The Effectiveness of Warning Labels for Consumers: A Meta-Analytic Investigation into Their Underlying Process and Contingencies

Mostafa Purmehdi, Renaud Legoux, François Carrillat, and Sylvain Senecal

Although several meta-analyses have been conducted on the effectiveness of warning labels, many questions regarding their effectiveness remain unanswered. The authors identify 243 effect sizes from 66 primary articles, more than three times the number of effect sizes included in the most comprehensive meta-analysis to date. This updated and substantially larger data set shows that label effectiveness is contingent on the type of expected behavioral outcome. Labels aimed at moderation/cessation display a generally diminishing cascade of effects from attention (r = .32), comprehension (r = .37), recall (r = .31), judgment (r = .22), and behavior (r = .18). Labels targeting safe use show stronger effect sizes for behavior (r = .39) despite displaying a downward trend for attention (r = .35), comprehension (r = .29), recall (r = .32), and judgment (r = .21). The authors also find evidence of increased effectiveness when preactivating the label by means of an integrated communication strategy (r = .49). In addition, the results show the impact of several contextual factors (e.g., social influence [r = .33] and exposure frequency [r = .12]).

Keywords: warning labels, meta-analysis, product hazard, tobacco, alcohol

Many products on the market entail residual risks. Pharmaceutical drugs, pesticides, commonly used chemicals, household cleaners, tobacco products, cosmetics, prepared foods, consumable appliances, and tools are examples of such products (Earle and Cvetkovich 1995; Hieke and Taylor 2012). In consumer markets, regulatory measures play a key role in helping and protecting customers, given that producers are generally willing to keep silent about potentially harmful aspects of their products (Chen, Ganesan, and Liu 2009). Thus, it is important to examine the impact of potential public policy measures prior to legislation or enactment (Bhalla and Lastovicka 1984).

Governments and third-party organizations are pushing producers to use warning labels as the means of communicating risk management issues. In a comprehensive effort by the U.S. government in 2009, the Family Smoking Prevention and Tobacco Control Act was signed into law to give the Food and Drug Administration the power to further regulate the tobacco industry. The law put new warning labels on tobacco packaging and as well as on advertisements, mostly aimed at minors and young adults. Allowing products with residual risks to remain on the market, together with the use of warning labels, is less expensive for both manufacturers and policy makers than other forms of risk management such as recalling a product from market shelves or engaging in long and cumbersome litigation processes (Cvetkovich and Earle 1995).

In recent years, warning labels have become increasingly subject to regulation and litigation because of changing dietary guidelines or health and environmental concerns. Thus, application of warning labels has spread from the traditional tobacco and alcohol products to a variety of other categories such as food, environment, and pharmaceuticals. For example, the California Senate recently passed a bill requiring sugary soft drinks to carry warnings of obesity, diabetes, and tooth decay (California Center for Public Health Advocacy 2015). Nevertheless, the current literature is focused mostly on certain products only. In the current meta-analysis, we find a large number of studies on cigarettes (104 effect sizes), chemicals (50), and alcohol (28), whereas all other product categories amount to only 60 effect sizes (for studies included in the meta-analysis, see the Appendix).

Another challenge associated with the wider range of products relying on warning labels lies in determining whether the ubiquity of risk information defeats its own purpose. The literature is torn between two opposite perspectives on this matter. Whereas some studies prescribe increased exposure to labels to obtain attention and message retention, others are

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concerned that overexposure could result in ineffective messages as a result of warning "wear out" (Beltramini 1988; Hassan et al. 2007; Rooke, Malouff, and Copeland 2012; Thrasher et al. 2010).

Research on warning labels spans over 40 years and includes a few systematic reviews (e.g., Stewart and Martin 1994) and two meta-analyses (Argo and Main 2004; Cox et al. 1997). Cox et al. (1997) published a meta-analysis of 15 studies showing that, overall, on-product warning labels promote safe consumer behavior, though much variation in study results remains unexplained. Seven years later, Argo and Main (2004) extended this meta-analysis and addressed the issue of unexplained variance by identifying five dimensions of effectiveness based on the information processing framework (McGuire 1976). They also identified some moderating factors on the effectiveness of each dimension but were not able to draw detailed conclusions for all potential moderators because of the small number of primary studies available (Argo and Main 2004). The present research is a complement to the previous works of synthesis in this area.

More than a decade after these meta-analytic contributions, many researchers still view the quantification of warning label effectiveness as puzzling. Study results are scattered, and conflicting findings remain that undermine empirical generalizations (Kees et al. 2010; Monárrez-Espino et al. 2014; Steinhart, Carmon, and Trope 2013). In the same vein, within the nutritional domain, Hieke and Taylor (2012) point out that most findings on warning labels take the form of tentative and conditional statements preventing clear guidelines on their use.

It seems that the literature has not moved much further since Stewart and Martin's (1994, p. 15) evaluation that the emphasis of policy making tends to focus more on the *identification* of potential hazards than on helping consumers develop an understanding of the *magnitude* and *probability* of these hazards, which can be used for informed decision making. In addition, calls for investigation of new moderators remain unheeded (e.g., Kees et al. 2010). For instance, Laughery and Wogalter (2014) point out that studies focusing on labels' nondesign features, such as contextual factors, are few and far between.

Although prior research has identified information processing phases in the chain that leads to behavior, it has not presented theoretical predictions to help policy makers. This meta-analysis (1) proposes an enhanced conceptual framework that demonstrates a cascade of effects in the chain and distinguishes between the expected behavior for safe use type of warning messages and moderation/cessation type. In addition, whereas the previous two meta-analyses focus on the conspicuousness (attention-grabbing) characteristics of a label, the present work (2) identifies and tests new categories of moderators unexamined in previous meta-analyses in the light of new evidence (i.e., contextual moderators). Finally, our work complements previous efforts to (3) update the big picture of the literature and address methodological issues that skew the interpretations of results, including the way they ultimately influence public policies.

Our proposed conceptual framework, based on McGuire's (1976) information processing model, is more comprehensive than previous meta-analytic research because it encompasses a wide array of contingencies through investigation of the communication environment, contextual moderators, and methodological moderators. It models warning labels influence as a sequential system of effectiveness dimensions and depicts a diminishing cascade of effects throughout the chain. Our results show how the distinction between different types of expected behaviors (safe use vs. moderation/cessation) yields important insights into labels' effectiveness useful for policy makers and researchers. In addition, investigation of new moderators offers actionable recommendations to implement more effective warning label strategies such as preactivation of warning messages and use of influential social factors. Furthermore, a more detailed breakdown of label characteristics enables us to draw new conclusions about the conspicuousness of warning labels, especially on the use of pictorial warnings. Finally, the identification of methodological moderators that systematically alter research results provides guidelines on how to best interpret study outcomes and design intervention plans.

