preventing an ailment than when curing it. We replicate this effect across many products, both for medical and household needs, and in both within-subjects and between-subjects designs. Studies 2 and 3 examine why natural

is preferred more in preventative contexts. Study 2 shows natural is perceived to be less risky and less potent, and that less risky, less potent alternatives are preferred more for prevention. Study 3 finds that the strengthened preference for natural when preventing is mediated by reduced importance of a treatment's potency relative to safety. Study 4 tests how preferences change when natural products look like synthetic products in terms of risk and potency. If intuitive inferences are reversed, and natural products are *more* potent and *more* risky than synthetic products, then the effect of treatment purpose reverses: natural is more preferred for curing than for preventing.

In the real world, preventing and curing contexts involve many possible confounds. Prevention often involves a more abstract goal (cf. Trope and Liberman 2003), such as overall wellness as opposed to treating a specific illness. Preventatives may be used for longer periods of time or in smaller doses than curatives, and doctors might be less likely to prescribe preventatives. Our controlled experiments ensure that usage goal (i.e., preventing or curing) affects the natural preference holding these other factors constant.

Beyond these factors, preventing and curing intrinsically differ in both temporal distance and uncertainty. The effects of temporal distance and uncertainty are difficult to disentangle. Prevention is about the future, which is inherently uncertain. In the words of Frederick, Loewenstein, and O'Donoghue, "it is unclear whether subjects do (or can) accept [the assumption that delayed rewards will be delivered with certainty], because delay is ordinarily—and perhaps unavoidably—associated with uncertainty" (p. 382, 2002). We expect that both temporal distance and uncertainty generate changes in the natural preference, and leave the relative importance of these variables as a question for future research.

It is worth noting that across our studies, we generally find that consumers prefer the natural alternative, albeit to a lesser extent when curing as compared to preventing a problem. However, in Study 4 we demonstrate a case for which natural products are less preferred—when they are specified to be *more* risky and *more* potent than the synthetic products. It could be that safety is generally highest priority—even more so than potency—which causes natural to generally be preferred. It could also be that the ailments we examined are relatively mundane and that for more severe ailments (e.g., cancer), potency would be prioritized over safety and synthetic medicines would therefore be preferred on average.

The research herein presents one possible organizing principle for understanding why the natural preference is so strong in some domains and weaker in others. The present work helps explain why the natural preference is stronger for food than for medicine (Gaskell et al. 1999; Rozin et al. 2004). Food is a form of preventative health and medicines are usually used to cure existing ailments. In addition, the preventative/curative distinction helps make sense of other puzzling preferences, such as concerns about vaccination. Vaccination involves a synthetic treatment used in a preventative context, a context where the natural preference is strong (DiBonaventura and Chapman 2008; Lombrozo 2015).

Finally, we view the preference for natural products as similar to the preference for branded products, which are heuristically believed to be better than generics (Becker and Murphy 1993; Bronnenberg et al. 2015). Heuristic thinking can distort good decision making if consumers' beliefs about the potency and risks associated with different treatment options are inaccurate. In fact, the inference that natural is safer might be grossly misguided in the current regulatory environment. In the U.S., natural products are often categorized as “dietary supplements” as opposed to “medicines.” These dietary supplements (unlike medicines) do not

need to demonstrate safety and efficacy to the FDA before being sold on the market, and thus could paradoxically be less consistent and safe (Bent 2008). As a result, marketers might exploit these heuristics (Akerlof and Shiller 2015) thus exacerbating sub-optimal consumer decision making.

*REFERENCES*

- Akerlof, George A. and Robert J. Shiller (2015), *Phishing for Phools: The Economics of Manipulation and Deception*. Princeton, NJ: Princeton University Press.
- Becker, Gary S. and Kevin M. Murphy (1993), “A Simple Theory of Advertising as a Good or Bad,” *The Quarterly Journal of Economics*, 108 (4), 941-964.
- Bent, Stephen (2008), “Herbal Medicine in the United States: Review of Efficacy, Safety, and Regulation,” *Journal of General Internal Medicine*, 23 (6), 854-859.
- Bronnenberg, Bart J., Jean-Pierre Dubé, Matthew Gentzkow, and Jesse M. Shapiro (2015), “Do Pharmacists Buy Bayer? Informed Shoppers and the Brand Premium,” *Quarterly Journal of Economics*, 130 (November), 1669-1729.
- Centers for Disease Control and Prevention (2016), “Measles Causes and Outbreaks” (accessed June 21, 2016), [available at <http://www.cdc.gov/measles/cases-outbreaks.html>]
- Cruz, Jaime S. (2015), “Call the Midwife,” (accessed June 21, 2016), [available at <http://www.theatlantic.com/health/archive/2015/06/midwives-are-making-a-comeback/395456/>]

DiBonaventura, Marco D. and Gretchen B. Chapman (2008), “Do Decision Biases Predict Bad Decisions? Omission Bias, Naturalness Bias, and Influenza Vaccination,” *Medical Decision Making*, 28 (4), 532-539.

Food and Drug Administration (2016), “‘Natural’ on Food Labeling,” (accessed June 21, 2016), [available at <http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm456090.htm>]

Frederick, Shane, George F. Loewenstein, and Ted O’Donoghue (2002), “Time Discounting and Time Preference: A Critical Review”, *Journal of Economic Literature*, 40 (2), 351-401.

Gaskell, George, Martin W. Bauer, John Durant, and Nicholas C. Allum (1999), “Worlds Apart? The Reception of Genetically Modified Foods in Europe and the U.S.,” *Science*, 285 (5426), 384-387.

Hallman, William K., Adesoji O. Adelaja, Brian J. Schilling, and John T. Lang (2002), *Public Perceptions of Genetically Modified Foods: Americans Know Not What They Eat*. Food Policy Institute Report No. RR-0302-001. New Brunswick: Rutgers, the State University of New Jersey, Food Policy Institute.

