Title
Dangerous Double Dosing: How Naive Beliefs Can Contribute to Unintentional Overdose with Over-the-Counter Drugs

Journal
Journal of Public Policy & Marketing, 34(2)

ISSN
0743-9156

Authors
Catlin, Jesse R
Pechmann, Cornelia
Brass, Eric P

Publication Date
2015-09-01

DOI
10.1509/jppm.14.061

Peer reviewed

Dangerous Double Dosing: How Naive Beliefs Can Contribute to Unintentional Overdose with Over-the-Counter Drugs

Jesse R. Catlin, Cornelia (Connie) Pechmann, and Eric P. Brass

In a series of studies, consumers reviewed over-the-counter (OTC) drug packages and evaluated these drugs for concurrent use. The authors investigate whether the consumers utilized the active ingredients listed on the package and recognized the risks of double dosing when using two drugs with the same active ingredient. Both novice and expert consumers used the active ingredients to assess drug similarity, indicating that the information was accessible. However, only medically trained experts used this information to assess the risks of taking two drugs concurrently, indicating that they understood its diagnosticity or relevancy. Novices' failure to view double dosing as risky suggests that they might hold a naive belief that OTC drugs are relatively risk free; thus, the authors test interventions to increase active ingredient diagnosticity versus accessibility. One intervention considered by OTC drug manufacturers makes active ingredients more accessible on packages using icons. However, the authors found this approach alone to be ineffective, whereas interventions enhancing the diagnosticity of ingredients through public service messages or package warnings yielded promising results. Thus, interventions may benefit by going beyond accessibility to also highlight active ingredient diagnosticity.

Keywords: over-the-counter drugs, accessibility-diagnosticity model, consumer expertise, naive beliefs, drug labels

Online Supplement: http://dx.doi.org/10.1509/jppm.14.061

Consumer overdoses on over-the-counter (OTC) drug active ingredients, such as acetaminophen, are an area of increasing concern (www.knowyourdose.org). For example, a study of 3,618 acetaminophen users showed that 4.5% of them exceeded the recommended total daily dose (4,000 mg) on at least one of seven observation days (Kaufman et al. 2012). One way that consumers may inadvertently overdose is by taking two or more OTC drugs at the same time that contain the same active ingredient; that is, they may double dose on it. Research has suggested that 31% of U.S. consumers have taken an OTC drug in the past 12 months (Keckley and Coughlin 2012) and that taking two or more OTC drugs at the same time is quite common (Slone Epidemiology Center 2006). In a simulated drug-use scenario study, more than 45% of participants indicated that they would take two products with acetaminophen simultaneously (Wolf et al. 2012). Insights into consumer decision making may provide information relevant to the root cause of overdoses with OTC drugs and suggest approaches to mitigate this problem.

In the current research, we use the accessibility-diagnosticity model as a conceptual framework (Feldman and Lynch 1988; Lynch, Marmorstein, and Weigold 1988) to examine how consumers evaluate OTC drug labels and determine how they use the information on the packaging about the drugs' active ingredients. Specifically, we showed participants OTC drug packages that listed the active ingredients on the Principal Display Panel and in the Drug Facts Label

Jesse R. Catlin is Assistant Professor of Marketing, College of Business Administration, California State University, Sacramento (e-mail: jesse.catlin@csus.edu). *Cornelia (Connie) Pechmann* is Professor of Marketing, The Paul Merage School of Business, University of California, Irvine (e-mail: cpechman@uci.edu). *Eric P. Brass* is Professor of Medicine, David Geffen School of Medicine at University of California, Los Angeles, and Director, Harbor-UCLA Center for Clinical Pharmacology (e-mail: ebrass@ucla.edu). This project was funded in part by a UC Irvine Public Impact Distinguished Fellowship awarded to the first author. The authors appreciate feedback on previous versions of this article from Kitt Carpenter, Loraine Lau-Gesk, James M. Leonhardt, Lauren Louie, and Ted Wright. The authors also gratefully acknowledge assistance with stimuli design from Steven Chen and Jimin Zheng and data coding from Douglas Albertson and Skyler King. Disclosure: The third author serves as a consultant to companies on issues related to OTC drug labeling and comprehension. No outside organization provided funding for or directed this research. Janet Hoek served as associate editor for this article.

ISSN: 0743-9156 (print), 1547-7207 (electronic)

(Labeling Requirements for Over-the-Counter Drugs 2014a, b). We then asked them to rate pairs of OTC drugs on overall similarity and on the risk of taking the two drugs together. We recruited both novice consumers and expert consumers with medical training as our participants. We found that active ingredients consistently affected judgments of the similarity between two OTC drugs, indicating that the active ingredient information was accessible or salient to both novices and experts. However, experts, but not novices, considered active ingredients when judging the risk of taking two OTC drugs at the same time. Therefore, it seems that only the experts understood the diagnosticity or relevance of the active ingredient information for avoiding health risks caused by active ingredient double dosing.

In addition, our research compares the efficacy of two fundamentally different types of interventions to discourage consumers from double dosing on OTC drugs' active ingredients: interventions that focus on active ingredient information accessibility versus diagnosticity. One intervention considered by OTC drug industry members aims to increase the accessibility of active ingredient information by using package icons to draw attention to them (Kuffner 2010). In our research, we did not find that this method improved consumer risk assessments on its own. Another possible intervention is to increase active ingredient information diagnosticity through public service messages or warnings on drug package labeling that explicitly state that taking two OTC drugs together with the same active ingredient is risky (King et al. 2011). In our research, we found that this method helped consumers assess drug risks more appropriately. Thus, OTC drug makers and regulatory authorities may want to consider messages that stress active ingredient diagnosticity and not just accessibility.

Background, Theory, and Hypotheses

OTC Drugs

The growth in the size and sophistication of the OTC drug market mirrors the general rise in consumers' responsibility for their own health care (Scammon et al. 2011). More than 108 drug ingredients or dosages have been switched from prescription to OTC status in the United States since 1975 (Consumer Healthcare Products Association 2013a), and consumers spent more than $29 billion on OTC drugs in 2012 (Consumer Healthcare Products Association 2013b). However, despite these drugs' widespread availability and use, studies on OTC drugs in the marketing literature are sparse (cf. DeLorme et al. 2010; Ellen, Bone, and Stuart 1998; Hoy 1994; Morris et al. 1998). Furthermore, most studies have examined consumers' consideration of individual drug labels (Brass 2004; Catlin, Pechmann, and Brass 2012; Goyal et al. 2012; Raymond, Dalebout, and Camp 2002; Sansgiry and Cady 1995; Sansgiry, Cady, and Adamcik 1997) rather than their evaluation of labels for two drugs considered for concurrent use. Our research aims to address these knowledge gaps.

The widespread availability of OTC products and the ability to purchase them without a doctor's prescription may imply to consumers that these products are harmless even if used inappropriately or in excess (Bower, Grau, and Taylor 2013; Kaufman et al. 2012). However, this belief is erroneous. One of the most widely used and marketed OTC active ingredients is acetaminophen, and it exemplifies how exceeding dosage recommendations can have severe health consequences. In the United States, acetaminophen overdose is one of the most common causes of acute liver failure (Larrey and Pageaux 2005; Ostapowicz et al. 2002) and leads to over 100,000 calls to poison control centers and more than 56,000 emergency room visits per year (Lee 2007). Although some of these cases are due to self-harm, more than half are unintentional (Bower et al. 2007; Larson et al. 2005; Ostapowicz et al. 2002).

One means by which consumers may overdose is by taking two medications at the same time that contain the same active ingredient (i.e., double dosing), and research has suggested that this kind of mistake is common (Wolf et al. 2012). For example, if a consumer with cold symptoms takes a multisymptom cold medication with acetaminophen and decides to take a separate pain relief medication with acetaminophen, (s)he will likely ingest at least 1,300 mg of acetaminophen. If these dosages are repeated every four to six hours as directed, the consumer will ingest at least 5,200 mg of acetaminophen in a day, well exceeding the recommended limit of 4,000 mg per day (Epocrates 2014). Moreover, many OTC drugs contain the same active ingredients but are marketed for different symptoms and/or under different brand names. Thus, the only way to avoid double dosing is to compare the active ingredients (i.e., active ingredient is a diagnostic attribute; Feldman and Lynch 1988). In this context, the drug brand name and symptom indicated are less diagnostic (i.e., less indicative of risk and more subject to strategic manipulation by marketers).

Given the ease with which inappropriate dosing decisions can occur and the possibility of serious consequences, OTC drug makers and regulators are considering several consumer interventions. Some focus on active ingredient information accessibility or salience (e.g., including active ingredients icons on the package [Kuffner 2010], listing ingredients on bottle caps [CNN 2013]). A different type of intervention focuses on active ingredient information diagnosticity or relevance (e.g., using public service messages or warnings on the product packaging to clearly tell consumers not to take two OTC drugs with the same active ingredient; King et al. 2011). We use the accessibility-diagnosticity model and focus on consumer naive beliefs to examine consumer OTC drug decision making and the efficacy of these two intervention approaches.

Accessibility-Diagnosticity Model

The accessibility-diagnosticity model (Feldman and Lynch 1988; Lynch, Marmorstein, and Weigold 1988) provides a simple, yet powerful conceptual framework for understanding consumers' use of OTC drug information and for designing interventions to nudge consumers toward using this information more effectively. Utilized widely by researchers in marketing and other fields (Ahluwalia and Gürhan-Canli 2000; Herr, Kardes, and Kim 1991; Menon, Raghubir, and Schwarz 1995), this model states that the probability that information will be used in judgments is dependent on the degree to which the information is both

accessible and perceived as diagnostic. Extending this model to OTC drugs, we address the following research questions. First, do novice and/or expert consumers attend to OTC active ingredient information on the product packaging (i.e., is this information accessible to them)? Furthermore, do novice and/or expert consumers understand the diagnosticity or relevance of the OTC active ingredient information in terms of helping them determine whether they can safely take two OTC drugs concurrently? Do novices instead hold a naive belief that OTC drugs are relatively risk free, leading to the incorrect perception that active ingredients are nondiagnostic for assessing health risk? Finally, can interventions benefit novice and/or expert consumers by enhancing OTC active ingredient accessibility and/or diagnosticity, and if so, what types of interventions are optimal?

Prior research has indicated that novice consumers (i.e., those without medical training), are prone to ignore or discount active ingredient information about OTC drugs. In a study by the National Council on Patient Information and Education (2002), just 34% of respondents reported that they looked at active ingredients when making OTC drug purchase decisions, and only 20% reported that they looked at active ingredients the first time they took an OTC drug. The results of an eye-tracking study by Bix et al. (2009) suggest that more than 20% of the participants did not even look at the Drug Facts Label that listed the active ingredients on the packaging that they were given to review. In addition, 67% could not recall any of the active ingredients; instead, they were most likely to recall attributes such as the brand names and symptoms indicated.

In line with these results, many of the interventions under consideration are attempts to make active ingredients more accessible or salient on OTC drug packaging. However, drawing on the accessibility-diagnosticity model (Feldman and Lynch 1988; Lynch, Marmorstein, and Weigold 1988), consumers' perceptions of the diagnosticity of the active ingredients should also be considered. Consumers must understand that active ingredients are diagnostic, consider the active ingredients in their risk judgments, and avoid overdosing on any active ingredient. However, novice consumers may possess a naive or erroneous belief that OTC drugs are relatively risk free, so they may perceive OTC active ingredients as nondiagnostic for assessing health risks. If so, it may be necessary to educate them that OTC active ingredient information is diagnostic for assessing the health risk of taking two OTC drugs concurrently.