Literature Review and Conceptual Framework

Rogers, Lamson, and Rousseau (2000, p. 102) define warnings as "anything that alerts one's attention to a potentially dangerous situation." Labeling is also described as "any form of information disclosure on a product" (Hieke and Taylor 2012, p. 126). In line with this notion, our operational definition of warning labels is that of conspicuous information vehicles that are attached to a product, designed as part of the packaging, or included in instruction manuals or promotional material that address the hazards associated with use of the product. This definition clearly specifies what is to be considered a warning label in our meta-analysis; for instance, it excludes nonwritten warnings.

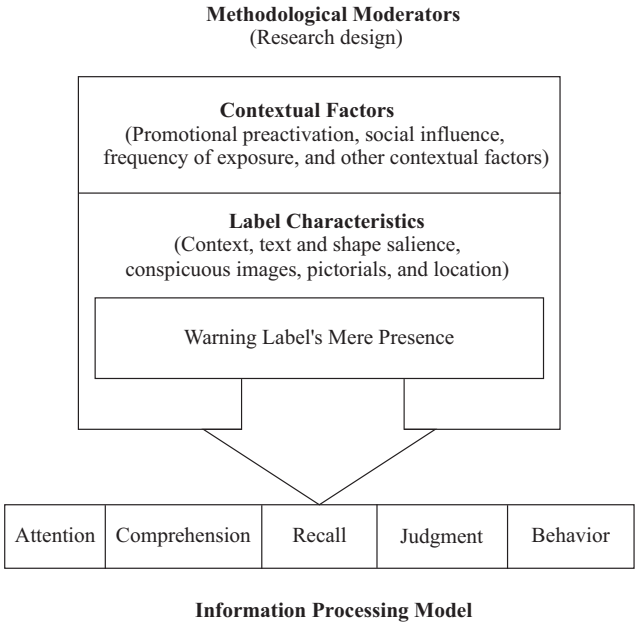
Labels are tools for increasing awareness of hidden aspects of product/consumption that might otherwise remain unidentified to the ordinary consumer (Argo and Main 2004; Hassan et al. 2007). Labels fulfill two general purposes: (1) to provide consumers with information they require before using the product and (2) to help manufacturers avoid potential lawsuits (Shuy 1990).

Figure 1 depicts our conceptual framework. At the core of our framework is the effect of mere presence of a product warning label onto the five effectiveness dimensions. Mere presence is the impact of a warning label versus lack thereof. In addition, we organize the moderating variables into the following three major categories:

1. Label characteristics: Variables purported to optimize and enhance warning effectiveness through various design factors on the label such as message content, text salience, shape salience, location of the warning on the product, and use of pictorial elements.
2. Contextual factors: Variables that are extrinsic to a label such as consumption settings and style, social influence, frequency of exposure, and promotional preactivation.
3. Methodological moderators: Variables that can influence research results and affect substantive interpretations—namely, publication bias and choice of research design.

In the most recent meta-analysis, Argo and Main (2004) undertook an examination of the factors that moderate the effectiveness of warning labels such as physical characteristics of the label (e.g., vividness-enhancing characteristics, warning location) and product categories (convenience vs. shopping

Figure 1. Conceptual Model



goods). They acknowledge the limits of their conclusions in that they were "unable to divide these characteristics further into specific categories because of the small sample size" (p. 204). For instance, label attributes such as shape of the label or usage of icons in support of the text were lumped together into a single "vividness-enhancing" category. With the accumulation of studies since their article, we obtain enough evidence to investigate these moderators at a more granular level, which enables us to conceive a new and broader conceptual framework. In the following subsections, we further describe each category of moderators and develop a set of research hypotheses.

Effectiveness Dimensions

Argo and Main (2004) adopted five effectiveness dimensions as dependent variables: attention, comprehension, recall, judgment, and behavior. Hassan et al. (2007) used a similar set of parameters for their study (i.e., attention, elaboration, compliance contemplation, and behavioral compliance). Laughery and Wogalter (2014) simplified and summarized those steps into three broad categories: attention, knowledge, and compliance. All these frameworks can be mapped onto McGuire's (1976) original information processing model of consumer decision making, in which each of the five steps (attention, comprehension, recall, judgment, and behavior) depends highly on its antecedent in the process.

To better compare our study with its predecessor, we adopt Argo and Main's (2004) operationalization of McGuire's (1976) five dimensions as our dependent variables. Accordingly, the sequence of information processing depicted in Figure 1 begins with a warning label that attracts consumers' attention, followed by transmission of an effectively crafted message that aims to influence consumer judgment and ultimately lead to behavioral compliance. Importantly, although Argo and Main (2004) explored the five effectiveness dimensions, they did not examine or theorize on their relative susceptibility to warning labels' influence.

Relying on McGuire's (1976) model, we expect to observe the largest effect sizes for attention, followed by a downward shift throughout the process. If attention can be automatic in some circumstances (Bargh, Chen, and Burrows 1996), other steps necessitate more cognitive resources. Our first hypothesis is based on the increasing cognitive effort required throughout the information processing steps. For example, comprehension can require higher-order processes (e.g., categorization) that are more resource intensive (Meyers-Levy and Tybout 1997), and recall implies a retrieval process that is quite effortful (Cacioppo, Petty, and Morris 1983). Further down the line, judgment is an even more cognitively demanding task (Meyers-Levy and Tybout 1997). Finally, behavior requires physical resources in addition to psychological energy (Park et al. 2010). For cigarettes and alcohol, for example, the addiction that drives consumption further impedes behavioral compliance. Thus, the magnitude of the label's influence should become weaker along the information processing model such that:

H_1: The effectiveness dimensions of warning labels display a diminishing cascade of effects from attention to behavioral compliance.

We propose that this cascade of effects will be affected by the compliance objectives that warning labels pursue. Although all warning labels aim at preventing consumer harm, there is a fundamental distinction between labels promoting "safe use" and labels promoting "moderation or cessation of product usage." These two types of warning labels differ in terms of the compliance that they are designed to elicit. Safe-use labels are designed around educating the consumer to avoid potential hazards during consumption by using the product in a manner that minimizes risk. Thus, safe-use labels are meant to change *how* products such as chemicals or toys are consumed. In contrast, moderation/cessation labels are meant to reduce or even stop the consumption of a target product. Cigarettes and alcohol warning labels are typically moderation/cessation messages.