Hamilton, Brady E., Joyce A. Martin, Michelle J.K. Osterman, Sally C. Curtin, and T.J. Mathews (2015), “Births: Final Data for 2014,” *National Vital Statistics Reports*, 64 (12). Hyattsville,

MD: National Center for Health Statistics.

Higgins, E. Tory (1998), "Promotion and Prevention: Regulatory Focus as a Motivational Principle," in *Advances in Experimental Social Psychology*, Vol. 30, Mark P. Zanna, ed. New York: Academic Press, 1-46.

Hopkinson, Jenny (2016), "How Vermont Beat Big Food," (accessed on June 21, 2016), [available at <http://www.politico.com/agenda/story/2016/03/vermont-gmo-labeling-law-national-standard-000067>]

Hughner, Renée S., Pierre McDonagh, Andrea Prothero, Clifford J. Shultz, and Julie Stanton (2007), "Who are Organic Food Consumers? A Compilation and Review of Why People Purchase Organic Food," *Journal of Consumer Behaviour*, 6 (2-3), 94–110.

Kahneman, Daniel, Ilana Ritov, Karen E. Jacowitz, and Paul Grant (1993), "Stated Willingness to Pay for Public Goods: A Psychological Perspective," *Psychological Science*, 4 (5), 310-315.

— and Amos Tversky (1979), "Prospect Theory: An Analysis of Decision Under Risk," *Econometrica*, 47 (2), 263-292.

Lee, Wan-chen J., Mitsuru Shimizu, Kevin M. Kniffin, and Brian Wansink (2013), "You Taste What You See: Do Organic Labels Bias Taste Perceptions?" *Food Quality and Preference*, 29 (1), 33-39.

Levinovitz, Alan (2016), "What is 'Natural' Food? A Riddle Wrapped in Notions of Good and Evil," (accessed June 21, 2016), [available at <http://www.npr.org/sections/thesalt/2016/05/08/477057872/what-is-natural-food-a-riddle-wrapped-in-notions-of-good-and-evil>]

Li, Meng, & Gretchen B. Chapman (2012), "Why Do People Like Natural? Instrumental and Ideational Bases for the Naturalness Preference," *Journal of Applied Social Psychology*, 42 (12), 2850-2878.

Lombrozo, Tania (2015), "Psychological Biases Play A Part In Vaccination Decisions," (accessed November 20, 2015), [available at <http://www.npr.org/sections/13.7/2015/02/09/384877284/psychological-biases-play-a-part-in-vaccination-decisions>]

Luchs, Michael G., Rebecca W. Naylor, Julie R. Irwin, and Rajagopal Raghunathan (2010), "The Sustainability Liability: Potential Negative Effects of Ethicality on Product Preference," *Journal of Marketing*, 74 (5), 18-31.

Meier, Brian P. and Courtney M. Lappas (2016), "The Influence of Safety, Efficacy, and Medical Condition Severity on Natural v. Synthetic Drug Preference," *Medical Decision Making*, 1-9.

Montoya, Amanda K. and Andrew F. Hayes (in press), “Two-Condition Within-Participant Statistical Mediation Analysis: A Path-Analytic Framework,” *Psychological Methods*.

National Center for Health Statistics (2012), *Adult Alternative Medicine, National Health Interview Survey, 2012*, [public use data file and documentation available at [http://www.cdc.gov/nchs/nhis/nhis\\_2012\\_data\\_release.htm](http://www.cdc.gov/nchs/nhis/nhis_2012_data_release.htm)]

Novemsky, Nathan, and Daniel Kahneman (2005), “The Boundaries of Loss Aversion,” *Journal of Marketing Research*, 42 (May), 119-128.

Rozin, Paul (2005), “The Meaning of ‘Natural’: Process More Important than Content,” *Psychological Science*, 16 (8), 652-658.

—, Mark Spranca, Zeev Krieger, Ruth Neuhaus, Darlene Surillo, Amy Swerdlin, and Katherine Wood (2004), “Preference for Natural: Instrumental and Ideational/Moral Motivations, and the Contrast Between Foods and Medicine,” *Appetite*, 43 (2), 147-154.

Rudski, Jeffrey M., William Osei, Ari R. Jacobson, and Carl R. Lynch (2011), “Would You Rather be Injured by Lightning or a Downed Power Line? Preference for Natural Hazards,” *Judgment and Decision Making*, 6 (4), 314-322.

Salzberg, Stephen (2012), “Anti-Vaccine Movement Causes the Worst Whooping Cough Epidemic in 70 Years,” (accessed June 21, 2016), [available at

<http://www.forbes.com/sites/stevensalzberg/2012/07/23/anti-vaccine-movement-causes-the-worst-whooping-cough-epidemic-in-70-years/#20d0b92e34fd>]

— (2015), “Anti-Vaccine Movement Causes Worst Measles Epidemic in 20 Years,” (accessed June 21, 2016), [available at <http://www.forbes.com/sites/stevensalzberg/2015/02/01/anti-vaccine-movement-causes-worst-measles-epidemic-in-20-years/#5917c06e7ef9>]

Scott, Sydney E., Yoel Inbar, and Paul Rozin (2016), “Evidence for Absolute Moral Opposition to Genetically Modified Food in the United States,” *Perspectives on Psychological Science*, 11 (3), 315-324.

Slovic, Paul (1987), “Perception of Risk,” *Science*, 236 (4799), 280–285.

—, Melissa L. Finucane, Ellen Peters, and Donald G. MacGregor (2007), “The Affect Heuristic,” *European Journal of Operational Research*, 177 (3), 1333-1352.