Consumers' Naive Beliefs

Research has suggested that consumers often hold naive beliefs or lay theories about products (Deval et al. 2013; Hughner and Kleine 2008; Wang, Keh, and Bolton 2010). Naive beliefs are "informal, common-sense explanations people use in their everyday lives to make sense of their environment and often diverge from formal, scientific accounts" (Furnham 1988, cited in Deval et al. 2013, p. 1185). Some common naive product beliefs are that healthy foods do not taste good (Raghunathan, Naylor, and Hoyer 2006) and that sustainable products are not strong enough to be effective (Luchs et al. 2010).

In the health domain, Wang, Keh, and Bolton (2010) find that when consumers feel certain about their diagnosis, they tend to be influenced by the naive belief (or "lay theory") that Western medicine treats specific ailments with precision, so they prefer Western medicine. In contrast, when consumers feel uncertain about their diagnosis, they tend to be influenced by their naive belief that Eastern medicine provides a more holistic focus on the body, so they prefer Eastern medicine. Despite the demonstrated usefulness of studying consumers' naive beliefs in health domains, consumers' naive beliefs about OTC drugs have not been systematically studied. Over-the-counter drugs are widely available without consulting a medical professional, are ubiquitously advertised and used, and can usually be purchased in large quantities. This may suggest to consumers that OTC drugs are relatively harmless. Indeed, a recent study has found that many consumers hold the belief that they could choose their own OTC dose irrespective of the label directions, and this belief was associated with an increased likelihood to exceed recommended dosages of acetaminophen (Kaufman et al. 2012). In addition, Bower, Grau, and Taylor (2013) find that college students judged the consequences of noncompliance with drug dosing and other instructions to be less serious for OTC drugs than prescription drugs and expressed a lower intention to comply with OTC drug instructions. These findings suggest that many consumers may believe that OTC drugs are relatively risk free even if they take more than the recommended dose. This naive belief would mean that the OTC active ingredients would not be perceived as diagnostic when judging health risk.

Current Methods and Hypotheses

We examine the accessibility and diagnosticity of OTC active ingredient information by comparing the open-ended responses of experts (with medical training) and novice consumers (without medical training) to prompts about OTC drugs. In effect, we use expert versus novice comparisons to examine whether novice consumers lack the accessible information about OTC drugs' active ingredients that experts possess. In addition, we investigate whether novice consumers lack the understanding that OTC active ingredients are diagnostic for assessing health risks that experts possess and, instead, hold a naive belief that OTC drugs are relatively risk free.

Drawing on studies suggesting that OTC drugs' active ingredients are often not recalled (Bix et al. 2009) or considered in purchase decisions (National Council on Patient Information and Education 2002), we posit that when novices are asked their thoughts about OTC drugs, they will report few thoughts about active ingredients, indicating low information accessibility. We also posit that expert consumers with medical training will report more thoughts about active ingredients owing to their greater awareness of active ingredients.

H_1: Novices report fewer thoughts about OTC drugs' active ingredients relative to experts.

Furthermore, we expect that owing to OTC drugs' ubiquitous availability, extensive use, and widespread advertis-

ing, novice consumers will hold the naive belief that OTC drugs are relatively risk free and view OTC active ingredients as nondiagnostic for assessing health risk. Specifically, we expect novice consumers, but not expert consumers, to report thoughts about OTC drugs' safety and risks that are consistent with this naive belief.

H_2: Novices report more thoughts suggesting that OTC drugs are safe and fewer thoughts suggesting that OTC drugs are risky, relative to experts.

We also employ other measures to examine whether the OTC drugs' active ingredients are salient or accessible on the packaging and diagnostic with respect to health risks, because a failure to perceive this diagnosticity would suggest a naive belief. We showed both novice and expert consumers pairs of OTC drugs that included the front of the package (Principal Display Panel) and the back of the package (Drug Facts Label), both of which listed the active ingredients as required by the Food and Drug Administration (Labeling Requirements for Over-the-Counter Drugs 2014a, b). Then, we measured judgments of similarity and the risk of taking both drugs concurrently.

In line with the categorization literature about how similarity judgments are made, we expect consumers to judge the similarity of two OTC drugs on the basis of whether their salient features are the same versus different (Goldstone 1994). In other words, we expect them to look for features that match or are mismatched and conclude that more matches suggest greater similarity and vice versa (Gierl and Huettl 2011; Tversky 1977). Furthermore, we expect a comparable pattern of results for OTC active ingredient accessibility and diagnosticity using this similarity-based method as we did using the free recall method discussed previously. We posit that novices, relative to experts, will be less sensitive to matches or mismatches in two OTC drugs' active ingredients when judging the drugs' similarity because the active ingredient information will be less accessible to them. In addition, we anticipate that novices, relative to experts, will be less sensitive to matches or mismatches in two OTC drugs' active ingredients when judging the health risk of taking the drugs concurrently because they will perceive the active ingredient information as less diagnostic for assessing health risk, owing to the naive belief that OTC drugs are relatively risk free. Our formal hypotheses are as follows:

H_3: Novices are less influenced by whether the active ingredient in two OTC drugs is the same (vs. different) when judging the drugs' similarity, relative to experts.

H_4: Novices are less influenced by whether the active ingredient in two OTC drugs is the same (vs. different) when judging the risk of taking both drugs concurrently, relative to experts.

Building on these hypotheses, we also aim to assess potential interventions to assist consumers. We rely on the accessibility-diagnosticity model (Feldman and Lynch 1988; Lynch, Marmorstein, and Weigold 1988), which posits that information accessibility is necessary but insufficient to ensure that information is used in judgments. Information must also be perceived as diagnostic to be used in judgments. Thus, we anticipate that interventions that merely make OTC drugs' active ingredients more accessible or noticeable by drawing attention to them (e.g., by using package icons) will fail on their own to improve consumers' judgments of the risk of taking two drugs concurrently with the same active ingredient.

Rather, we predict that interventions will improve consumers' risk judgments only if they educate consumers that active ingredient information is diagnostic because taking two OTC drugs with the same active ingredient concurrently poses a health risk. Doing so would help weaken or dispel the naive belief that OTC drugs are relatively risk free. Furthermore, we reason that, in the general population, consumers across a range of expertise levels would likely benefit from interventions that enhance the diagnosticity or relevance of OTC active ingredient information. Medically trained experts such as physicians or nurses would likely not benefit, owing to a ceiling effect, but they would not be the target of such interventions. In our intervention studies, we focus on the general target population and hypothesize the following:

H_5: An intervention that merely draws attention to OTC drugs' active ingredients (vs. control) does not affect consumers' judgment of the risk of taking two OTC drugs together with the same active ingredient.

H_6: An intervention that states that it is risky to take two OTC drugs together with the same active ingredient (vs. control) increases consumers' judgment of this risk.

We test these hypotheses across five studies. In the first two studies, we compare the responses of medically trained experts with those of novices without medical training to explore OTC active ingredient information accessibility and diagnosticity for assessing health risks. We reason that if people consider the ingredients nondiagnostic of health risks, this would suggest a naive belief that OTC drugs are relatively risk free. Next, we conduct three more studies to evaluate intervention strategies that either merely enhance OTC active ingredient accessibility or enhance diagnosticity and weaken naive beliefs by helping consumers recognize the risk of concurrently taking two OTC drugs that contain the same active ingredient.

Study 1: Open-Ended Thoughts

Aim and Participants

In Study 1, we use an open-ended thought-listing task to examine whether novices and experts differ in their accessible thoughts about OTC drugs' active ingredients or in their diagnostic thoughts about the drugs being safe versus risky. We recruited 24 nursing students as experts (M_{age} = 22.7 years; 87.5% female) and 114 students enrolled in undergraduate business courses as novices (M_{age} = 22.8; 42.1% female). Both samples were from a large U.S. West Coast university. As an incentive for participating, the experts were entered into a lottery for a retail gift card and the novices received partial course credit.

Design, Stimuli, Procedure, and Measures

We used a one-factor between-subjects design with two levels: experts versus novices. The study was conducted online using Qualtrics. First, participants completed an open-ended thought-listing task in which they responded to one

randomly presented prompt for a common OTC product or brand (OTC medicines, OTC cold medicines, OTC pain relievers, or Advil Pain Reliever). Participants were asked to list the thoughts that came to mind in response to the prompt and to list one thought per line.

Afterward, participants completed a multiple-choice measure of objective OTC drug knowledge. They were asked to identify the main active ingredient for 13 common OTC drug brands (e.g., Aleve, Motrin) and for 7 common symptoms treated by OTC drugs (e.g., pain reliever, decongestant) ($\alpha = .76$). Next, participants completed a subjective measure of their OTC drug knowledge adapted from Cowley and Mitchell (2003): "How much do you know about Over-the-Counter medications?" (1 = "very little," and 7 = "a great deal") and "I know more than most about Over-the-Counter medications" (1 = "strongly disagree," and 7 = "strongly agree") ($\alpha = .75$). Finally, participants reported their demographic information.

Analyses and Results

Analyses

We analyzed the data by comparing the responses of experts and novices using chi-square tests for their coded responses on the thought-listing task and t-tests for the objective and subjective knowledge measures. Because our Institutional Research Board mandated that participants be allowed to skip questions, there were a small number of missing responses, which caused the degrees of freedom to vary slightly across measures.

Expertise Check

As we expected, experts answered the objective knowledge questions more accurately than novices ($M_{expert} = 39.8\%$ vs. $M_{novice} = 20.7\%$; $t(136) = 6.26$, $p < .001$). Similarly, experts reported higher levels of subjective knowledge than novices ($M_{expert} = 3.71$ vs. $M_{novice} = 3.00$; $t(136) = 2.48$, $p = .014$).

Responses to the Drug Prompts

Participants listed a total of 960 thoughts in response to the open-ended prompts about OTC drugs, or an average of approximately 7 thoughts per participant. Experts and novices listed roughly similar numbers of thoughts ($M_{expert} = 8.04$ vs. $M_{novice} = 6.73$; $t(136) = 1.18$, $p = .24$). Two independent judges who were blind to the research hypotheses coded each thought to indicate whether it mentioned (1) an active ingredient, (2) a brand name, (3) a symptom indicated, (4) a belief that OTC drugs are safe, (5) a belief that OTC drugs can sometimes be risky, or (6) miscellaneous (see Table 1). There was an acceptable level of agreement among the coders (Kappa = .82, $p < .001$) (Landis and Koch 1977), and coding discrepancies were resolved through discussion. We then generated a dichotomous variable for each thought type in which 1 indicated that a participant mentioned it and 0 indicated that (s)he did not.

We found that 50.0% of experts mentioned active ingredients, compared with 16.7% of novices ($\chi^2(1) = 12.65$, $p < .001$). In addition, 50.0% of experts mentioned that OTC drugs can sometimes be risky, compared with 24.6% of novices ($\chi^2(1) = 6.23$, $p = .01$). But experts and novices did not differ in stating the belief that OTC drugs are safe, and mentions of this belief were infrequent in both groups (experts = 4.2% vs. novices = 7.9%; $\chi^2(1) = .41$, $p = .52$). We found no other expert versus novice differences in terms of reported thoughts (ps > .22; see Table 1).

Discussion

Using an open-ended thought-listing task, Study 1 showed that the active ingredients of OTC drugs were less accessible in the minds of novices as compared with experts, consistent with H_1. In partial support of H_2, novices (vs. experts) were less likely to report diagnostic thoughts about OTC drugs being risky, suggesting that they might have held the naive belief that OTC drugs were relatively risk free. However, novices (vs. experts) were not more likely to state affirmatively that OTC drugs were safe; very few participants in either group did so explicitly. These findings provided some preliminary evidence that among novices, compared with experts, OTC active ingredient information is less accessible and lower in diagnosticity, with lower diagnosticity indicating a possible naive belief.