Laughery and Wogalter (2014) suggest that the decision not to comply can be viewed in terms of a cost–benefit trade-off, in the sense that the costs (e.g., time, effort, money, beliefs, attitudes) may outweigh the benefits of compliance. We contend that consumers mentally associate a higher cost to comply with moderation/cessation labels, compared with safe-use labels. Consumers will also tend to mentally discount the future health benefits of following the advice on a moderation/cessation label (Green, Fry, and Myerson 1994; Mischel and Grusec 1967; Rachlin and Green 1972). We do not expect a difference between safe use and moderation/cessation early in the process. As noted previously, the early steps of information processing do not require extant cognitive effort. However, the later steps are much more cognitively demanding. We expect this cost of information to be compounded by the cost of compliance. In other words, when a consumer is not willing or able to exert cognitive effort in the decision process (Mandler 1982), the exposure to a warning label is less likely to trickle all the way down through the chain of effects. Thus, we hypothesize the following:

H_2: The diminishing cascade of effects is steeper for the moderation/cessation warning type than for safe use.

Label Characteristics

In the literature, a dominant strategy for improving label effectiveness has been to enhance the conspicuousness of the label by manipulating its design characteristics. These manipulations are operationalized through label message content, its textual and pictorial formats, and the location of the warning label on the product/packaging.

Label content refers to the choice of vocabulary, the tone of the message, the use of signal words, the presence of guidance information (or lack thereof), the source of the message, and use of American National Standards Institute standard guidelines (e.g., Bansal-Travers et al. 2011; Borland 1997; Braun and Silver 1995; Cvetkovich and Earle 1995; Dingus, Wreggit, and Hathaway 1993; Wogalter et al. 1987; Wogalter and Laughery 2006). Effective content characteristics warn about the hazard, explain its consequences, and provide instructions to avoid that hazard.

Text salience encompasses all the characteristics of text formatting such as font color, font size, text direction, white space ratio, embeddedness in instruction text, highlighted text, and so on that make a text message more readable or noticeable (e.g., Adams and Edworthy 1995; Barlow and Wogalter 1993; Frantz 1992; Hammond et al. 2007; Malouff et al. 1993; Strawbridge 1986a, b; Wogalter, Fontenelle, and Laughery 1985; Wogalter, Conzola, and Smith-Jackson 2002). Shape salience includes parameters that bring more attention to the label itself such as label configuration, shape of the label, border width, package design, color of the label, and so on (e.g., Adams and Edworthy 1995; Barlow and Wogalter 1993; Bhalla and Lastovicka 1984; Cvetkovich and Earle 1995; Goldberg et al. 1999; Strawbridge 1986a, b; Wogalter, Allison, and McKenna 1989; Wogalter and Laughery 1996).

Pictorials refer to the use of icons, graphics, pictures, and images that add to the conspicuousness of a label or communicate a message without text and words (Bansal-Travers et al. 2011; Bhalla and Lastovicka 1984; Hassan et al. 2007; Kees et al. 2006, 2010; Peters et al. 2007; Sabbane, Lowrey, and Chebat 2009; Young and Wogalter 1990). In this framework, we distinguish between pictorial elements that merely add to the conspicuousness of a warning label and images that are designed to induce an emotional response (e.g., fear) along with improving conspicuousness. For example, warning labels on packs of cigarettes are fear arousing and conspicuous, whereas a "no smoking" sign is only conspicuous. To isolate the effect of conspicuousness from that of fear, we sorted the pictorial elements into "conspicuous images without fear appeal" and "conspicuous images with fear appeal" categories. The former category facilitates cognitive process by increasing readability and overcoming language barriers and illiteracy issues, while the latter has an added impact on consumers by inducing a negative emotion toward consumption (Kees et al. 2010).

Location of a warning label on a product, or in relation to other package design elements (e.g., inclusion in the instructions for use), can also affect whether a warning label is noticed. Some locations are more conspicuous than others (e.g., front rather than back or side). Thus, location of the label is positioned under the label characteristics category (Barlow and Wogalter 1993; Frantz and Rhoades 1993; Magurno and Wogalter 1994; Torres, Sierra, and Heiser 2007; Wogalter, Kalsher, and Racicot 1992).

Table 1 summarizes our categorization of label characteristics together with commonly used terms and keywords as they appear in the literature. By manipulating such design characteristics, a label becomes more conspicuous (e.g., a larger font size, a more noticeable shape), attracts more consumer attention, and facilitates comprehension and recall, all of which enhance overall label effectiveness. The key underlying notion is that conspicuousness leads to a more effective label (Barlow and Wogalter 1993; Young and Wogalter 1990). Thus, we expect,

H_3: The conspicuousness of label characteristics is positively associated with label effectiveness.

Contextual Factors

Consumer behavior is highly susceptible to environmental influences (Dickson 1996; Erdem and Keane 1996; Foxall and Yani-de-Soriano 2005); however, previous meta-analyses have not fully examined the impact of contextual moderators on the effectiveness of warning labels. This is an important shortcoming considering that the most appropriate unit of analysis of behavior is person-activity-occasion rather than any one component taken individually (Yang, Allenby, and Fennel 2002).

Following Belk's (1974) suggestion that a factor of behavioral influence is contextual if it does not pertain to the realm of either the consumer or the product, we considered the following moderators to be contextual in nature: preactivation of the warnings in promotional campaigns, social influences (e.g., Cvetkovich and Earle 1995; Wogalter, Allison, and McKenna 1989), and frequency of consumer exposure to a warning (e.g., Borland 1997; Goldhaber and DeTurck 1988; MacKinnon and Fenaughty 1993). Other contextual parameters (e.g., physical cost of compliance), which did not yield enough eligible primary studies to be examined as a group of moderators, were collected under "Other" in the contextual factors category.

We coded promotional preactivation according to manipulations of the medium carrying the warning label (on-package vs. off-package), and we posit that warning labels can feature in advertisements and other promotional materials in addition to appearing on products. This ancillary communication activates the warning message in the consumer's mind before purchase or consumption, leading to higher compliance (Dillman 2000; Haggett and Mitchell 1994). Supporting the warning message through promotional preactivation is akin to sales promotion activation. For example, Neslin (2002) compares the effectiveness of sales promotions with and without promotional activation and finds that preactivating a price cut promotion can increase sales by up to 545% compared with a 35% increase when the sales promotion is not activated. Thus, we expect,

H_4: Promotional preactivation is positively associated with label effectiveness.