Smith-Spangler, Crystal, Margaret Brandeau, Grace E. Hunter, J. Clay Bavinger, Maren Pearson, Paul J. Eschbach, et al. (2012), “Are Organic Foods Safer or Healthier than Conventional Alternatives? A Systematic Review,” *Annals of Internal Medicine*, 157 (5), 348–366.

Tenbült, Petra, Nanne K. de Vries, Ellen Dreezens, and Carolien Martijn (2005), “Perceived Naturalness and Acceptance of Genetically Modified Food,” *Appetite*, 45 (August), 47-50.

Trope, Yaacov and Nira Liberman (2003), "Temporal Construal," *Psychological Review*, 110 (3), 403-421.

United States Department of Agriculture (2011), "New Products," (accessed on June 21, 2016), [available at <http://www.ers.usda.gov/topics/food-markets-prices/processing-marketing/new-products.aspx> ]

Wang, Wenbo, Hean T. Keh, and Lisa E. Bolton (2010), "Lay Theories of Medicine and a Healthy Lifestyle," *Journal of Consumer Research*, 37 (June), 80-97.

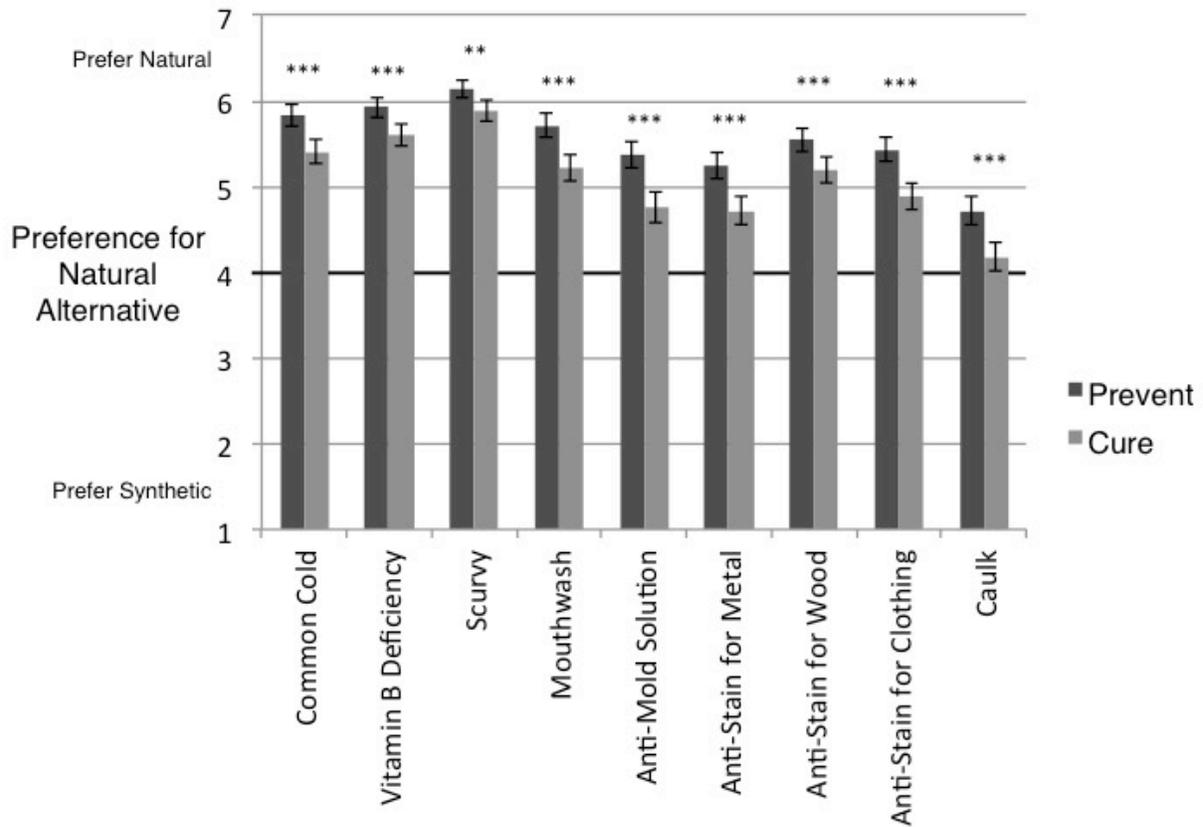
### Footnotes

[1] Lay consumers define natural products as those that lack human intervention or processing (Rozin 2005).

[2] Those who saw the risk item in the reverse response scale order rated natural medicines as riskier overall ( $t(200) = 2.19, p = .030$ ). However, since this pattern of results was neither predicted nor found for danger and side effects items, we collapse across order.

[3] Note that the estimate for the  $a$  path is much larger than the estimate for the  $b$  path because in  $a$  the outcome variable is on a 0 to 100 scale, and in  $b$ , the predictor variable is a 0 to 100 scale and the outcome variable is a 1 to 7 scale.

## Figures



*Figure 1.* Preference for natural when preventing versus curing in study 1C is displayed. The bolded line of four represents indifference between natural and synthetic alternatives. Error bars represent 95% confidence intervals of the mean.