Study 2: Similarity and Risk Judgments

Aim and Participants

In Study 2, both novice and expert consumers rated the similarity of pairs of OTC drugs and indicated the risk of

Table 1. Expert Versus Novice Differences in Response to OTC Drug Prompts in Study 1

Thought Type	Novice	Expert	*p*-Value	Examples of Thoughts
Active ingredient	16.7%	50.0%	$p < .001$	Ibuprofen, acetaminophen
Brand name	44.7%	58.3%	$p = .23$	Advil, Aleve
Symptom indicated	54.4%	66.7%	$p = .27$	Cold, pain relief
Belief that OTC drugs are safe	7.9%	4.2%	$p = .52$	Safe, no dependence
Belief that OTC drugs can sometimes be risky	24.6%	50.0%	$p = .013$	Dangerous, overdose
Miscellaneous	75.4%	79.2%	$p = .70$	No prescription, affordable

Notes: Percentages represent the proportion of respondents listing each type of thought in response to an OTC drug–related prompt. *p*-values are from chi-square tests.

taking both drugs together when the drugs had the same active ingredient, brand name, or symptom indicated. We used similarity judgments to examine whether active ingredient information was accessible. We used risk judgments to assess the diagnosticity of active ingredient information for assessing the risk of taking two drugs concurrently, with low diagnosticity suggesting a naive belief that OTC drugs are relatively risk free.

We also examined how novice and expert consumers responded to other attribute information on the drug packaging: the brand name (e.g., Aleve, Motrin) and the symptoms indicated to describe the drug's purpose (e.g., pain reliever, cough suppressant). We compared how they used these attributes relative to active ingredients when judging the similarity of two drugs and the risk of taking both drugs together. We recruited 11 nursing students and 15 medical students as experts (total n = 26; M_{age} = 24.6 years; 76.9% female) and 77 students enrolled in undergraduate psychology courses as novices (M_{age} = 20.3 years; 77.9% female). Both samples were from large U.S. West Coast universities. Participants were compensated as in the previous study.

Design and Stimuli

This online Qualtrics study used a 2 (expert vs. novice) × 2 (active ingredient same vs. different) × 2 (brand name same vs. different) × 2 (symptom indicated same vs. different) mixed design in which expertise was a between-subjects factor and active ingredient, brand name, and symptom-indicated sameness were within-subject factors. The stimuli were images of OTC drugs in their retail packaging, except each package was simplified to list a single active ingredient to reflect the study design. Specifically, each participant was shown eight pairs of OTC drugs (2 active ingredient × 2 brand name × 2 symptom-indicated sameness; Web Appendix A), with each pair presented on a separate page and in random order. Both the front package panel (Principal Display Panel) and the back package panel (Drug Facts Label) were shown (Web Appendix B).

Procedure and Measures

For each OTC drug pair, participants were asked to imagine that a person experiencing discomfort had taken both drugs at the same time and then to rate the riskiness of this decision (i.e., the concurrent use risk) with these two questions: (1) "How safe would it be for this person to take both of these medications at the same time?" (1 = "not at all safe," and 7 = "very safe"; reverse coded) and (2) "How likely is it that the decision to take these two medications at the same time could cause this person harm?" (1 = "not at all likely," and 7 = "very likely") (average α = .81).

Participants also rated the similarity of each OTC drug pair using three seven-point semantic differential scales with endpoints ("not at all similar/very similar," "not at all related/very related," and "not at all alike/very alike"; adapted from Mervis and Crisafi 1982; Muthukrishnan and Weitz 1991; average α = .95). Participants could refer to the drug packages while completing these measures. Next, participants completed a subset of the objective knowledge measures used in Study 1 (with seven brand and seven drug function items; α = .87) and the same subjective knowledge measure (α = .88). Finally, they reported their demographics.

Analyses and Results

Analyses

We analyzed the data using mixed-model analyses of variance (ANOVAs) with a between-subjects factor representing expertise (expert vs. novice) and within-subject factors representing active ingredient sameness, brand name sameness, and symptom-indicated sameness (same vs. different). The models included all main effects and the interactions for expertise × active ingredient sameness, expertise × brand name sameness, and expertise × symptom-indicated sameness. Degrees of freedom differed slightly owing to some missing responses.

Expertise Check

Experts answered the objective knowledge questions more accurately than novices (M_{expert} = 69.2% vs. M_{novice} = 32.1%; t(101) = 7.18, $p < .001$) and reported higher levels of subjective knowledge than novices (M_{expert} = 4.44 vs. M_{novice} = 3.47; t(101) = 3.00, $p < .01$).

Similarity Judgments

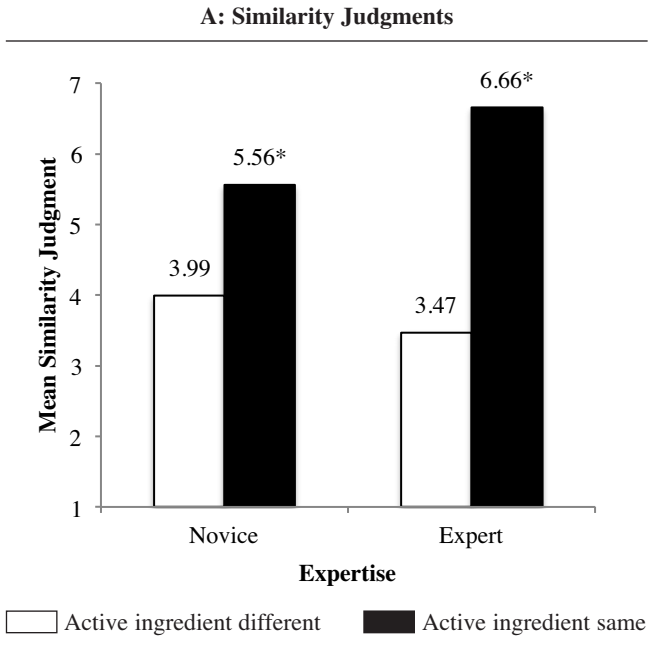
When the drug pair had the same (vs. different) active ingredient, similarity judgments increased ($M_{same\ ingredient}$ = 6.11 vs. $M_{diff.\ ingredient}$ = 3.73; F(1, 715) = 381.57, $p < .001$). Likewise, the same brand name increased similarity judgments ($M_{same\ brand}$ = 5.22 vs. $M_{diff.\ brand}$ = 4.62; F(1, 715) = 24.08, $p < .001$), as did the same symptom indicated ($M_{same\ symptom}$ = 5.58 vs. $M_{diff.\ symptom}$ = 4.26; F(1, 715) = 118.57, $p < .001$). Furthermore, experts were marginally more likely to judge drug pair similarity as being higher than novices (M_{expert} = 5.07 vs. M_{novice} = 4.77; F(1, 101) = 3.65, $p = .059$).

In addition, there was an expertise × active ingredient sameness interaction for similarity judgments (F(1, 715) = 44.50, $p < .001$). When the drug pair had the same (vs. different) active ingredient, similarity judgments among novices increased ($M_{novice\_same\ ingredient}$ = 5.56 vs. $M_{novice\_diff.\ ingredient}$ = 3.99; t(715) = 12.83, $p < .001$), but even more so among experts ($M_{expert\_same\ ingredient}$ = 6.66 vs. $M_{expert\_diff.\ ingredient}$ = 3.47; t(715) = 15.19, $p < .001$; Figure 1, Panel A). There was also an expertise × brand name sameness interaction for similarity judgments (F(1, 715) = 5.05, $p = .025$). When the drug pair had the same (vs. different) brand name, similarity judgments among novices increased ($M_{novice\_same\ brand}$ = 5.21 vs. $M_{novice\_diff.\ brand}$ = 4.34; t(715) = 7.14, $p < .001$) but expert similarity judgments did not ($M_{expert\_same\ brand}$ = 5.23 vs. $M_{expert\_diff.\ brand}$ = 4.91; t(715) = 1.54, $p = .12$). There was no expertise × symptom-indicated-sameness interaction for similarity judgments (F(1, 715) = 2.54, $p = .11$).

Concurrent Use Risk Judgments

When the drug pair had the same brand name, this did not affect concurrent use risk judgments ($M_{same\ brand}$ = 4.46 vs. $M_{diff.\ brand}$ = 4.46; F(1, 714) = .00, $p = .96$). When the drug pair had the same symptom indicated, this did not affect

Figure 1. Effects of the Same (vs. Different) Active Ingredients Among Novices and Experts in Study 2



*Indicates a difference ($p < .05$) between active ingredient same versus active ingredient different within each expertise group.

concurrent use risk judgments ($M_{same\ symptom} = 4.54$ vs. $M_{diff.\ symptom} = 4.38$; $F(1, 714) = 1.99$, $p = .16$). However, when the drug pair had the same (vs. different) active ingredient, this increased concurrent use risk judgments ($M_{same\ ingredient} = 4.91$ vs. $M_{diff.\ ingredient} = 4.01$; $F(1, 714) = 59.86$, $p < .001$). The main effect for expertise on risk judgments was not significant ($M_{expert} = 4.46$ vs. $M_{novice} = 4.46$; $F(1, 101) = .00$, $p = .99$).

In addition, there was an expertise × active ingredient sameness interaction for concurrent use risk judgments ($F(1, 714) = 68.66$, $p < .001$). When the drug pair had the same (vs. different) active ingredient, this did not affect concurrent use risk judgments among novices ($M_{novice\_same\ ingredient} = 4.43$ vs. $M_{novice\_diff.\ ingredient} = 4.49$; $t(714) = .55$, $p = .59$) but increased concurrent use risk judgments among experts ($M_{expert\_same\ ingredient} = 5.39$ vs. $M_{expert\_diff.\ ingredient} = 3.53$; $t(714) = 9.26$, $p < .001$; Figure 1, Panel B). Furthermore, there was an expertise × symptom-indicated sameness interaction for risk judgments ($F(1, 714) = 10.67$, $p = .001$). When the drug pair had the same (vs. a different) symptom indicated, risk judgments among novices marginally decreased ($M_{novice\_same\ symptom} = 4.35$ vs. $M_{novice\_diff.\ symptom} = 4.57$; $t(714) = 1.84$, $p = .065$) but those among experts increased ($M_{expert\_same\ symptom} = 4.73$ vs. $M_{expert\_diff.\ symptom} = 4.19$; $t(714) = 2.70$, $p < .01$). There was no expertise × brand name sameness interaction for risk judgments ($F(1, 714) = .85$, $p = .36$).

Discussion

Study 2 found that novices' similarity judgments were less influenced by active ingredients than experts, consistent with H_3. This indicates that active ingredients may have been less accessible or noticeable among novices than among experts. In addition, consistent with H_4, novices' risk judgments were uninfluenced by active ingredient information, whereas experts' judgments were influenced. In other words, novices failed to use active ingredients as a diagnostic or relevant attribute when assessing the risk of taking two OTC drugs together; only experts did this. Novices seemed to hold the naive belief that OTC drugs are relatively risk free because they viewed double doses of the same active ingredient as approximately the same in terms of health risk as single doses of two different ingredients. In the next three studies, we evaluate different interventions that focus on increasing only OTC active ingredient accessibility compared with those that also emphasize diagnosticity among consumers of varying expertise levels in the general population.