Social influence takes into account that consumption behaviors can vary significantly according to whether a product is used privately or in a social context. Impression management theory indicates that in social situations, consumers will often act with the awareness that others are watching them (e.g., Ariely and Levav 2000; Ratner and Kahn 2002). Thus, in the presence of other people, consumers are likely to be willing to display an impression of paying attention and conforming to social norms. For instance, Wogalter, Allison, and McKenna (1989) altered warning compliance in a study simply by having a silent confederate present during a lab experiment while the

Table 1. Summary of Coding Scheme for Dependent and Independent Variables

Notation in our Framework	Notation from Literature	Example Studies
Attention	Notice, seeing the warning, conspicuousness, salience of warning, awareness, attention to ad, attention to brand	Bansal-Travers et al. (2011), Barlow and Wogalter (1993), Bhalla and Lastovicka (1984), Borland (1997), Braun and Silver (1995), Goldhaber and DeTurck (1988, 1989), Hammond et al. (2007), Hassan et al. (2007), Jaynes and Boles (1990), Magurno (1994), Magurno and Wogalter (1994), Mazis, Morris, and Swasy (1991), Torres, Sierra, and Heiser (2007)
Comprehension	Reading the warning, readability, looking at the warning label for longer time, comprehension, knowledge, depth of processing	Bhalla and Lastovicka (1984), Braun and Silver (1995), Frantz and Rhoades (1993), Hassan et al. (2007), Magurno and Wogalter (1994), Kalsher, Clarke, and Wogalter (1991), Otsubo (1988), Peters et al. (2007), Strawbridge (1986a, b), Young and Wogalter (1990)
Recall	Free recall of message, cued recall, memory of the warning, recall the danger, recall of shaking the bottle, recall safety instructions, report accurately, memory of the risks, identify driving message among a few options	Barlow and Wogalter (1993), Bhalla and Lastovicka (1984), Chowwanapoonpohn et al. (2005), Gardner-Bonneau et al. (1989), Goldberg et al. (1999), Goldhaber and DeTurck (1989), Jaynes and Boles (1990), Karnes and Leonard (1986), Kees et al. (2010), MacKinnon and Fenaughty (1993), Malouff et al. (1993), Mazis, Morris, and Swasy (1991), Orr and Hughes (1988), Otsubo (1988), Strawbridge (1986a), Torres, Sierra, and Heiser (2007), Wogalter, Kalsher, and Racicot (1992), Young and Wogalter (1990)
Judgment	Brand attitude, website attitude (with cigarette ad), package attractiveness, perceived safety, perceived hazard, urgency of warning label, belief in paralysis, think about health risks, truthfulness, believability, perceived likelihood of injury, think wine or whiskey is dangerous, elaboration on harm	Adams and Edworthy (1995), Bansal-Travers et al. (2011), Borland (1997), Braun and Silver (1995), Cvetkovich and Earle (1995), Frantz (1992), Goldhaber and DeTurck (1988, 1989), Hammond et al. (2004), Hassan et al. (2007), Hatem (1995), Kaskutas 1993, Kees et al. (2006. 2010), Magurno and Wogalter (1994), Sabbane, Lowrey, and Chebat (2009), Wogalter et al. (1987)
Behavior	Compliance, purchase intention, use of mask or gloves, smoking intent, motivate to quit, perceived effectiveness to encourage others to quit, wearing protective tools, shaking the bottle, more likely to drive, stubbing out a cigarette at least once, smoke less, quit likelihood, quit confidence, alcohol use, drinking less	Bansal-Travers et al. (2011), Borland (1997), Braun and Silver (1995), Desaulniers (1987), Dingus, Hunn, and Wreggit (1991), Dingus, Wreggit, and Hathaway (1993), Frantz (1992), Frantz and Rhoades (1993), Godfrey, Rothstein, and Laughery (1985), Goldhaber and DeTurck (1988, 1989), Hammond et al. (2004), Hassan et al. (2007), Kaskutas (1993), Jaynes and Boles (1990), MacKinnon et al. (2001), Magurno and Wogalter (1994), Sabbane, Bellavance, and Chebat (2009), Schucker et al. (1983), Strawbridge 1986a, b, Torres, Sierra, and Heiser (2007), Wogalter, Allison, and McKenna (1989), Wogalter, Fontenelle, and Laughery (1985); Wogalter et al. (1987), Wogalter, Kalsher, and Racicot (1992, 1993)
Content	Prominence, signal words, presence of guidance information, American National Standards Institute standard, procedural explicitness, source of message, specificity	Bansal-Travers et al. (2011), Borland (1997), Braun and Silver (1995), Cvetkovich and Earle (1995), Dingus, Wreggit, and Hathaway (1993), Wogalter et al. (1987)
Text salience	Conspicuous print, font color, font size, text direction, embeddedness in instruction text, highlighting text, white space	Adams and Edworthy (1995), Barlow and Wogalter (1993), Frantz (1992), Hammond et al. (2007), Malouff et al. (1993), Strawbridge (1986a, b), Wogalter, Fontenelle, and Laughery (1985)
Shape salience	Conspicuousness of label configuration, shape of the label, package design, border width	Adams and Edworthy (1995), Bhalla and Lastovicka (1984), Cvetkovich and Earle (1995), Barlow and Wogalter (1993), Goldberg et al. (1999) , Strawbridge (1986a,b), Wogalter, Allison, and McKenna (1989)
Picture	Text versus picture, pictorial icons, visual information factor, graphic images	Bansal-Travers et al. (2011), Hassan et al. (2007), Kees et al. (2006, 2010), Peters et al. (2007), Sabbane, Lowrey, and Chebat (2009), Young and Wogalter (1990)