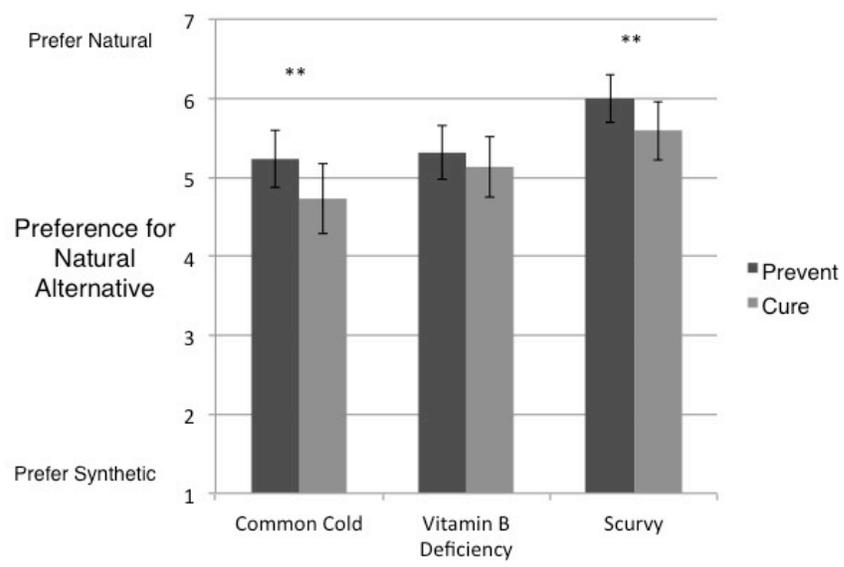
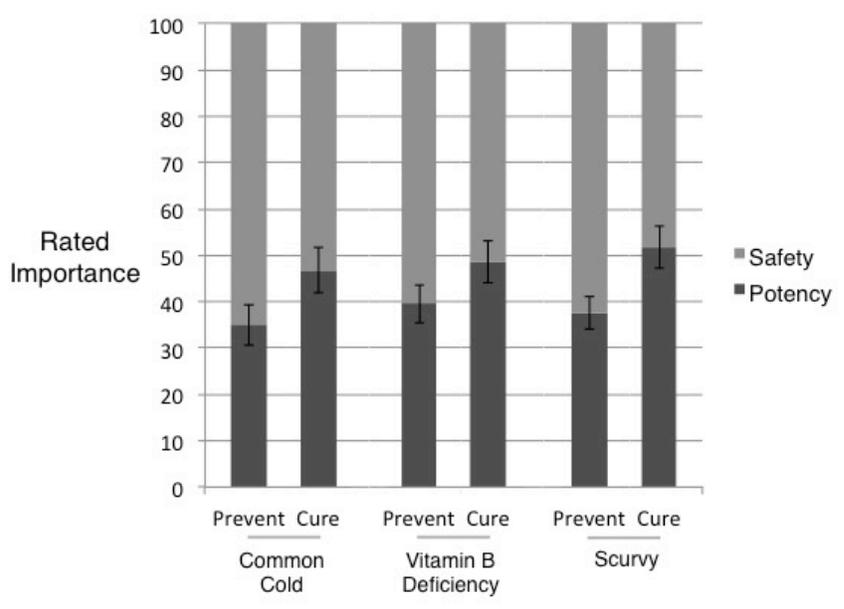
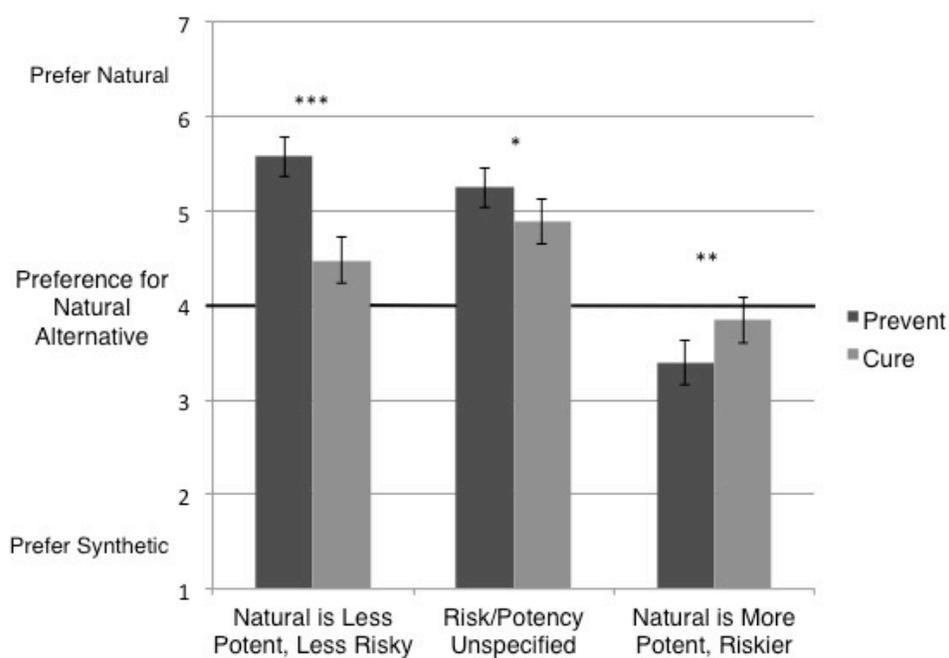


Figure 2. The relative importance of a treatment's safety increases (panel a), and the preference for natural increases (panel b) when consumers are preventing diseases as compared to curing them. Error bars represent 95% confidence intervals.