Study 3: Package Icon

Aim and Participants

In Study 3, we examine the efficacy of an intervention that is currently being considered to make active ingredients more accessible or salient on the product packaging (Kuffner 2010). This intervention would use simple icons and text to flag the active ingredients on the Drug Facts Label on the back of the packaging. In our studies, one possible explanation for novices' (vs. experts') relatively weaker use of active ingredient information in judging drug similarity and nonuse of active ingredient information in judging drug risk could be that the active ingredients were not sufficiently accessible. If so, then an inter-

vention that makes active ingredients more noticeable could help.

During data collection for Study 2, data were concurrently collected for Study 3 from a second group of undergraduate novices from the same subject pool (n = 78; M_{age} = 20.4 years; 70.5% female) who saw drug package labels with icons that made the active ingredients more salient. We compared these novices who saw the icons with the novices in Study 2 (n = 77; M_{age} = 20.3 years; 77.9% female), who were randomly assigned not to see the icons.

Design, Stimuli, Procedure, and Measures

This study used a 2 (active ingredient icon present vs. absent) × 2 (active ingredient same vs. different) × 2 (brand name same vs. different) × 2 (symptom indicated same vs. different) mixed design and included only novices. The active ingredient icon was a between-subjects factor. Active ingredient, brand name, and symptom-indicated sameness were within-subject factors. Similar to Kuffner (2010), the active ingredient icon featured (1) a red two-letter abbreviation (e.g., Ib for Ibuprofen) in a black hexagon and (2) white capitalized text in a rectangular red banner stating the active ingredient (e.g., "CONTAINS IBUPROFEN"; Figure 2). The icon appeared in the Drug Facts Label on the back of the packaging in the active ingredient section. The rest of the packaging and the other procedures and measures mirrored Study 2.

Analyses and Results

Analyses

We analyzed the data using mixed-model ANOVAs with a between-subjects factor representing the active ingredient icon (present vs. absent) and within-subject factors representing active ingredient, brand name, and symptom-indicated sameness (same vs. different). The models included all main effects and the active ingredient icon × active ingredient sameness interaction. A pooled analysis with Study 2 and Study 3 data and the icon variable specified as a nested factor within the novice group yielded comparable results; therefore, for parsimony we only report the unpooled analysis for novices. Degrees of freedom differ slightly owing to some missing responses.

Similarity Judgments

When the drug pair had the same (vs. different) active ingredient, novices' similarity judgments increased ($M_{same\ ingredient}$ = 5.55 vs. $M_{diff.\ ingredient}$ = 4.17; F(1, 1,075) = 265.48, p < .001). Novices' similarity judgments also increased when the drugs had the same brand name ($M_{same\ brand}$ = 5.28 vs. $M_{diff.\ brand}$ = 4.44; F(1, 1,075) = 98.19, p < .001) or the same symptom indicated ($M_{same\ symptom}$ = 5.56 vs. $M_{diff.\ symptom}$ = 4.16; F(1, 1,077) = 270.20, p < .001).

The active ingredient icon main effect was nonsignificant (M_{icon} = 4.95 vs. $M_{no\ icon}$ = 4.77; F(1, 153) = 2.34, p = .13;), but there was an active ingredient icon × active ingredient

Figure 2. Example of an OTC Drug Package with an Active Ingredient Icon Used in Study 3

Notes: Labels were presented in a format sufficiently large to permit reading of text.

sameness interaction ($F(1, 1{,}075) = 4.51$, $p = .034$). When the drug pair contained the same (vs. a different) active ingredient, novices' judgments of similarity were greater regardless of icon condition, but this effect was actually weaker in the condition with the active ingredient icon ($M_{icon\_same\ ingredient} = 5.55$ vs. $M_{icon\_diff.\ ingredient} = 4.35$; $t(1{,}076) = 10.03$, $p < .001$) relative to the condition with no icon ($M_{no\ icon\_same\ ingredient} = 5.56$ vs. $M_{no\ icon\_diff.\ ingredient} = 3.99$; $t(1{,}075) = 13.04$, $p < .001$). That is, when the active ingredient icons were included on the packaging, active ingredient sameness (vs. difference) actually had less impact on drug similarity judgments.

Concurrent Use Risk Judgments

When the drugs had the same (vs. different) active ingredient, novices' judgments of concurrent use risk actually decreased marginally ($M_{same\ ingredient} = 4.42$ vs. $M_{diff.\ ingredient} = 4.56$; $F(1, 1{,}071) = 2.74$, $p = .098$;). When the drug pair had the same (vs. a different) symptom indicated, novices' judgments of concurrent use risk also decreased ($M_{same\ symptom} = 4.40$ vs. $M_{diff.\ symptom} = 4.57$; $F(1, 1{,}073) = 4.31$, $p = .038$). The main effects for brand name sameness ($M_{same\ brand} = 4.42$ vs. $M_{diff.\ brand} = 4.55$; $F(1, 1{,}071) = 2.56$, $p = .11$) and the active ingredient icon ($M_{icon} = 4.52$ vs. $M_{no\ icon} = 4.46$; $F(1, 153) = .13$, $p = .72$) were nonsignificant. The icon × active ingredient sameness interaction was also nonsignificant ($F(1, 1{,}071) = .75$, $p = .39$).

Discussion

Consistent with H_5, Study 3 showed that an intervention considered by the OTC drug industry to increase the salience of the active ingredients on the packaging through icons was relatively ineffective on its own at improving risk assessments among novice consumers (i.e., consumers without medical training). Even after they saw the active ingredient icons, these consumers continued to naively believe that taking two OTC drugs with the same active ingredient (i.e., double dosing) was about as safe as taking two OTC drugs with different active ingredients. In addition, there was an unexpected trend suggesting that the icon may have actually made novices less sensitive to active ingredients in their drug similarity judgments. Though preliminary, this finding could indicate that novices focused on the icon itself rather than on the active ingredients in the context of this study. The studies that follow test interventions that go beyond merely trying to increase active ingredient accessibility; they also try to communicate the diagnosticity of the active ingredients.

Study 4: Public Service Message

Aim and Participants

In Study 4, we examine whether consumers' risk judgments could be improved by a public service message that both challenges their naive beliefs that OTC drugs are relatively risk free and educates them that OTC active ingredient information is diagnostic because taking two drugs concurrently with the same active ingredient poses a health risk. We use a general population sample to increase external validity.

Adult participants were recruited through a Qualtrics survey panel. A total of 3,031 invitations to participate were sent to U.S. residents over three days, with 259 people clicking the survey link and 160 completing the survey (age range: 18–78 years; $M_{age} = 45.1$ years; 50.0% female; 41.3% held a bachelor's degree or higher). One participant failed to complete the subjective knowledge measure and was excluded from the main analysis.

Design and Stimuli

The study used a 2 (treatment vs. control public service message) × 2 (active ingredient same vs. different) × 2 (brand name same vs. different) × 2 (symptom indicated same vs. different) mixed design. The message was a between-subjects factor, and the active ingredient, brand name, and symptom-indicated sameness were within-subject factors.

The public service message explicitly stated that taking two OTC drugs together with the same active ingredient was dangerous (Web Appendix C). We adapted this message from existing Food and Drug Administration (2013) public service messages about OTC drugs. The control message warned about the dangers of improper storage of OTC drugs around children and was based on public service messages from organizations affiliated with the Centers for Disease Control and Prevention (www.upandaway.org; Web Appendix C).

Procedure and Measures

Participants were told that they would be reading pages from a new online magazine that "specializes in short articles written by experts that are designed to help people live better lives" and that they would be asked their opinions about the articles. Participants then saw four one-page news articles as well as a one-page public service message on the third page that was randomly determined to be either the treatment or control message. The other articles were on personal finance, food safety, traveling with pets, and portable speakers and were adapted from Australian news websites (e.g., www.ninemsn.com.au). After viewing the pages at their own pace, participants completed a filler task in which they rated the articles on quality and other attributes. Then, they indicated whether they recalled reading articles on various topics and a question about recall of an article about OTC medicines served as an exposure check.

Next, participants were told that they would complete a different task and were shown the OTC drug rating task from Studies 2 and 3. They saw eight OTC drug pairs varying in whether the active ingredient, brand name, and/or symptom indicated were the same or different, and then they rated the drug pairs on similarity (average $\alpha = .96$) and concurrent use risk (average $\alpha = .70$). Finally, they completed the subjective knowledge measure used previously ($\alpha = .83$) and reported their demographics.

Analyses and Results

Analyses

We analyzed the data using mixed-model analyses of covariance with the public service message (treatment vs. control) as the between-subjects factor; active ingredient,

brand name, and symptom-indicated sameness (same vs. different) as within-subject factors; and a continuous covariate representing expertise, which used the subjective knowledge measure. Reported means were adjusted for the continuous expertise covariate (M = 4.38). The models included all main effects and the interactions for message × active ingredient sameness, message × expertise, active ingredient sameness × expertise, and message × active ingredient sameness × expertise.

Exposure Check

On average, 87% of the participants correctly recalled seeing the public service message about OTC drugs to which they had been exposed. Restricting the data to those who reported correct recall did not change the findings, and so the following analyses include the full sample.

Similarity Judgments

Similarity judgments increased when the drug pair had the same (vs. a different) active ingredient ($M_{same\ ingredient}$ = 5.88 vs. $M_{diff.\ ingredient}$ = 3.79; F(1, 1,107) = 47.86, p < .001), same (vs. a different) brand name ($M_{same\ brand}$ = 5.13 vs. $M_{diff.\ brand}$ = 4.55; F(1, 1,107) = 45.69, p < .001), or same (vs. a different) symptom indicated ($M_{same\ symptom}$ = 5.39 vs. $M_{diff.\ symptom}$ = 4.29; F(1, 1,107) = 166.38, p < .001). The expertise main effect was significant (F(1, 155) = 7.77, p < .01), but the public service message main effect was not ($M_{treatment}$ = 4.79 vs. $M_{control}$ = 4.89; F(1, 155) = .011, p = .92).

In addition, there was a public service message × active ingredient sameness interaction (F(1, 1,107) = 6.38, p = .012). When the drug pair contained the same (vs. a different) active ingredient, similarity judgments increased with both the treatment and control messages, but the effect was larger for the treatment message ($M_{treatment\_same\ ingredient}$ = 5.98 vs. $M_{treatment\_diff.\ ingredient}$ = 3.60; t(1,107) = 20.12, p < .001) than for the control message ($M_{control\_same\ ingredient}$ = 5.79 vs. $M_{control\_diff.\ ingredient}$ = 3.98; t(1,107) = 14.84, p < .001) (Figure 3, Panel A). Message × expertise (F(1, 155) = .02, p = .90), active ingredient sameness × expertise (F(1, 1,107) = .39, p = .53), and the three-way interaction (F(1, 1,107) = 2.54, p = .11) were all nonsignificant.