Table 1. Continued

Notation in our Framework	Notation from Literature	Example Studies
Location	Location of warning label, label location relative to instructions on product	Barlow and Wogalter (1993), Frantz and Rhoades (1993), Magurno and Wogalter (1994), Torres, Sierra, and Heiser (2007), Wogalter, Kalsher, and Racicot (1992)
Promotional preactivation	Conspicuousness of location of warning label (off-product), location of warning in print ads, ads on the wall, television ads	Barlow and Wogalter (1993), Torres, Sierra, and Heiser (2007)
Frequency of exposure	Frequency of noticing a warning, substance use frequency, cigarettes per day, lifetime cigarette use, alcohol use, smoking habits	Beltramini (1988), Borland (1997), Cantrell et al. (2013), Gardner-Bonneau et al. (1989), Goldhaber and DeTurck (1988), Hassan et al. (2007), MacKinnon and Fenaughty (1993), Rooke, Malouff, and Copeland (2012), Thrasher et al. (2010)
Social influence	Situation of administration of the test, presence of a confederate	Cvetkovich and Earle 1995, Wogalter, Allison, and McKenna (1989)
Other contextual factors	Low versus medium cost of compliance, cost of compliance, product type	Braun and Silver (1995), Dingus, Hunn, and Wreggit (1991), Dingus, Wreggit, and Hathaway (1993), Wogalter, Allison, and McKenna (1989), Wogalter et al. (1987)

subject filled out a questionnaire on smoking habits. Consequently, we propose the following:

H_5: Social influence is positively associated with label effectiveness.

Laughery and Wogalter (2014) emphasize that understanding a warning does not necessarily ensure that it will be recalled at the proper time. To address this issue, warnings tend to be ubiquitous and repetitive. Indeed, the effectiveness of increasing the "exposure frequency" of warnings is a matter of debate in the literature. On the one hand, it could be that frequent encounters with a warning label revive pieces of latent or dormant knowledge and lead to higher compliance. For instance, Borland (1997) suggests that people who are repeatedly exposed to warning labels think about smoking dangers more frequently and comply more easily. On the other hand, frequency could lead to overexposure, making the label's effectiveness subject to wear out (e.g., Beltramini 1988; Hassan et al. 2007; Thrasher et al. 2010) as the result of a habituation effect (Rooke, Malouff, and Copeland 2012). After a certain level of exposure, adaptation may set in and consumers might start ignoring the warning message by activating mental barriers that degrade the intended effects (Abelson 1976). To illustrate, a study of Gallopel-Morvan et al. (2011) suggests that French consumers no longer react to old and overused textual warning labels.

While conceptually compelling, the adaptation argument does not have strong empirical support in the context of warning labels; this lack of evidence can be attributed to the exposure frequencies tested being usually restricted to the lower end of the experimental region. Thus, we side with Borland's (1997) view in that:

H_6: Frequency of exposure is positively associated with label effectiveness.

Methodological Moderators

The warning label literature comprises various research designs—namely, laboratory experiments, field experiments, and surveys. These designs have differing capabilities to "maximize systematic variance, control extraneous systematic variance, and minimize error variance" (Kerlinger and Howard 2000, p. 456). While laboratory experiments, field experiments, and surveys are equally able to minimize error variance, they differ on the two other sources of variance.

Experimental treatments are best for controlling systematic variance; field experiments do not allow the researcher to calibrate precisely the modality and strength of manipulations, while surveys rely on the naturally occurring variance among the variables of interest (Pedhazur and Schmelkin 1991). Because experiments manipulate only the variables of interest while ideally keeping all other sources of extraneous variance constant, they are superior. By contrast, field experiments and surveys are exposed to an array of nuisance variables beyond the researcher's control (Pedhazur and Schmelkin 1991). Our data collection reveals that warning labels have been analyzed more frequently through experiments (153 effect sizes) than by field experiments (30) and surveys (59) combined. Researchers should be aware of the characteristics of each design in their interpretation of the results. Whereas field experiments and surveys are subject to independent variable validity threats, which can attenuate the strength of the observed effect size (Hunter and Schmidt 2004), experiments are prone to effect size inflation. Therefore, we hypothesize the following:

H_7: Laboratory experiments display the strongest effect sizes, followed by field experiments and then surveys.

Method

Study Collection

We collected studies for coding using Cooper's (1998) guidelines for conducting a thorough literature search in four major steps. First, we retrieved the pool of studies identified by Argo and Main (2004). Next, we extended our list by identifying the research they cited or the articles that later cited them. We then complemented these steps by using both computer-based search procedures and manual search of (1) portals of scientific journals and academic databases through ProQuest and JSTOR, to include the most relevant marketing articles, and Google

Scholar gateway (keywords: "warning label," "warning*," and "label*") to make sure we retrieved all the eligible research, and (2) conference papers (e.g., *Proceedings of Human Factors Society*). Finally, we also included three published and unpublished thesis reports that we identified through a dissertation database. To overcome the limitations of computer-based literature resources, we took advantage of interlibrary document transfer services to access older articles or those that were not available online. Our initial search yielded 123 papers in total.

We set the following inclusion criteria according to general guidelines put forth by Hunter and Schmidt (2004, pp. 471–78):

1. The study should include quantitative reports (this condition excludes qualitative works and conceptual papers).
2. The study should measure the effect of an actual warning message framed as a label rather than the evocation of a label (this excludes lab simulations of warning messages that are not carried by a label; e.g., Muñoz, Chebat, and Suissa 2010).
3. The impact of the independent variables (e.g., text, shape salience, picture) should be assessed on at least one of the five dimensions of effectiveness (this excludes studies with other tested dependent variables such as relapse of behavior, as in Partos et al. [2013]).
4. The sample should comprise consumers rather than "patients" or "addicts." We are interested in the effectiveness of warning labels within the general population as a prevention rather than as a treatment (this excludes pathological users, addicts, former addicts, etc. and the studies conducted within a purely medical setting). Furthermore, this condition is important to keep consistency with Argo and Main's (2004) meta-analysis.
5. The study should report sufficient information that allows for the computation of effect sizes usable in a meta-analysis (e.g., having key pieces of quantitative data or displaying adequate methodological information in terms of study design) as explained by Hunter and Schmidt (2004).

On the basis of these criteria, 66 works were eventually included in the meta-analysis, amounting to 80 studies.

Our pool of primary studies shows an enhancement compared with its predecessor: whereas Argo and Main (2004) included 72 effect sizes from 39 papers (covering the period 1983–2002), our search process yielded 243 effect sizes from 66 papers from 1983 to June 2014. The larger number of collected effect sizes reflects a larger number of included studies and a more comprehensive coding scheme required for incorporating a wider range of moderators.