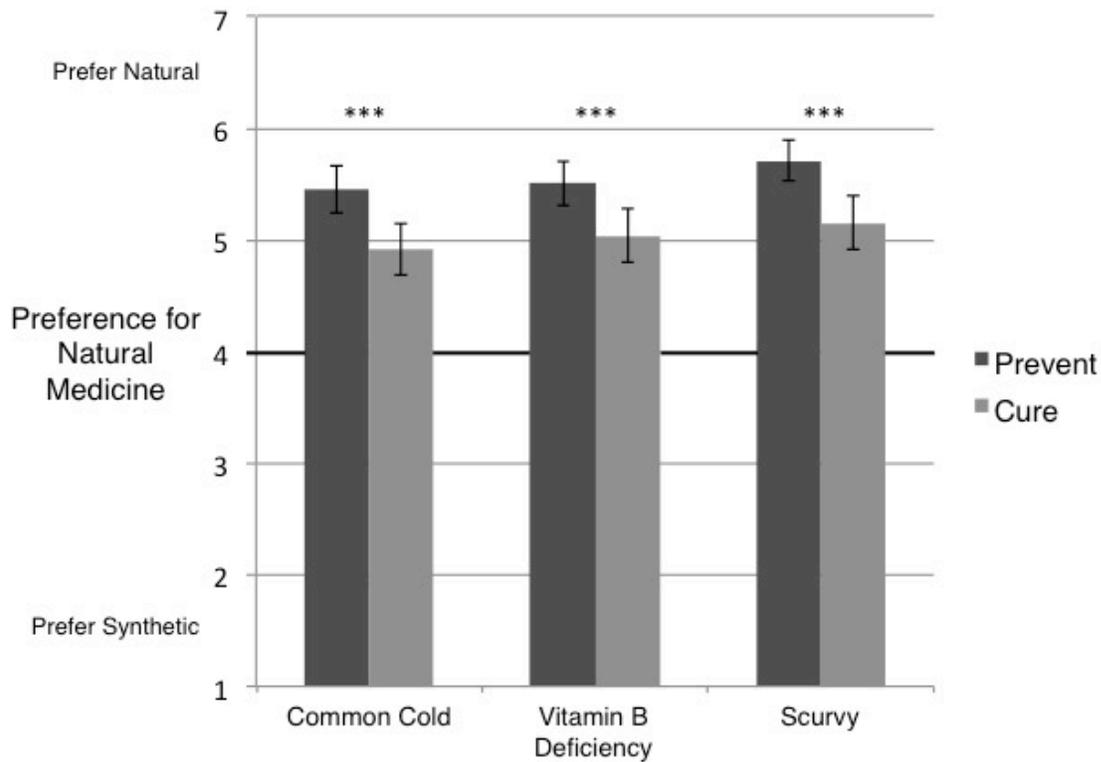
*Figure 3.* In study 4, preference for natural as a function of a) preventing/curing and b) information about risk and potency is displayed. The bolded line of four represents indifference between natural and synthetic alternatives. Error bars represent 95% confidence intervals of the mean.

**Supplementary Materials**

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<b>Survey Design</b>	<b>5</b>
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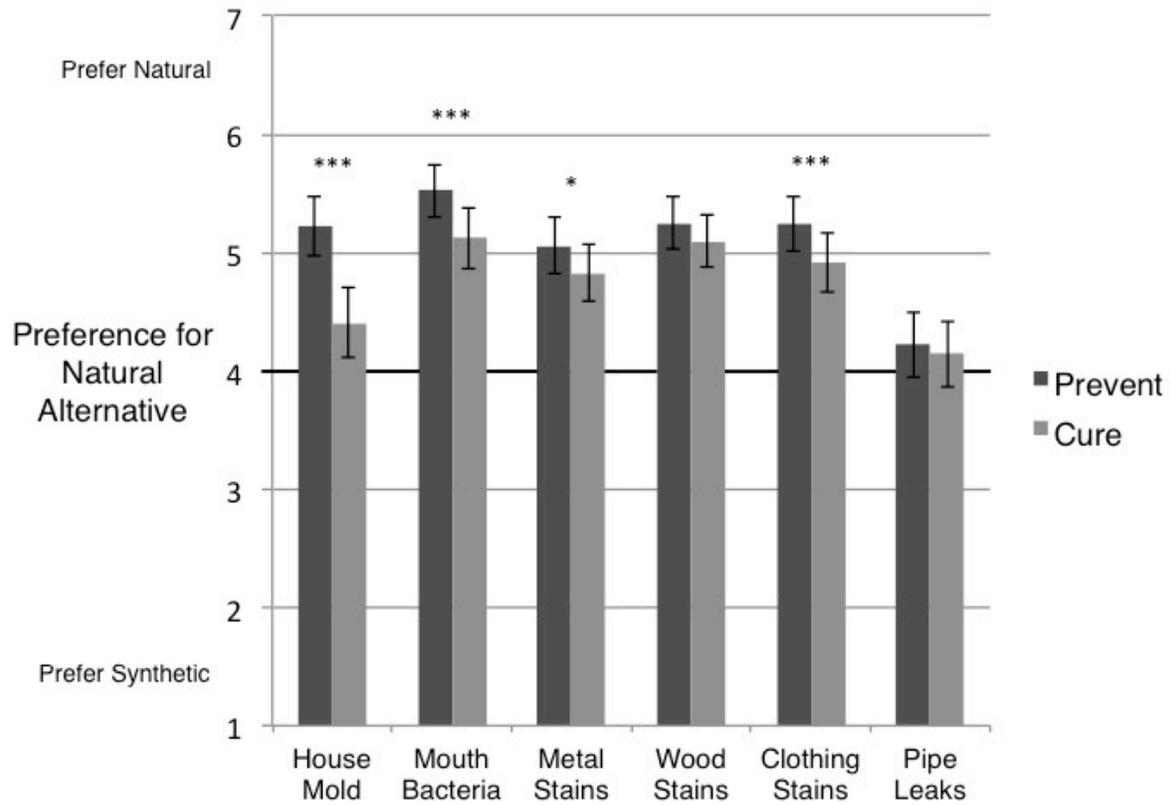
## 1. Study 1A, 1B Figures

Figure S1 displays the preference for a natural medicine when preventing versus curing an ailment in study 1A. Figure S2 displays the preference for a natural non-medical product when preventing versus curing a problem in study 1B.



*Figure S1.* The bolded line represents indifference between natural and synthetic alternatives.

Error bars represent 95% confidence intervals of the mean. \*\*\* =  $p < .001$



*Figure S2.* The bolded line represents indifference between natural and synthetic alternatives.