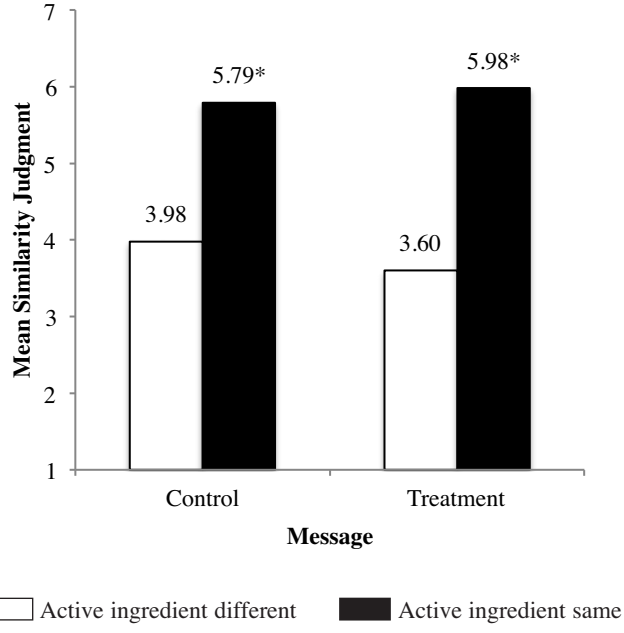
Concurrent Use Risk Judgments

When the drug pair had the same (vs. different) symptom indicated, this increased concurrent use risk judgments ($M_{same\ symptom}$ = 4.65 vs. $M_{diff.\ symptom}$ = 4.45; F(1, 1,107) = 5.35, p = .021). The main effects for active ingredient sameness ($M_{same\ ingredient}$ = 5.02 vs. $M_{diff.\ ingredient}$ = 4.08; F(1, 1,107) = .93, p = .34), brand name sameness ($M_{same\ brand}$ = 4.54 vs. $M_{diff.\ brand}$ = 4.56; F(1, 1,107) = .02, p = .89), message ($M_{treatment}$ = 4.63 vs. $M_{control}$ = 4.47; F(1, 155) = .77, p = .38), and the expertise covariate (F(1, 155) = .00, p = .99) were nonsignificant. Message × expertise (F(1, 155) = .33, p = .57) and the three-way interaction were also nonsignificant (F(1, 1,107) = 2.11, p = .15).

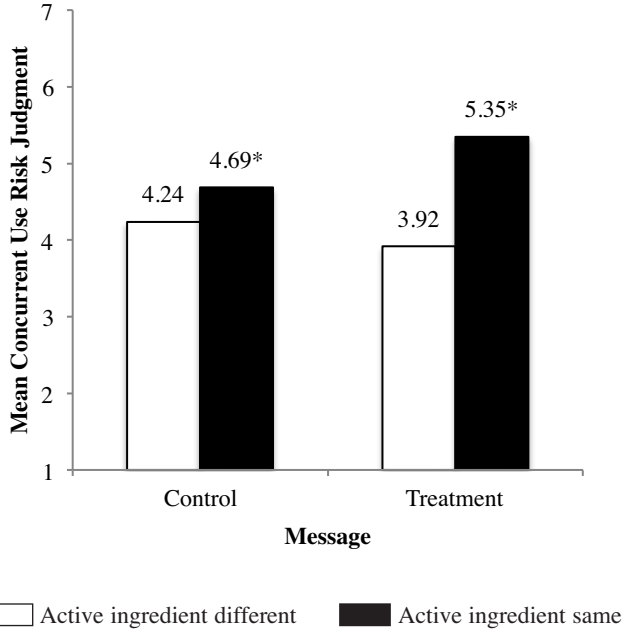
However, there was a public service message × active ingredient sameness interaction (F(1, 1,107) = 9.42, p < .01). Concurrent use risk judgments increased when active

Figure 3. Effects of the Same (vs. Different) Active Ingredients in the Treatment and Control Message Conditions in Study 4

A: Similarity Judgments



B: Concurrent Use Risk Judgments



*Indicates a difference (p < .05) between active ingredient same versus active ingredient different within each message condition.

ingredients were the same (vs. different) for both messages, but the effect was more pronounced for the treatment message ($M_{treatment\_same\ ingredient}$ = 5.35 vs. $M_{treatment\_diff.\ ingredient}$ = 3.92; t(1,107) = 11.70, $p < .001$) than for the control message ($M_{control\_same\ ingredient}$ = 4.69 vs. $M_{control\_diff.\ ingredient}$ = 4.24; t(1,107) = 3.63, $p < .001$) (Figure 3, Panel B).

Finally, there was an active ingredient sameness × expertise interaction (F(1, 1,107) = 5.93, $p = .015$). We used floodlight analyses (Spiller et al. 2013) to identify the region of expertise (range: 1 to 7; M = 4.38, SD = 1.42) in which the simple effect of active ingredient sameness was significant. We found that the turning point from nonsignificance to significance (i.e., the Johnson–Neyman point) for the effect of active ingredient sameness was at an expertise score of 3.65 (for a graph, see Web Appendix D). In other words, for participants with expertise scores of 3.65 or lower, active ingredient sameness (vs. difference) had no impact on concurrent use risk judgments. For participants with expertise scores greater than 3.65, active ingredient sameness (vs. difference) increased concurrent use risk judgments.

Discussion

Study 4 tested a public service message that expressly stated that taking two OTC drugs with the same active ingredient was dangerous. Consistent with H_6, the findings indicate that this message weakened the naive belief that OTC drugs were relatively risk free and enhanced the perception of the active ingredient as diagnostic in assessing the risk of taking two OTC drugs concurrently. Specifically, participants who saw the intervention message correctly judged that double dosing or using two OTC drugs with the same active ingredient (vs. different active ingredients) increased risk. Participants who saw the control message judged that using two OTC drugs with the same (vs. different active ingredients) active ingredient increased risk, but to a significantly lesser degree.

Notably, in our prior studies, novices did not judge that using two OTC drugs with the same (vs. different) active ingredients increased risk. However, in this study we recruited from the general population, and some of the participants had greater OTC drug expertise, as our subjective knowledge measure indicated. A floodlight analysis showed that participants who reported greater expertise correctly judged that taking two drugs with the same active ingredient (vs. different active ingredients) increased risk, while participants who reported less expertise did not.

However, the effect of the public service message did not depend on level of subjective expertise, as the nonsignificant three-way message × active ingredient sameness × expertise interaction indicated. That is, participants benefited from the public service message similarly, regardless of their subjective, self-reported OTC drug expertise. However, experts with formal medical training (e.g., medical and nursing students such as those in our previous studies) may be less likely to benefit from these types of interventions. In our final study, we test the impact of a similar message on the drug packaging.

Study 5: Warning on Package

Aim and Participants

Study 5 tests a warning message on the OTC drug packaging that explicitly tells consumers that they should not take two OTC drugs with the same active ingredient concurrently because doing so could be harmful. The warning aimed to increase the diagnosticity of active ingredient information for judging concurrent use risk by dispelling the naive belief that OTC drugs were relatively risk free. In this study, for parsimony, we did not vary whether the active ingredient in two drugs was the same versus different. Instead, we focused on consumers contemplating concurrent use of two OTC drugs with the same active ingredient and studied the efficacy of an on-package warning not to do so.

We again used a general population sample to increase external validity. Adult participants were recruited through a Qualtrics survey panel. A total of 8,069 invitations were sent to U.S. residents over three days, with 1,231 people clicking the survey link and 159 completing the survey (age range: 19–83 years; M_{age} = 46.3 years; 50.3% female; 45.9% held a bachelor's degree or higher).

Design and Stimuli

This study used a one-factor, between-subjects design with participants randomly assigned to one of two message conditions (warning present vs. absent). Each participant saw the same pair of OTC drugs that contained the same active ingredient, naproxen sodium, but the drugs had different brand names (Aleve or Sudafed) and different symptoms indicated (pain or congestion). Participants viewed the front and the back of the retail packaging for each drug, and the packaging did or did not include a warning in the Drug Facts Label.

Specifically, in the warning present condition, both drug packages included the following: (1) a black hexagon with red text stating, "Read First," and (2) black text highlighted in yellow stating, "Taking too much naproxen sodium can harm you. Follow instructions and do not take more than one drug that contains naproxen sodium at a time." These warnings appeared at the top of the warning section, immediately below the active ingredient section (Figure 4). In the warning absent condition, the same drug pair was used but the packages lacked this warning.

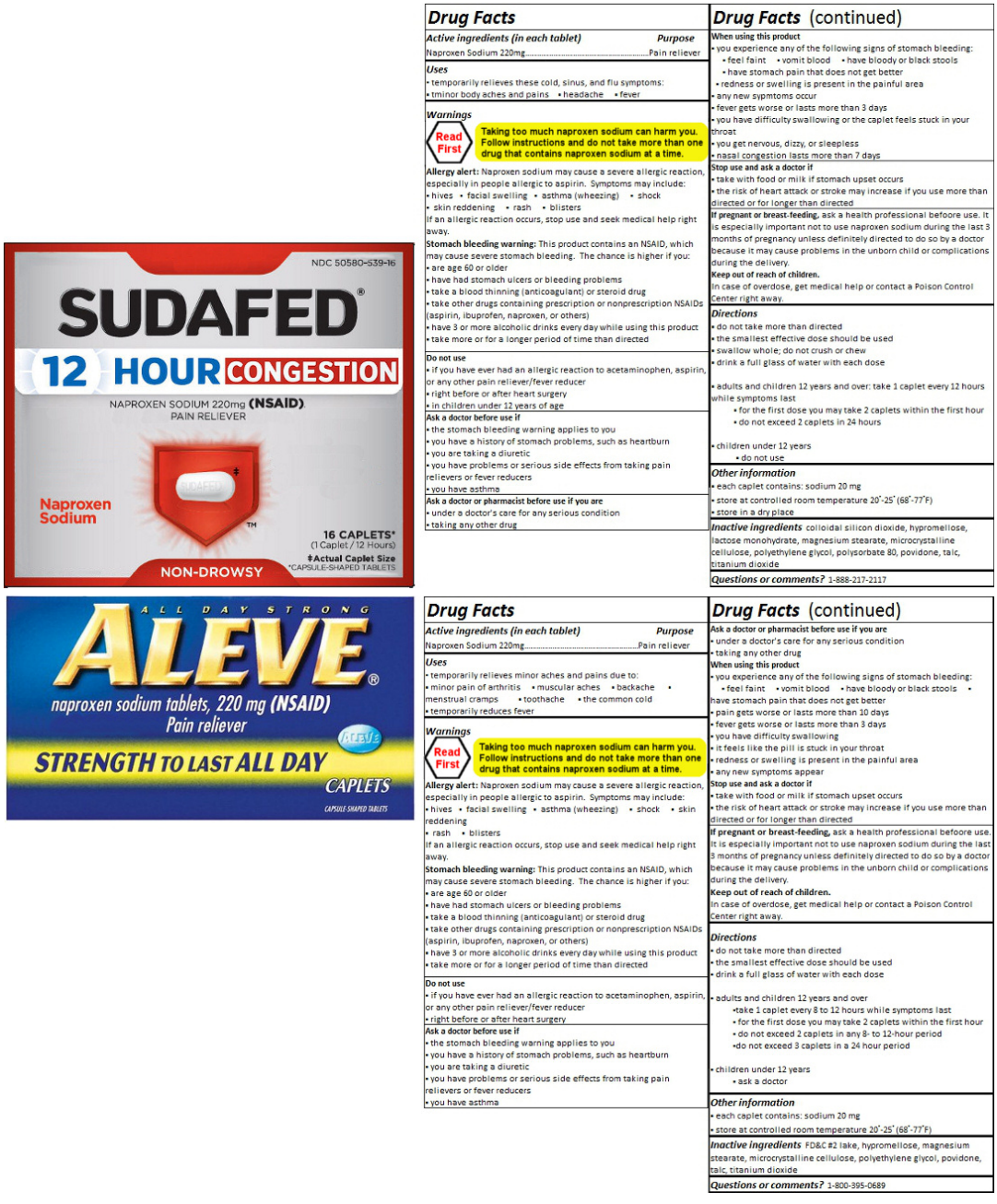
Procedure and Measures

Participants rated the pair of drugs using the same measures of similarity ($\alpha = .96$) and concurrent use risk ($\alpha = .56$) that we used previously. Participants were then asked to complete the same subjective knowledge measure ($\alpha = .84$) and to provide their demographics.