Effect Size Coding

We coded the effect sizes according to recommendations by Lipsey and Wilson (2001). We integrated correlational reports and other statistics that could easily be translated into correlation, such as chi-square, F-test and t-test, contingency table data, and frequency data. Odds-ratio effect sizes and standardized mean differences (Cohen's d) were appropriately coded into correlational r coefficients along with their respective sample size. If raw data were present in the form of tables, coders recalculated the effect size and compared it with the reported statistics for improved accuracy. Each effect size was then weighted by its sample size (Hunter and Schmidt 2004).

Coders then classified each moderator into different categories: mere label presence, label characteristics category, contextual factors category, or methodological factors. Note that moderators were included only if there were at least five effect sizes available (Palmatier et al. 2006). Our coders coded for "fear" to distinguish between conspicuous image graphics and fear appeal graphics. Primary studies were also coded for including a no-warning control group. In the case of various conditions with varying label characteristics, we compared the conditions two by two and extracted the effect sizes, correcting each individual effect size for its nested nature using hierarchical linear modeling (HLM).

Coders followed Rogers, Lamson, and Rousseau (2000) and operationalized the dependent and independent variables adjusted by their own interpretation if necessary. For example, whereas a study may claim to assess comprehension, it might actually measure warning recall instead. Coders closely monitored such operationalizations. For more details, see Table 1.

Analysis

We used Hunter and Schmidt's (2004) more conservative random-effects model rather than the fixed-effects model. Because this model allows for the possibility that effect sizes may come from distinct populations, they allow population parameters to vary freely and provide estimates of their variance.

We followed Bijmolt and Pieters (2001) in dealing with multiple measurements at the article level, study level, and effect size level by adopting a general model with a nested error structure in a complete set of measurements. The simplified general model is depicted as follows:

$$y_{es} = \beta_0 + \Sigma_{k=1}^{K} \beta_k x_{a,s,es} + r_a + u_s + e_{es}, \quad (1)$$

where y_{es} is the measurement of the effect size and $x_{a,s,es}$ is the denotation for moderator variables at the article, study, and effect size levels. In this model, measurements of the effect size are not independent within a study, leading to a nested error structure. The nested error structure decomposes the error variance into three error terms—r_a at the article level, u_s at the study level, and e_{es} at the effect size level—which corresponds to the general error term of the model. Error components r_a, u_s, and e_{es} are assumed to be normally distributed with zero mean and variances σ_a^2, σ_s^2, and σ_{es}^2, respectively.

We performed a data analysis using Raudenbush and Bryk's (2002) HLM based on 243 effect sizes collected from 80 studies nested within 66 articles. This high embeddedness of the data indicates that a multilevel approach is best suited to perform a fully hierarchical analysis of moderators. Although most meta-analyses in this area have not adopted the HLM approach, the importance of data hierarchies in meta-analyses is key for researchers to make appropriate assumptions. Despite being less obvious than repeatedly gathered data on an individual subject, the hierarchy of data in a meta-analysis exists because subjects, results, procedures, and experimenters are nested within a study (Bryk and Raudenbush 1992). A deviance test demonstrated that giving up some parsimony by adopting a three-level structure was warranted because a model estimating the overall effect size with the three-level specification fits the data better than a two-level model ($\Delta\chi^2 = 42.8$, d.f. = 1, $p < .001$) or a fixed-effect model ($\Delta\chi^2 = 174.9$, d.f. = 1, $p < .001$).

Although many meta-analyses evaluate moderator effects one after the other (e.g., Argo and Main 2004; Verlegh and Steenkamp 1999), they require the assumption of independent moderators whose effects are additive (Hunter and Schmidt 2004). This assumption is not satisfied in the field of warning labels because moderators overlap in the effect sizes they include. For example, because studies on pictorial warning

messages have mainly focused on cigarettes and have been predominantly set in a laboratory, pictorial moderators cannot be studied without accounting for methodological moderators.

To address the problem of correlated moderators, we adopted a multiple-regression approach to test the effect of all moderating variables in the model at once. This is critical because it circumvents the issue of potentially confounding effects and leads to more accurate estimates of interdependent moderators (Hunter and Schmidt 2004).

We calculated credibility intervals and confidence intervals according to Hunter and Schmidt (2004), Whitener (1990), and Arthur, Bennet, and Huffcutt (2001). In meta-analyses, credibility intervals indicate the plausible values of the effect size that may be found in any given primary study. Confidence intervals describe how much error is included in the estimate of a parameter (Jaramillo, Carrillat, and Locander 2005). We used SAS software (version 9.2) to perform our analyses with a maximum likelihood estimation method.

Results

In total, the studies sampled 33,243 participants and covered various parameters. Tables 2a, 2b, 3, and 4 report the mean effect sizes (ES) for each parameter alongside the number of effect sizes (k), the cumulated sample size (n), the standard error, the confidence intervals (CIs), and the credibility intervals. They are presented in separate tables for reader convenience despite being estimated simultaneously using a single hierarchical metaregression model.

Diminishing Cascade of Effects

Table 2, Panel A, shows that warning labels moderately attract consumers' attention ($ES_{attention}$ = .33, CI = [.24, .42]), followed by moderate effect sizes for both comprehension and recall of the message ($ES_{comprehension}$ = .31, CI = [.21, .42]; ES_{recall} = .31, CI = [.22, .39]). The relationships between warnings and judgment as well as behavior drop to the small effect size range defined by Cohen (1988; $ES_{judgment}$ = .25, CI = [.18, .32]; $ES_{behavior}$ = .29, CI = [.22, .35]).

Following McGuire (1976), we expect a diminishing cascade of effects throughout the information processing steps. However, despite a downward trend that conformed to our prediction, the linear test is not significant (t-value = –1.10, $p > .05$); thus, H_1 is not supported. However, when distinguishing expected behavior (compliance) into safe-use versus moderation/cessation, the cascade of effects emerges. For moderation/cessation labels, the effectiveness dimensions follow a downward linear pattern (t-value = –2.55, $p < .05$), whereas there is no such decreasing trend for safe-use labels (t-value = .81, $p = .42$). This result supports H_2.

Figure 2 illustrates that the effect sizes of moderation/cessation and safe-use labels are comparable from attention to judgment. As Table 2, Panel B, shows, the confidence intervals of these effect sizes greatly overlap. However, cessation/moderation labels are associated with markedly lower effect sizes for behavior ($ES_{moderation/cessation}$ = .18, CI = [.09, .27] vs. $ES_{safe\ use}$ = .39, CI = [.31, .47]). Note that the two confidence intervals do not overlap.