Error bars represent 95% confidence intervals of the mean. \* =  $p < .05$ , \*\*\* =  $p < .001$

## 2. Studies 1A-C Analyses of First Scenario Only

In addition to the repeated measures ANOVAs reported in the main text, we also looked at the first scenario only in studies 1A-C. The results are displayed in Table S1.

Table S1

*Preference for Natural Alternative When Preventing Versus Curing in First Scenario*

	Mean Natural Preference When Preventing (S.D.)	Mean Natural Preference When Curing (S.D.)	<i>df</i>	<i>t</i>	<i>p</i>	Effect Size ( <i>d</i> )
Study 1A (within-subjects)	5.57 (1.36)	5.05 (1.63)	206	5.34	< .001	.38
Study 1B (within-subjects)	5.32 (1.61)	4.89 (1.81)	201	3.62	< .001	.26
Study 1C (between-subjects)	5.79 (1.55)	5.44 (1.41)	1002	10.53	< .001	.24

Note. The effect of treatment purpose in the first scenario completed by each participant is displayed for studies 1A-C. Consistent with the study designs, t-tests are within-subjects in study 1A and 1B and between-subjects in study 1C.

### 3. Study 1A Ancillary Measures and Results

In study 1A, participants answered questions about how beneficial and risky different medicines were in general, ranging from 1 = not at all beneficial/risky, to 7 = very beneficial/risky. They answered these questions with respect to a) natural preventative medicines, b) natural curative medicines, c) synthetic preventative medicines, and d) synthetic curative medicines. Thus they answered eight questions (i.e., 2 (Consequence: Risk, Benefit) x 2

(Natural: Natural, Synthetic) x 2 (Treatment Purpose: Prevent, Cure)) presented in randomized order. Half of participants were randomly assigned to answer these questions before seeing the scenarios about preventing and curing specific illnesses (described in the main text), and half answered after the scenarios.

Natural medicines were, in general, perceived to be less risky when curing ( $M_{\text{natural}} = 3.10$ ,  $SD = 1.54$ , versus  $M_{\text{synthetic}} = 4.34$ ,  $SD = 1.36$ ,  $t(206) = 9.17$ ,  $P < .001$ ,  $d = 1.27$ ) and when preventing ( $M_{\text{natural}} = 3.06$ ,  $SD = 1.49$ , versus  $M_{\text{synthetic}} = 4.14$ ,  $SD = 1.36$ ,  $t(206) = 8.18$ ,  $p < .001$ ,  $d = 1.14$ ). Natural medicines were perceived to be marginally less beneficial when curing diseases ( $M_{\text{natural}} = 4.86$ ,  $SD = 1.56$ , versus  $M_{\text{synthetic}} = 5.08$ ,  $SD = 1.20$ ,  $t(206) = 1.73$ ,  $P = .086$ ,  $d = .24$ ). Perceived benefits of natural and synthetic medicines did not reliably differ when preventing diseases ( $M_{\text{natural}} = 5.01$ ,  $SD = 1.45$ , versus  $M_{\text{synthetic}} = 4.81$ ,  $SD = 1.19$ ,  $t(206) = 1.64$ ,  $P = .103$ ).

#### **4. Observational Study Using Large, Nationally Representative Dataset**

In a supplementary study, we examined what consumers' say about why they have used natural products in a large national survey about uses of alternative therapies. This survey fortuitously included a few items relevant for our predictions.

##### **Survey Design**

We used a dataset from the National Health Interview Survey (CDC/NCHS, National Health Interview Survey 2012a, 2012b). The NHIS is conducted annually on a nationally representative sample of the U.S. population by the Centers for Disease Control and Prevention (CDC), and the data are publicly available at

[http://www.cdc.gov/nchs/nhis/nhis\\_questionnaires.htm](http://www.cdc.gov/nchs/nhis/nhis_questionnaires.htm). The 2012 survey included a set of questions about the use of complementary and alternative medicines.

**Sample.** The NHIS sampled adults ( $N = 34,525$ ) in the U.S. population. Each adult completed a set of questions about his or her healthcare, including the supplementary questions on complementary and alternative medicines. In a few ( $N = 468$ ) cases, a knowledgeable proxy answered for the adult, who was mentally or physically unable to answer. Additionally, some individuals ( $N = 931$ ) opted out of or were unavailable to complete the complementary and alternative supplement.

**Interview Method.** Census interviewers collected NHIS data throughout the year through face-to-face interviews (though follow-ups to complete interviews may have been conducted via telephone). Interviews were computer-assisted. A computer program presented the questionnaire to an interviewer and interviewers entered survey responses directly into the computer. Based on previous responses, the computer program automatically routed the interviewer to appropriate questions.

### **Survey Questions.**

#### *Overview.*

Respondents were first asked about whether or not they used eighteen different types of alternative treatment therapies in the past 12 months. Of all participants, 28.9 % ( $N = 9,972$ ) had used at least one alternative treatment. These participants listed their top three alternative treatments, in order of importance. Each participant answered a number of questions about their top three alternative therapies, including two measures of interest—whether *preventing* was a reason for usage (Yes or No) and whether *natural preference* was a reason for usage (Yes or No). For exact question wording of these items, see bolded items in “Questions for Top Three Treatments Only” section below. Participants would first complete all questions about their most important alternative treatment, then cycle through these items for their second and third most

important alternative treatment. Participants who did not have a second or third most important alternative treatment bypassed this section of questions.

*Questions for All Alternative Treatments.* Participants were first asked about 18 alternative treatments: acupuncture, aryuveda, biofeedback, chelation therapy, chiropractic or osteopathic manipulation, craniosacral therapy, energy healing therapy, hypnosis, massage, naturopathy, traditional healers, movement therapies (Pilates/Trager/psychophysical integration/Feldenkrais), herbal and non-vitamin supplements, vitamins and minerals, homeopathy, special diets, yoga/tai chi/qi gong, and relaxation techniques (meditation/guided imagery/progressive relaxation).