Analyses and Results

We analyzed the data using an ANOVA with a between-subjects factor representing the message condition (warning present vs. warning absent). We excluded the expertise (subjective knowledge) measure from the analysis because

Figure 4. OTC Drug Packages with the Warning Message Used in Study 5



it did not interact significantly with the message condition. This result is consistent with Study 4, which also indicates that the efficacy of a public service message did not depend on subjective expertise. Previously, we found that expertise affected whether the same versus different active ingredient affected risk judgments, but here this factor was held constant; this focal drug pair had the same active ingredient.

Similarity and Concurrent Use Risk Judgments

The two OTC drugs were judged as more similar when the packaging contained the warning message ($M_{message}$ = 5.70) versus when it did not ($M_{no\ message}$ = 5.00; $F(1, 157) = 7.95$, $p < .01$). In addition, participants judged the riskiness of taking the two OTC drugs concurrently to be higher when the packaging contained the warning message ($M_{message}$ = 5.67) versus when it did not ($M_{no\ message}$ = 5.01; $F(1, 157) = 8.34$, $p < .01$).

Discussion

Study 5 examined the efficacy of including a warning message on OTC drug packaging that stated that taking two drugs with the same active ingredient concurrently was harmful. We found that including this warning, which focused on active ingredient diagnosticity and challenged the naive belief about OTC drugs being nonrisky, was efficacious, consistent with H_6. Consumers who saw the drug packaging with this warning judged the risk of double dosing on the active ingredient to be higher compared with those who saw the standard drug packaging.

General Discussion

Across five studies, we investigate consumers' beliefs about OTC drugs and their judgments about whether it is safe to take two OTC drugs that have the same active ingredient concurrently. Our findings indicate that novice consumers (e.g., consumers without medical training) incorrectly think that it is equally safe to take two OTC drugs that have the same or different active ingredients concurrently. In other words, most consumers without medical training do not seem to understand the risk of double dosing on OTC drugs' active ingredients, consistent with their holding the naive belief that OTC drugs are relatively risk free.

We also evaluated two fundamentally different types of interventions for addressing this problem: interventions that increase only the accessibility or salience of OTC drug active ingredient information on the packaging and interventions that also increase the diagnosticity or relevance of active ingredient information by expressly stating that concurrently taking two OTC drugs with the same active ingredient can be harmful. Some of the interventions being considered by the OTC drug makers and regulators focus on salience. For example, using package icons to signal active ingredients such as acetaminophen (Kuffner 2010) could make it easier for consumers to see which drugs have the same active ingredient; they could simply look for matching icons. However, our results suggest that adding active ingredient icons without educating consumers as to their meaning may not have a straightforward effect. Instead, the icons seemed to make participants less sensitive to whether two OTC drugs had the same or different active ingredients when they made drug similarity judgments. In our study, consumers focused on the icons per se rather than on the active ingredients. Most importantly, icons had no effect on consumers' judgments of concurrent drug use risk when employed alone in our study.

Our results suggest that interventions should also include efforts to make OTC drugs' active ingredient information more diagnostic. For example, public service messages or warnings on packages could expressly state that consumers should avoid concurrently taking two OTC drugs with the same active ingredient (King et al. 2011). Consumers who saw messages and warnings of this type in our studies more appropriately judged the risk of taking two OTC drugs concurrently to be higher when the drugs contained the same (vs. different) active ingredients.

Theoretical and Methodological Contributions

This research makes theoretical contributions by utilizing theories about information accessibility and diagnosticity (Feldman and Lynch 1988) and consumers' naive beliefs (e.g., Deval et al. 2013) to better understand the decision-making processes that consumers use to evaluate OTC risks. We found evidence that consumers' naive beliefs were related to misperceptions of attribute diagnosticity. Consumers held the naive belief that OTC drugs were relatively risk free and failed to appreciate the diagnosticity or relevance of OTC drugs' active ingredients for assessing the risk of taking two drugs concurrently.

Thus, these studies build on prior work examining consumers' naive beliefs, including beliefs about health (Hughner and Kleine 2008) and Eastern and Western medicine (Wang, Keh, and Bolton 2010). In addition, we add to the evidence that naive beliefs are malleable (Deval et al. 2013) and can be corrected through public service messages and warnings. However, we also find that corrective efforts should explicitly address the specific beliefs to be effective (e.g., state that concurrently taking OTC drugs with the same active ingredient is risky). Simply drawing attention to active ingredients on the packaging may not be enough in isolation.

This research also makes methodological contributions by demonstrating a different approach to measuring product attribute accessibility and diagnosticity. Specifically, we measured accessibility by asking participants to judge the similarity of drug pairs with the same (vs. different) active ingredients. If they considered active ingredients in their similarity judgments, this implied that the information was accessible to them. Correspondingly, we measured diagnosticity by asking participants to judge the concurrent use risk of taking two drugs with the same (vs. different) active ingredients. If they considered active ingredients in their risk judgments, this implied that they perceived the information to be diagnostic of risk. In addition, our work demonstrates how comparing the thoughts and judgments of novices relative to experts can help identify novices' incorrect perceptions of attribute diagnosticity and their related naive beliefs. These approaches might be useful in further research.

Policy and Practical Implications

This article has important implications for the OTC drug industry as well as for policy makers. First, this research reinforces previous work suggesting that novice consumers show relatively low awareness or consideration of the active ingredients in OTC drugs (Hanoch et al. 2007; National Council on Patient Information and Education 2002). Importantly, our research also highlights that the problem may go beyond a simple lack of attention to active ingredients and may instead require educating consumers that overdosing on OTC drugs' active ingredients is risky and should be avoided. Therefore, interventions should emphasize that (1) the active ingredients in OTC drugs are diagnostic or relevant to risk, (2) these active ingredients should not be taken in excess, (3) even merely double dosing on active ingredients is risky, and (4) double dosing can occur even when consumers take two separate medications with different brand names and symptom-based indications.

Furthermore, our results provide evidence that efficacious interventions can be successfully implemented both on and off the product packaging. Public service messages can be

used and/or warnings can appear on the OTC drug packaging itself. For example, we found evidence that consumers benefited from a warning that was added to the Drug Facts Label on the back of the package, in the designated warning section. The warning explicitly told consumers not to combine two drugs containing the same active ingredient. We found that a proposed OTC drug active ingredient icon system that lacks this explicit warning could be ineffective if used in isolation. Thus, our results suggest that the OTC drug industry could supplement or modify some of their proposed interventions (Kuffner 2010) with ones that explicitly tell consumers that they should not concurrently take OTC drugs with the same active ingredient (e.g., King et al. 2011). Our on-package warning could serve as a useful basis for a possible intervention (Figure 4; for other potential approaches, see King et al. 2011).

More broadly, our research contributes to the ongoing discussion of best practices for developing product warnings (Argo and Main 2004; Cox et al. 1997; Stewart and Martin 1994). It suggests that warnings and other interventions may be most effective when they precisely address the area of consumer misunderstanding, such as directly dispelling a naive belief about product riskiness. As such, it is necessary for practitioners and policymakers to ensure that they have a clear understanding of the specific reasons underlying consumer misunderstanding or confusion and develop interventions that target these specific issues. In the context of drug package labeling, which is tightly regulated by the FDA, it is important that any new requirements be optimized and based on empirical evidence (Stewart and Martin 1994). The current work suggests a strategy for meeting this standard to address the previously identified public health problem of double dosing with OTC drugs.

Limitations and Further Research

Additional research would be useful to further explore the effects of these and other OTC drug interventions. First, it would be worthwhile to study whether and how these interventions affect consumer comprehension of other aspects of the Drug Facts Label. Doing this would help minimize the possibility of unintended consequences (Stewart and Martin 1994). One limitation of our research is that many of our participants were relatively well educated, and the OTC drug packaging was readily available to them when making judgments. Thus, for example, we may have overestimated consumer response to the on-package warning. Furthermore, although we used realistic OTC packaging, we simplified our stimuli to include only a single active ingredient. Results may vary when consumers see drug packages that list two or more active ingredients. Further research should investigate consumers' OTC drug decisions in more varied populations and in more naturalistic settings, including actual behavior.

References

Ahluwalia, Rohini and Zeynep Gürhan-Canli (2000), "The Effects of Extensions on the Family Brand Name: An Accessibility–Diagnosticity Perspective," *Journal of Consumer Research*, 27 (3), 371–81.

Argo, Jennifer J. and Kelley J. Main (2004), "Meta-Analyses of the Effectiveness of Warning Labels," *Journal of Public Policy & Marketing*, 23 (Fall), 193–208.

Bix, Laura, Nora M. Bello, Rafael Auras, Jon Ranger, and Maria K. Lapinski (2009), "Examining the Conspicuousness and Prominence of Two Required Warnings on OTC Pain Relievers," *Proceedings of the National Academy of Sciences*, 106 (16), 6550–55.

Bower, Amanda B., Stacy Landreth Grau, and Valerie A. Taylor (2013), "Over-the-Counter vs. Prescription Medications: Are Consumer Perceptions of the Consequences of Drug Instruction Non-Compliance Different?" *International Journal of Consumer Studies*, 37 (2), 228–33.

Bower, William A., Matthew Johns, Harold S. Margolis, Ian T. Williams, and Beth P. Bell (2007), "Population-Based Surveillance for Acute Liver Failure," *American Journal of Gastroenterology*, 102 (11), 2459–63.

Brass, Eric P. (2004), "Consumer Behavior in the Setting of Over-the-Counter Statin Availability: Lessons from the Consumer Use Study of OTC Mevacor," *American Journal of Cardiology*, 94 (9, Supplement 1), 22–29.

Catlin, Jesse R., Cornelia Pechmann, and Eric P. Brass (2012), "The Influence of Need for Cognition and Principal Display Panel Factors on Over-the-Counter Drug Facts Label Comprehension," *Health Communication*, 27 (3), 264–72.

CNN (2013), "New Tylenol Cap Will Have Warning Label," (accessed May 19, 2015), [available at http://www.cnn.com/2013/08/29/health/tylenol-cap-warning/index.html].

Consumer Healthcare Products Association (2013a), "Ingredients & Dosages Transferred From Rx-to-OTC Status (or New OTC Approvals) by the Food and Drug Administration Since 1975," (accessed May 19, 2015), [available at http://www.chpa.org/switchlist.aspx].

—— (2013b), "OTC Retail Sales 1964–2013," (accessed on May 19, 2015), [available at http://www.chpa.org/PR_OTCRetailSales.aspx].

Cowley, Elizabeth and Andrew A. Mitchell (2003), "The Moderating Effect of Product Knowledge on the Learning and Organization of Product Information," *Journal of Consumer Research*, 30 (3), 443–54.

Cox, Eli P., III, Michael S. Wogalter, Sara L. Stokes, and Elizabeth J. Tipton Murff (1997), "Do Product Warnings Increase Safe Behavior? A Meta-Analysis," *Journal of Public Policy & Marketing*, 16 (Fall), 195–204.

DeLorme, Denise E., Jisu Huh, Leonard N. Reid, and Soontae An (2010), "The State of Public Research on Over-the-Counter Drug Advertising," *International Journal of Pharmaceutical and Healthcare Marketing*, 4 (3), 208–231.

Deval, Hélène, Susan P. Mantel, Frank R. Kardes, and Steven S. Posavac (2013), "How Naive Theories Drive Opposing Inferences from the Same Information," *Journal of Consumer Research*, 39 (6), 1185–1201.

Ellen, Pam Scholder, Paula Fitzgerald Bone, and Elnora W. Stuart (1998), "How Well Do Young People Follow the Label? An Investigation of Four Classes of Over-the-Counter Drugs," *Journal of Public Policy & Marketing*, 17 (Spring), 70–85.