Mere Presence, Label Characteristics, and Contextual Factors

Table 3 shows the results for mere presence, as well as for label characteristics and contextual moderators. The mere presence of a label tests the general effect of warning labels as communication vehicles compared with their absence, whereas label characteristics focus on the incremental improvements from modifying specific label attributes. The mere presence of a label is associated with a significant effect size of .24 (CI = [.15, .34]).

Label Characteristics

According to Table 3, content has a small effect size ($ES_{content}$ = .25, CI = [.14, .35]), as do text salience ($ES_{text\ salience}$ = .19,

Table 2. Effectiveness Dimensions Step-by-Step

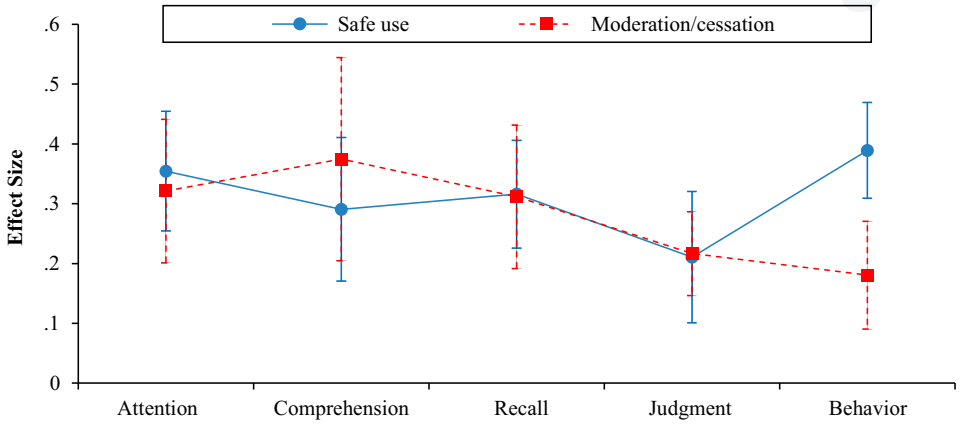
A: Effectiveness Dimensions

	K	n	r	SE	Confidence Interval	Credibility Interval
Attention	29	17,036	.33	.04	(.24, .42)	(–.14, .80)
Comprehension	21	7,138	.31	.05	(.21, .42)	(–.18, .80)
Recall	48	6,433	.31	.04	(.22, .39)	(–.27, .88)
Judgment	63	8,189	.25	.04	(.18, .32)	(–.33, .82)
Behavior	82	26,861	.29	.03	(.22, .35)	(–.30, .88)

B: Effectiveness Dimensions for Moderation/Cessation Versus Safe Use

	Moderation/Cessation				Safe Use			
	r	SE	Lower	Upper	r	SE	Lower	Upper
Attention	.32	.06	.20	.44	.35	.05	.25	.46
Comprehension	.37	.09	.20	.55	.29	.06	.17	.42
Recall	.31	.06	.19	.44	.32	.05	.22	.41
Judgment	.22	.04	.13	.30	.21	.06	.10	.33
Behavior	.18	.05	.09	.27	.39	.04	.31	.47

Figure 2. Comparing the Cascade of Effects (Safe Use vs. Moderation/Cessation)



CI = [.07, .31]) and shape salience ($ES_{shape\ salience}$ = .22, CI = [.07, .37]). A more prominent location of the label on the product ($ES_{location}$ = .32, CI = [.09, .55]) has a moderate effect size (Cohen 1988).

Regarding the "pictorial" characteristics of labels, images drawing on fear elicitation seem to yield a stronger effect size ($ES_{conspicuous\ image\ with\ fear}$ = .23, CI = [.13, .33]) than those with conspicuous-only images, which are not statistically different from zero (CI = [–.10, .16]). Indeed, we find that the difference between conspicuous pictures with fear appeal and those displaying conspicuous-only pictures is statistically significant (t-value = 2.44, $p < .05$).

In summary, these results confirm the mechanism from H_3 in that conspicuousness of text, shape, and location drive label effectiveness. Image conspicuousness, however, is a notable exception in that it seems to require a fear appeal to reach a similar effect size as other label characteristics. Overall, because most effect sizes associated with label characteristics are positive and significant, H_3 is generally supported. Note that the evidence for conspicuousness characteristics is in line with the findings of Argo and Main (2004); however, our results allow for disentangling the effect of image conspicuousness when fear appeal is removed as well as a more granular assessment of conspicuousness moderators, which Argo and Main's smaller sample size did not allow.

Contextual Factors

Compared with label characteristics, the promotional activation effect size is substantial at .49 (CI = [.27, .72]), which supports H_4. Social influence (ES_{social} = .33, CI = [.08, .58]) shows a moderate effect size, in support of H_5. We do not find a significant effect size for frequency of exposure ($ES_{frequency}$ = .12, CI = [–.004, .23]); thus, H_6 is not supported.

There are other contextual factors that could not be grouped homogeneously or within any of the aforementioned categories. For instance, there were only four eligible articles that dealt with cost of compliance (Dingus, Hunn, and Wreggit 1991; Dingus, Wreggit, and Hathaway 1993; Wogalter, Allison, and McKenna 1989; Wogalter et al. 1987). We analyze those parameters under "Other," and they exhibit a significant and small effect size of .28 (CI = [.09, .47]).

Methodological Moderators

As Table 4 shows, the effect size for field experiments falls between the two types of lab experiments ($ES_{experiment\_w\_control}$ = .32, CI = [.23, .41]; $ES_{field\ experiment}$ = .31, CI = [.16, .45]; $ES_{experiment\_w/o\_control}$ = .23 [.12–.33]) but is not significantly different from either type (experiments with control: t-value = –1.26, p = .21; experiments without control: t-value = .27, p = .79). Surveys yield a small effect size (ES_{survey} = .14, CI = [.03, .24]). Indeed, they are significantly different from experiments with a control group (t-value = 3.28, $p < .05$) and from field experiments (t-value = 2.16, $p < .05$), but not from the experiments without a control group (t-value = 1.41, $p > .10$).

As H_7 reasoned, the larger effect size of lab experiments was expected because of their more powerful designs. However, an alternative explanation is that because the review process favors articles with significant results, the usually small sample sizes of experiments require stronger effects to yield significant results. This phenomenon results in a publication bias (Greenwald 1975), which a meta-analysis can detect (Hunter and Schmidt 2004). We used three methods to test for publication bias: Begg's rank correlation, Egger's (1997) regression method, and a funnel plot regression. The logic of these three methods is that if publication bias inflates effect sizes within experimental designs, sample size and effect size should be negatively associated. However, if experimental control is responsible for the larger effect sizes, they should be unrelated to sample size. Importantly, none of the aforementioned tests shows a negative relationship between sample and effect sizes, thus failing to support the publication bias explanation. Therefore, H_7 is partially supported in that surveys produce smaller effect sizes than experimental methods (lab and field experiments), but experiments in the field did not yield smaller effect sizes than the ones in the lab.