For each treatment, participants were asked about whether they had used the treatment ever and in the past year; how frequently they had seen a practitioner for the treatment, insurance coverage versus out-of-pocket payment for the treatment, and materials purchased to learn about the treatment.

*Questions for Top Three Treatments Only.* After participants indicated the top three alternative treatments most important to their health, a number of questions were asked only about these three treatments. (For these treatments, the NHIS excluded Ayurveda, chelation therapy, and vitamins and minerals due to very low or high prevalence.) For each of the top three treatments, participants completed the following measures.

Participants were asked about five potential reasons for using the treatment. For each reason, participants could respond “Yes” or “No” (though a small percentage of participants’ answers were coded as “Don’t Know”, “Refused” or “Not Ascertained”). These reasons included one of the measures relevant to our hypothesis, the *preventing* measure, which is bolded below.

“Did you [use this therapy] for any of these reasons?”

**1. “For general wellness or general disease prevention?”**

2. “To improve your energy?”

3. “To improve your immune function?”

4. “To improve your athletic or sports performance?”

5. “To improve your memory or concentration?”

Then, participants were asked a number of questions about whether the treatment motivated them to engage in healthy behaviors (e.g., exercise more regularly) or led to positive outcomes (e.g., better sleep, reduced stress). Participants were also asked which—of the reasons, motivations, and outcomes—was the most important reason for using the alternative therapy, and how effective the therapy was with regards to that reason. Next, participants indicated whether they used the treatment for specific health problems and, if yes, what those health problems, which was the most important health problem, and what other conventional treatments they used for the most important health problem (e.g., prescription medication).

Participants were then asked further questions about why they used the alternative treatment therapy. (Five reasons, not listed below, were only asked of participants who were using the alternative therapy in addition other conventional treatment(s) for a specific health problem.) Four reasons were asked of all participants using an alternative therapy. For each reason, participants could respond “Yes” or “No” (though a small percentage of participants’ answers were coded as “Don’t Know”, “Refused” or “Not Ascertained”). These reasons included one of the measures relevant to our hypothesis, the *natural preference* measure, which is bolded below.

“Did you [use this therapy] for any of these reasons?”

1. “It is natural?”
2. “It focuses on the whole person, mind, body, and spirit?”
3. “It treats the cause and not just the symptoms?”
4. “It was part of your upbringing?”

Finally, a series of questions was asked about: whether the treatment had been recommended to them by someone (e.g., a medical doctor); whether they disclosed use of alternative therapy to a medical professional and, if not, why they chose not to disclose; and their sources of information about the treatment (e.g., the internet). More information about exact wording of questions is available at [www.cdc.gov/nchs/nhis.htm](http://www.cdc.gov/nchs/nhis.htm).

## Results

### **Bivariate Relationships between Treatment Purpose and Natural Preference.**

First, we examined the bivariate relationships between using a treatment because it was natural and using it for prevention. We conducted separate analyses for the most important treatment ( $N = 9,972$ ), the second most important treatment ( $N = 4,611$ ), and the third most important treatment ( $N = 2,045$ ). Because some participants only used one or two alternative treatments over the year, the number of participants decreases from the first to second and second to third most important treatments. We examine the percent of people who indicated they had used a treatment because it was natural. Consistent with our predictions, two-sample z-tests revealed that people are more likely to use a treatment because it was natural if they were using it for prevention (Most Important Treatment:  $M_{\text{preventing}} = 65.3\%$ ,  $M_{\text{not preventing}} = 39.8\%$ ,  $z = 24.5$ ,  $p < .001$ ; Second Most Important Treatment:  $M_{\text{preventing}} = 72.4\%$ ,  $M_{\text{not preventing}} = 45.2\%$ ,  $z = 17.1$ ,  $p < .001$ ; Third Most Important Treatment:  $M_{\text{preventing}} = 77.4\%$ ,  $M_{\text{not preventing}} = 59.5\%$ ,  $z = 7.8$ ,  $p <$

.001). This relationship persists when controlling for demographic variables (see Supplementary Materials). Additionally, there is a trend where the proportion of individuals preferring natural increases from first to second and second to third most important treatment. We expect this trend occurs because participants who more strongly prefer natural use more alternative medicines.

### **Robustness Checks.**

#### *Within Subjects Model.*

It is possible that some individual difference variable causes people to both prefer natural and use preventative treatments, and that this confound caused the relationships above. In order to control for this possible selection bias, we also isolated the 1,717 individuals who had used at least one alternative for preventing and one alternative not for preventing. We conducted a within subjects comparison on these participants, thereby controlling for selection on unobservable individual differences. We compared two proportions: the percentage of times a person indicated they had used a medicine because it was natural when preventing versus the percentage of times that same person indicated they had used a medicine because it was natural when *not* preventing. A paired, two-tailed Wilcoxon signed-ranks test indicated that consumers were more likely to say they had used a medicine because it was natural when they were using it for prevention ( $M_{\text{preventing}} = 65.4\%$ ,  $SD = 45.5\%$ ;  $M_{\text{not preventing}} = 53.1\%$ ,  $SD = 48.7\%$ ,  $V = 133483$ ,  $p < .001$ ).

#### *Binary Choice Models with Demographic Controls.*

As a further robustness check, we estimated the effect of treatment purpose on natural preference while controlling for demographic variables in a binary logistic regression. We entered whether or not a participant reported using a treatment because it was natural as the outcome variable, and entered as simultaneous predictors: whether the participant was using the

treatment for prevention, region of residence in the U.S. (East, Midwest, West or South region), age, gender, ethnicity, and marital status.