Epocrates (2014), "Acetaminophen Drug Monograph," (accessed May 19, 2015), [available at https://online.epocrates.com/u/10a307/acetaminophen].

Feldman, Jack M. and John G. Lynch Jr. (1988), "Self-Generated Validity and Other Effects of Measurement on Belief, Attitude, Intention, and Behavior," *Journal of Applied Psychology*, 73 (3), 421–35.

Food and Drug Administration (2013), "Educational Resources: Understanding Over-the-Counter Medicine," (accessed May 19, 2015), [available at http://www.fda.gov/Drugs/ResourcesForYou/Consumers/BuyingUsingMedicineSafely/UnderstandingOver-the-CounterMedicines/ucm277845.htm].

Furnham, Adrian (1988), *Lay Theories: Everyday Understanding of Problems in the Social Sciences*, International Series in Experimental Social Psychology, Vol. 17. Elmsford, NY: Pergamon Press.

Gierl, Heribert and Verena Huettl (2011), "A Closer Look at Similarity: The Effects of Perceived Similarity and Conjunctive Cues on Brand Extension Evaluation," *International Journal of Research in Marketing*, 28 (2), 120–33.

Goldstone, Robert L. (1994), "The Role of Similarity in Categorization: Providing a Groundwork," *Cognition*, 52 (2), 125–57.

Goyal, Ravi K., Suja S. Rajan, Ekere J. Essien, and Sujit S. Sansgiry (2012), "Effectiveness of FDA's New Over-the-Counter Acetaminophen Warning Label in Improving Consumer Risk Perception of Liver Damage," *Journal of Clinical Pharmacy and Therapeutics*, 37 (6), 681–85.

Hanoch, Yaniv, Konstantinos V. Katsikopoulos, Michaela Gummerum, and Eric P. Brass (2007), "American and German Students' Knowledge, Perceptions, and Behaviors with Respect to Over-the-Counter Pain Relievers," *Health Psychology*, 26 (6), 802–806.

Herr, Paul M., Frank R. Kardes, and John Kim (1991), "Effects of Word-of-Mouth and Product-Attribute Information on Persuasion: An Accessibility-Diagnosticity Perspective," *Journal of Consumer Research*, 17 (4), 454–62.

Hoy, Mariea Grubbs (1994), "Switch Drugs Vis-à-Vis Rx and OTC: Policy, Marketing, and Research Considerations," *Journal of Public Policy & Marketing*, 13 (Spring), 85–96.

Hughner, Renée Shaw and Susan Schultz Kleine (2008), "Variations in Lay Health Theories: Implications for Consumer Health Care Decision Making," *Qualitative Health Research*, 18 (12), 1687–1703.

Kaufman, David W., Judith P. Kelly, Jeffrey M. Rohay, Mary Kathryn Malone, Rachel B. Weinstein, and Saul Shiffman (2012), "Prevalence and Correlates of Exceeding the Labeled Maximum Dose of Acetaminophen Among Adults in a U.S.-Based Internet Survey," *Pharmacoepidemiology and Drug Safety*, 21 (12), 1280–88.

Keckley, Paul and Sheryl Coughlin (2012), "2012 Survey of Health Care Consumers: Five-Year Look Back," research report, Deloitte, (accessed May 19, 2015), [available at http://dupress.com/articles/2012-survey-of-u-s-health-care-consumers-five-year-look-back/].

King, Jennifer P., Terry C. Davis, Stacy Cooper Bailey, Kara L. Jacobson, Laurie A. Hedlund, Lorenzo Di Francesco, et al. (2011), "Developing Consumer-Centered, Nonprescription Drug Labeling: A Study in Acetaminophen," *American Journal of Preventive Medicine*, 40 (6), 593–98.

Kuffner, Edwin (2010), "Improving Patient's Awareness of Acetaminophen in Over-the-Counter (OTC) and Prescription (Rx) Medicines: 'APAP' OFF and Icon ON," paper presented at the FDA Public Workshop on Developing Guidance on Naming, Labeling, and Packaging Practices to Minimize Medication Errors, College Park, MD (July 25), (accessed May 19, 2015), [available at http://www.fda.gov/downloads/Drugs/NewsEvents/UCM218768.pdf].

Labeling Requirements for Over-the-Counter Drugs (2014a), 21 C.F.R. pt. 201.60-61.

—— (2014b), 21 C.F.R. pt. 201.66.

Landis, J. Richard and Gary G. Koch (1977), "The Measurement of Observer Agreement for Categorical Data," *Biometrics*, 33 (1), 159–74.

Larrey, Dominique and Georges-Philippe Pageaux (2005), "Drug-Induced Acute Liver Failure," *European Journal of Gastroenterology and Hepatology*, 17 (2), 141–43.

Larson, Anne M., Julie Polson, Robert J. Fontana, Timothy J. Davern, Ezmina Lalani, Linda S. Hynan, et al. (2005), "Acetaminophen-Induced Acute Liver Failure: Results of a United States Multicenter, Prospective Study," *Hepatology*, 42 (6), 1364–72.

Lee, William M. (2007), "Acetaminophen Toxicity: Changing Perceptions on a Social/Medical Issue," *Hepatology*, 46 (4), 966–70.

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

Lynch, John G., Jr., Howard Marmorstein, and Michael F. Weigold (1988), "Choices from Sets Including Remembered Brands: Use of Recalled Attributes and Prior Overall Evaluations," *Journal of Consumer Research*, 15 (2), 169–84.

Menon, Geeta, Priya Raghubir, and Norbert Schwarz (1995), "Behavioral Frequency Judgments: An Accessibility-Diagnosticity Framework," *Journal of Consumer Research*, 22 (2), 212–28.

Mervis, Carolyn B. and Maria A. Crisafi (1982), "Order of Acquisition of Subordinate-, Basic-, and Superordinate-Level Categories," *Child Development*, 53 (1), 258–66.

Morris, Louis A., Karen Lechter, Michael Weintraub, and Debra Bowen (1998), "Comprehension Testing for OTC Drug Labels: Goals, Methods, Target Population, and Testing Environment," *Journal of Public Policy & Marketing*, 17 (Spring), 86–96.

Muthukrishnan, A.V. and Barton A. Weitz (1991), "Role of Product Knowledge in Evaluation of Brand Extension," in *Advances in Consumer Research*, Vol. 18, Rebecca H. Holman and Michael R. Solomon, eds. Provo, UT: Association for Consumer Research, 407–413.

National Council on Patient Information and Education (2002), "Attitudes and Beliefs About the Use of Over-the-Counter Medicines: A Dose of Reality," research report, (January), (accessed May 19, 2015), [available at from http://www.bemedwise.org/survey/final_survey.pdf].

Ostapowicz, George, Robert J. Fontana, Frank V. Schiødt, Anne Larson, Timothy J. Davern, Steven H.B. Han, et al. (2002), "Results of a Prospective Study of Acute Liver Failure at 17 Tertiary Care Centers in the United States," *Annals of Internal Medicine*, 137 (12), 947–54.

Raghunathan, Rajagopal, Rebecca Walker Naylor, and Wayne D. Hoyer (2006), "The Unhealthy = Tasty Intuition and Its Effects on Taste Inferences, Enjoyment, and Choice of Food Products," *Journal of Marketing*, 70 (October), 170–84.

Raymond, Elizabeth G., Sandra M. Dalebout, and Sharon I. Camp (2002), "Comprehension of a Prototype Over-the-Counter Label

for an Emergency Contraceptive Pill Product," *Obstetrics & Gynecology*, 100 (2), 342–49.

Sansgiry, Sujit S. and Paul S. Cady (1995), "The Effect of Label Content and Placement on Consumers' Understanding of OTC Product Label Information," *Journal of Pharmaceutical Marketing & Management*, 9 (3), 55–68.

———, ———, and Barbara A. Adamcik (1997), "Consumer Comprehension of Information on Over-the-Counter Medication Labels: Effects of Picture Superiority and Individual Differences Based on Age," *Journal of Pharmaceutical Marketing & Management*, 11 (3), 63–76.

Scammon, Debra L., Punam A. Keller, Pia A. Albinsson, Shalini Bahl, Jesse R. Catlin, Kelly L. Haws, et al. (2011), "Transforming Consumer Health," *Journal of Public Policy & Marketing*, 30 (Spring), 14–22.

Slone Epidemiology Center (2006), "Patterns of Medication Use in the United States: A Report from the Slone Survey," research report, (accessed May 19, 2015), [available at http://www.bu.edu/slone/files/2012/11/SloneSurveyReport2006.pdf].

Spiller, Stephen A., Gavan J. Fitzsimons, John G. Lynch, and Gary H. McClelland (2013), "Spotlights, Floodlights, and the Magic Number Zero: Simple Effects Tests in Moderated Regression," *Journal of Marketing Research*, 50 (April), 277–88.

Stewart, David W. and Ingrid M. Martin (1994), "Intended and Unintended Consequences of Warning Messages: A Review and Synthesis of Empirical Research," *Journal of Public Policy & Marketing*, 13 (Spring), 1–19.

Tversky, Amos (1977), "Features of Similarity," *Psychological Review*, 84 (4), 327–52.

Wang, Wenbo, Hean Tat Keh, and Lisa E. Bolton (2010), "Lay Theories of Medicine and a Healthy Lifestyle," *Journal of Consumer Research*, 37 (1), 80–97.

Wolf, Michael S., Jennifer King, Kara Jacobson, Lorenzo Di Francesco, Stacy Cooper Bailey, Rebecca Mullen, et al. (2012), "Risk of Unintentional Overdose with Non-Prescription Acetaminophen Products," *Journal of General Internal Medicine*, 27 (12), 1587–93.

WEB APPENDIX

Dangerous Double Dosing: How Naive Beliefs Can Contribute to Unintentional Overdose with Over-the-Counter Drugs

Jesse R. Catlin

Cornelia (Connie) Pechmann

Eric P. Brass

WEB APPENDIX A

LIST OF OTC DRUG PAIRS USED IN STUDIES 2, 3, AND 4

Pair	OTC Drug 1		OTC Drug 2		Same or Different
1	**Brand**	Motrin	**Brand**	Benadryl	Different
	Symptom	Pain Reliever	**Symptom**	Allergy	Different
	Ingredient	Ibuprofen	**Ingredient**	Diphenhydramine	Different
2	**Brand**	Motrin	**Brand**	Motrin	Same
	Symptom	Nighttime Sleep-Aid	**Symptom**	Pain Reliever	Different
	Ingredient	Diphenhydramine	**Ingredient**	Ibuprofen	Different
3	**Brand**	Sudafed	**Brand**	Benadryl	Different
	Symptom	Allergy	**Symptom**	Allergy	Same
	Ingredient	Phenylephrine	**Ingredient**	Diphenhydramine	Different
4	**Brand**	Robitussin	**Brand**	Excedrin	Different
	Symptom	Nasal Relief	**Symptom**	Pain Reliever	Different
	Ingredient	Acetaminophen	**Ingredient**	Acetaminophen	Same
5	**Brand**	Sudafed	**Brand**	Robitussin	Different
	Symptom	Cough	**Symptom**	Cough	Same
	Ingredient	Dextromethorphan	**Ingredient**	Dextromethorphan	Same
6	**Brand**	Aleve	**Brand**	Aleve	Same
	Symptom	Cold	**Symptom**	Pain Reliever	Different
	Ingredient	Naproxen Sodium	**Ingredient**	Naproxen Sodium	Same
7	**Brand**	Excedrin	**Brand**	Excedrin	Same
	Symptom	Pain Reliever	**Symptom**	Pain Reliever	Same
	Ingredient	Aspirin	**Ingredient**	Acetaminophen	Different
8	**Brand**	Benadryl	**Brand**	Benadryl	Same
	Symptom	Allergy	**Symptom**	Allergy	Same
	Ingredient	Diphenhydramine	**Ingredient**	Diphenhydramine	Same

WEB APPENDIX B

EXAMPLE OF OTC DRUG PACKAGING USED IN STUDIES 2, 3, AND 4

Drug Facts

Active ingredients (in each tablet) ***Purpose***

Ibuprofen 200mg ..... Pain reliever

Uses

- temporarily relieves minor aches and pains due to:
- headache • muscular aches • minor pain of arthritis • toothache
- backache • the common cold • menstrual cramps
- temporarily reduces fever

Warnings

Allergy alert: Ibuprofen may cause a severe allergic reaction, especially in people allergic to aspirin. Symptoms may include:
- hives • facial swelling • asthma (wheezing) • shock
- skin reddening • rash • blisters

If an allergic reaction occurs, stop use and seek medical help right away.