We conducted separate regressions for the most important treatment ( $N = 9,972$ ), the second most important treatment ( $N = 4,611$ ), and the third most important treatment ( $N = 2,045$ ). Because some participants only used one or two alternative treatments over the year, the number of participants decreases from the first to second and second to third most important treatments. In all three regressions, individuals who used a treatment for preventing were significantly more likely to use the treatment because it was natural (Most Important Treatment:  $b = 1.05$ , Wald  $z$  statistic = 24.02,  $p < 0.001$ , odds ratio = 2.85; Second Most Important Treatment:  $b = 1.15$ , Wald  $z$  statistic = 16.64,  $p < 0.001$ , odds ratio = 3.17; Third Most Important Treatment:  $b = .85$ , Wald  $z$  statistic = 7.64,  $p < 0.001$ , odds ratio = 2.34). (See Tables S2-S4 for more information.) The odds of using a treatment because it was natural was estimated to increase between 2.34 and 3.17 times if it was used for preventing. Additionally, for less important treatments (e.g., second or third treatment), the base rate of using a medicine because it was natural increased. We expect this is because individuals who use three alternative therapies in a year, as opposed to one, have a higher trait preference for natural products.

Table S2

*Results for Most Important Treatment*

	Estimate	Std. Error	Z value	<i>P</i>
Intercept	-0.444	0.105	-4.226	<.001
Preventing	1.049	0.044	24.022	< .001
Midwest	-0.212	0.068	-3.138	0.002

Region				
South Region	0.115	0.066	1.754	0.079
West Region	0.097	0.064	1.516	0.130
Age	-0.003	0.002	-1.801	0.072
Female	0.104	0.044	2.379	0.017
African American	0.251	0.077	3.262	0.001
AIAN	0.091	0.226	0.4	0.689
Asian	0.438	0.087	5.017	0.000
Race not released	0.064	0.473	0.136	0.892
Multiple Race	0.097	0.134	0.728	0.466
Married, spouse not in household	0.062	0.179	0.344	0.730
Widowed	-0.160	0.088	-1.816	0.069
Divorced	0.196	0.063	3.091	0.002
Separated	0.080	0.142	0.561	0.575
Never married	0.024	0.059	0.404	0.686
Living with partner	0.047	0.093	0.509	0.610
Unknown marital status	-1.085	0.479	-2.263	0.024

*Note.* Binomial logistic regression predicting whether a treatment was used because it was natural, for the most important treatment ( $N = 9,972$ ). Data Source: CDC/NCHS, National Health Interview Survey 2012a.

Table S3

*Results for Second Most Important Treatment*

	Estimate	Std. Error	z value	Pr(> z )
Intercept	-0.106	0.165	-0.641	0.521
Prevention	1.155	0.069	16.637	<.001
Midwest Region	-0.313	0.106	-2.947	0.003
South Region	-0.133	0.105	-1.262	0.207
West Region	-0.104	0.099	-1.047	0.295
Age	-0.002	0.002	-0.71	0.478
Female	0.126	0.068	1.846	0.065
African American	0.244	0.128	1.899	0.058
AIAN	0.020	0.318	0.061	0.951
Asian	0.250	0.140	1.787	0.074
Race not released	0.365	1.122	0.326	0.745
Multiple Race	0.062	0.193	0.319	0.750
Married, spouse	0.134	0.272	0.495	0.621

not in household				
Widowed	-0.034	0.139	-0.242	0.809
Divorced	0.176	0.094	1.867	0.062
Separated	0.128	0.241	0.529	0.597
Never married	-0.029	0.089	-0.323	0.747
Living with partner	-0.034	0.145	-0.234	0.815
Unknown marital status	-2.168	1.138	-1.906	0.057

*Note.* Binomial logistic regression predicting whether a treatment was used because it was natural, for the second most important treatment ( $N = 4,611$ ). Data Source: CDC/NCHS, National Health Interview Survey 2012a.

Table S4

*Results for Third Most Important Treatment.*

	Estimate	Std. Error	z value	Pr(> z )
Intercept	0.347	0.268	1.296	0.195
Prevention	0.851	0.111	7.642	<.001
Midwest Region	-0.071	0.172	-0.416	0.677
South Region	-0.143	0.167	-0.861	0.389
West Region	0.080	0.154	0.518	0.605

Age	-0.002	0.004	-0.549	0.583
Female	0.107	0.111	0.967	0.334
African American	-0.087	0.204	-0.425	0.671
AIAN	-0.431	0.452	-0.954	0.340
Asian	0.287	0.244	1.175	0.240
Race not released	12.196	377.633	0.032	0.974
Multiple Race	0.042	0.287	0.145	0.884
Married, spouse not in household	-0.091	0.410	-0.223	0.823
Widowed	-0.064	0.229	-0.279	0.780
Divorced	0.240	0.150	1.602	0.109
Separated	0.408	0.410	0.997	0.319
Never married	0.110	0.138	0.796	0.426
Living with partner	0.091	0.229	0.398	0.690
Unknown marital status	-1.081	1.419	-0.762	0.446

*Note.* Binomial logistic regression predicting whether a treatment was used because it was natural, for the third most important treatment ( $N = 2,045$ ). Data Source: CDC/NCHS, National Health Interview Survey 2012a.

## References

National Center for Health Statistics, (2012a), *Adult Alternative Medicine, National Health Interview Survey, 2012*, [public use data file and documentation.available at [http://www.cdc.gov/nchs/nhis/nhis\\_2012\\_data\\_release.htm](http://www.cdc.gov/nchs/nhis/nhis_2012_data_release.htm)]

—, (2012b), *Sample Adult, National Health Interview Survey, 2012*, [public use data file and documentation.available at [http://www.cdc.gov/nchs/nhis/nhis\\_2012\\_data\\_release.htm](http://www.cdc.gov/nchs/nhis/nhis_2012_data_release.htm)]