Stomach bleeding warning: This product contains an NSAID, which may cause severe stomach bleeding. The chance is higher if you:
- are age 60 or older
- have had stomach ulcers or bleeding problems
- take a blood thinning (anticoagulant) or steroid drug
- take other drugs containing prescription or nonprescription NSAIDs (aspirin, ibuprofen, naproxen, or others)
- have 3 or more alcoholic drinks every day while using this product
- take more or for a longer period of time than directed

Do not use
- if you have ever had an allergic reaction to acetaminophen, aspirin, or any other pain reliever/fever reducer
- right before or after heart surgery

Ask a doctor before use if
- you have problems or serious side effects from taking pain relievers or fever reducers
- the stomach bleeding warning applies to you
- you have a history of stomach problems, such as heartburn
- you ahve high blood pressure, heart disease, liver cirrhosis, or kidney disease
- you have asthma
- you are taking a diuretic

Ask a doctor or pharmacist before use if you are
- taking aspirin for heart attack or stroke, because ibuprofen may decrease this benefit of aspirin
- under a doctor's care for any serious condition
- taking any other drug

Drug Facts (continued)

When using this product
- take with food or milk if stomach upset occurs
- the risk of heart attack or stroke may increase if you use more than directed or for longer than directed

Stop use and ask a doctor if
- you experience any of the following signs of stomach bleeding:
  - feel faint • vomit blood • have bloody or black stools
  - have stomach pain that does not get better
- pain gets worse or lasts more than 10 days
- fever gets worse or lasts more than 3 days
- you have difficulty swallowing
- it feels like the pill is stuck in your throat
- redness or swelling is present in the painful area
- any new symptoms appear

If pregnant or breast-feeding, ask a health professional befoore use. It is especially important not to use naproxen sodium during the last 3 months of pregnancy unless definitely directed to do so by a doctor because it may cause problems in the unborn child or complications during the delivery.

Keep out of reach of children.
In case of overdose, get medical help or contact a Poison Control Center right away.

Directions
- do not take more than directed
- the smallest effective dose should be used

- adults and children 12 years and over
  - take 1 taplet every 4 to 6 hours while symptoms persist
  - if pain or fever does not respond to 1 tablet, 2 tablets may be used
  - do not exceed 6 tablet in a 24 hour period, unless directed by a doctor
- children under 12 years
  - ask a doctor

Other information
- store at controlled room temperature 20°-25° (68°-77°F)

Inactive ingredients carnauba wax, colloidal silicon dioxide, corn starch, FD&C yellow #6, hypromellose, iron oxide, magnesium stearate, polydextrose, polyethylene glycol, pregelatinized starch, propylene glycol, shellac, stearic acid, titanium dioxide

Questions or comments? 1-800-395-0689

Drug Facts

Active ingredients (in each tablet) ***Purpose***

Diphenhydramine HCl 25mg ..... Antihistamine

Uses
- temporarily relieves these sypmtoms due to hay fever or other respiratory allergies:
- runny nose • sneezing • itchy, watery eyes • itching of the nose or throat
- temporarily relieves these sypmtoms due to the common cold:
- runny nose • sneezing

Warnings

Do not use
- to make a child sleepy
- with any other product containing diphenhydramine, even one used on skin

Ask a doctor before use if you have
- glaucoma
- trouble urinating due to an enlarged prostate gland
- a breathing problem such as emphysema or chronic bronchitis

Ask a doctor or pharmacist before use if you are taking sedatives or tranquilizers

When using this product
- marked drowsiness may occur
- avoid alcoholic drinks
- alcohol, sedatives, and tranquilizers may increase drowsiness
- be careful when driving a motor vehicle or operating machinery
- excitability may occur, especially in children

If pregnant or breast-feeding, ask a health professional befoore use.
Keep out of reach of children. In case of overdose, get medical help or contact a Poison Control Center right away.

Drug Facts (continued)

Directions
- if needed, repeat dose every 4 to 6 hours
- do not take more than 6 times in 24 hours

- adults and children 12 years and over
  - 1 to 2 gelcaps
- children 6 to under 12 years or age
  - 1 gelcap
- children under 6 years of age
  - do not use this product in children under 6 years of age

Other information
- each gelcap contains: calcium 35mg
- store at controlled room temperature 20°-25° (68°-77°F). Avoid high humidity.

Inactive ingredients benzyl alcohol, butylparaben, carboxymethylcellulose sodium, corn starch, D&C red #28, D&C yellow #10, edetate calcium disodium, FD&C blue #1, FD&C blue #2, FD&C red #40, gelatin, hypromellose, magnesium stearate, methylparaben, microcrystalline cellulose, polyethylene glycol, polysorbate 80, propylparaben, red iron oxide, sodium citrate, sodium lauryl sulfate, sodium propionate, sodium starch glycolate, titanium dioxide, yellow iron oxide

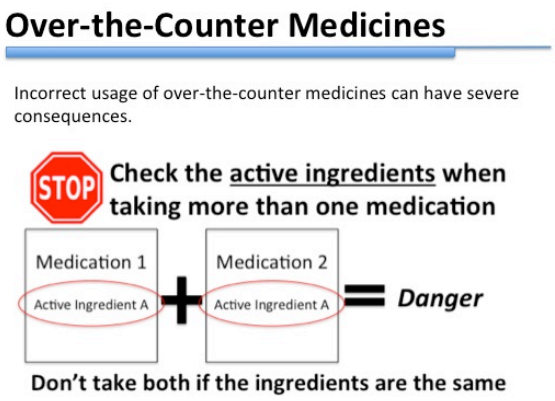
Questions or comments? 1-877-717-2824

Note: Labels were presented in a format sufficiently large to permit reading of text.

WEB APPENDIX C

PUBLIC SERVICE MESSAGES USED IN STUDY 4

Treatment Message



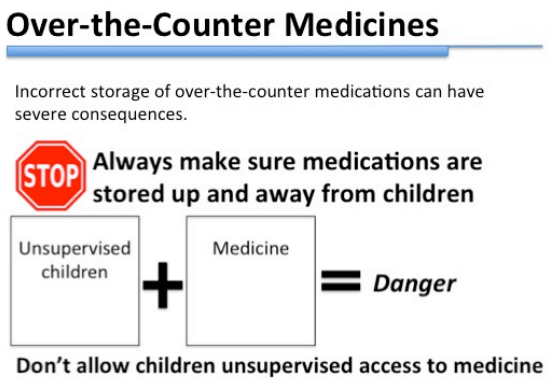
Though OTC medications are safe when used properly, many people end up in emergency departments every year because they took two or more medicines containing the same active ingredient.

But you can avoid these negative outcomes by:

- never taking more of a medicine than directed.
- never taking more than one medicine containing the same active ingredient.

For more information, ask your pharmacist, doctor, or nurse.

Control Message



Though OTC medications are safe when used properly, many young children end up in emergency departments every year because they got into medicines while their parent or caregiver was not looking.

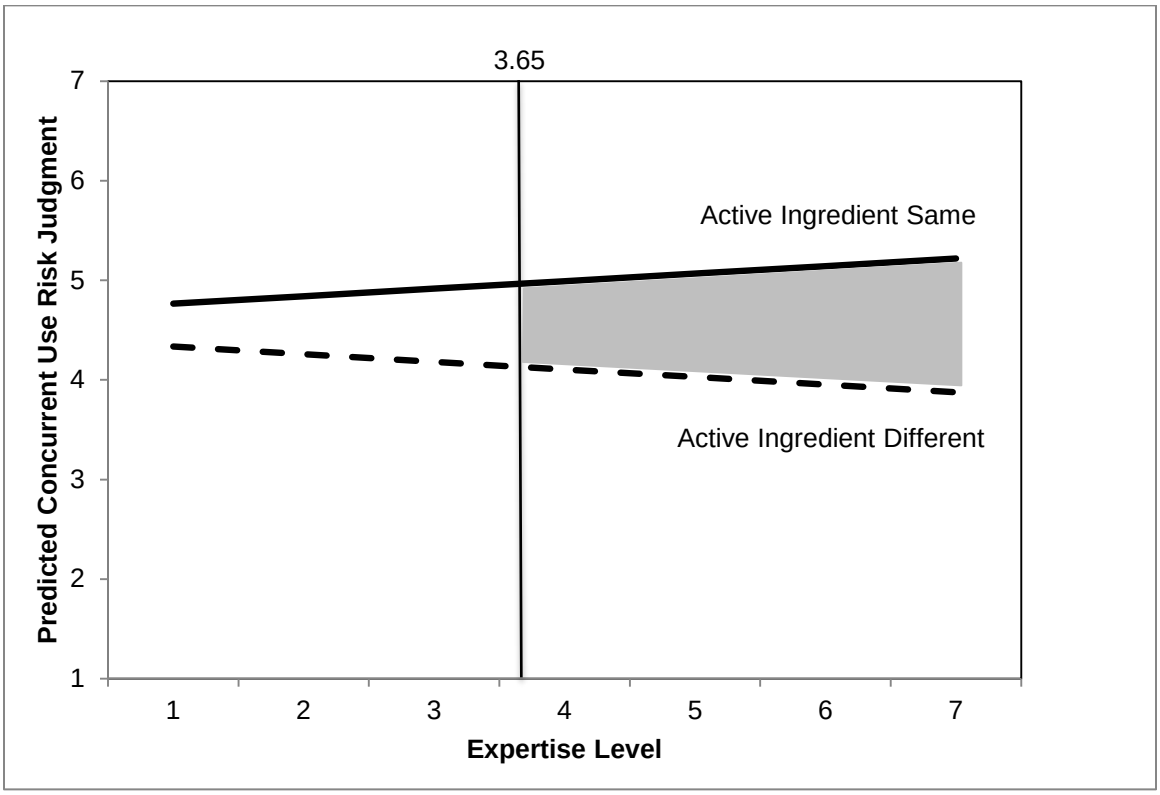
But you can avoid these negative outcomes by:

- never allowing children to use medicines unsupervised.
- never keep medicines in areas that can be reached by children.

For more information, ask your pharmacist, doctor, or nurse.

WEB APPENDIX D

EFFECTS OF THE SAME (VS. DIFFERENT) ACTIVE INGREDIENTS ON CONCURRENT USE RISK JUDGMENTS BASED ON PARTICIPANT EXPERTISE IN STUDY 4



Notes: The simple effect of active ingredient sameness (same vs. different) on concurrent use risk judgment is significant ($p < .05$) for values of expertise above 3.65 based on a subjective knowledge measure. Predicted values for this active ingredient sameness x expertise interaction also reflect the average marginal effects of the other dichotomous variables in the full model (intervention, brand name sameness, and symptom indicated sameness).