General Discussion

This meta-analysis provides numerous enhancements relative to its predecessors. Methodologically speaking, it uses tools and

Table 3. Label Characteristics and Contextual Factors

	K	n	r	SE	Confidence Interval	Credibility Interval
Mere presence	52	13,267	.24	.05	(.15, .34)	(–.20, .68)
Label Characteristics						
Content	27	2,641	.25	.05	(.15, .35)	(–.19, .69)
Textual salience	28	4,870	.19	.06	(.07, .31)	(–.29, .67)
Shape salience	19	2,456	.22	.08	(.07, .37)	(–.33, .77)
Conspicuous image	18	786	.03	.06	(–.10, .16)	(–.45, .51)
Picture with fear appeal	53	23,715	.23	.05	(.12, .33)	(–.21, .67)
Location on product	9	838	.32	.12	(.09, .55)	(–.36, 1.00)
Contextual Factors						
Promotional preactivation	6	622	.49	.11	(.27, .72)	(–.16, 1.00)
Frequency of exposure	20	13,446	.12	.06	(–.004, .23)	(–.36, .60)
Social influence	5	358	.33	.13	(.08, .58)	(–.38, 1.00)
Other contextual factors[a]	6	651	.28	.09	(.09, .47)	(–.31, .87)

[a]For example, physical cost of compliance.

methods that are more appropriate to the structure of the studies examined, enabling this work to confirm some of the conclusions of prior works while developing others. Argo and Main (2004) note the size of their sample of studies as a challenge in detecting influential moderators. By using HLM methods and increasing the span of data collection (1983–2014), our analysis addresses this issue and includes more than three times the number of effect sizes of Argo and Main (243 vs. 72 effect sizes). Our results are enhanced by a random-effects model that accounts for the nested nature of the collected effect sizes and by a metaregression approach that accounts for possible confounds.

We introduce a new conceptual framework for studying warning labels. Our framework models information processing as a sequential system of effectiveness dimensions. Depicting a diminishing cascade of effects enables our model to offer an important insight into the difference between two types of warning labels. Moreover, our framework brings to consideration a new set of contextual moderators that pertain to social and contextual awareness of warning messages. In addition, there are comprehensive findings about label characteristics especially on the use of pictorials. Finally, we discuss those methodological moderators that may skew results and affect their interpretation.

Distinction Between Safe Use and Moderation/Cessation

Consistent with the information processing model, we observe that in the moderation/cessation warning type, behavior follows the downward trend as expected after attention, comprehension, recall, and judgment. However, safe-use warnings elicit more favorable behavioral changes. Indeed, although the diminishing cascade of effects prevails until the judgment phase (both safe-use and moderation/cessation warnings produce statistically similar effect sizes in the earlier four steps), the question is, What seems to facilitate compliance in safe-use warnings? Note that if safe-use warnings have a stronger effect size on behavioral compliance compared with cessation/moderation, these two types of labels have a similar impact on judgment. The distinction of safe use versus moderation/cessation reveals three important issues.

First, the threat is credible and usually instant in safe-use warning types: for example, if an industrial chemical substance makes contact with a user's eyes, (s)he would instantly feel burning in the eyes and suffer considerable loss of eyesight. In contrast, a cancer threat, which a tobacco/alcohol user may or may not have to deal with, is less certain and obviously not instantaneous. Not only is this fact reflected in the moderation/cessation warning messages that such products bear, but most users have heard anecdotal stories of longtime smokers who are still healthy.

Second, in the safe-use warning type, the expected compliance improves the consumption experience by ensuring user safety: for example, wearing gloves or goggles keeps the user safe while providing the expected utility intended from the chemical substance. However, a reasonable compliance instruction is usually missing from the moderation/cessation warning type; at best, the warning message suggests that the consumer should forgo consumption of the product altogether.

Table 4. Methodological Moderators

	K	n	r	SE	Confidence Interval	Credibility Interval
Study Design						
Experiments w/o control group	96	14,101	.23	.05	(.12, .33)	(–.21, .67)
Experiment with control group	58	3,251	.32	.05	(.23, .41)	(–.12, .76)
Field experiment	30	3,428	.31	.07	(.16, .45)	(–.21, .83)
Survey	59	28,582	.14	.06	(.03, .24)	(–.34, .62)

Third, moderation/cessation labels stigmatize consumption, which imposes a negative self-concept on consumers. By directly discouraging consumption (e.g., antismoking messages warn about the negative consequences of the act of smoking), moderation/cessation labels attach a psychological cost to processing that information because the user engages in maintaining self-consistency and ego protection. In contrast, safe-use messages are usually aligned with the user's consumption goals and intervene only to instruct how to avoid potential hazards (e.g., avoid contact with chemical substance).

According to Swann et al. (1987), consumers with an already-negative self-concept (e.g., "I am a smoker") perceive a negatively framed message (i.e., moderation/cessation labels) as self-descriptive rather than as a source of motivation for self-enhancement through behavioral change. As a result, they engage in cognitive self-consistency strategies (justifying smoking) rather than self-enhancement (decreasing or quitting smoking). Such strategies undermine the opportunities to change behavior by engaging consumers in activities that perpetuate their (already-negative) self-view. Stewart and Martin (1994, p. 11) offer a detailed discussion on the psychological roots of such behavior among some consumers and suggest a link to psychological reactance.

The distinction between safe use and moderation/cessation is a key finding with important consequences for future public policies. Is there a way to improve behavioral compliance for the products currently bearing moderation/cessation warnings and replicate the satisfactory results that we have observed in safe-use warning type? For example, since 2004, the Centers for Disease Control and Prevention has claimed that obesity is a "prominent public health epidemic," with more than 30% of U.S. adults classified as obese (Fryar, Carroll, and Ogden 2012; Seiders and Petty 2004). Packaged food products and soft drink beverages, which already carry enhanced nutritional information labels (Food and Drug Administration 2014), are on the verge of being subjected to changing warning labels and nutritional value tables in North America. In 2015, California lawmakers voted to put warning labels on all advertisements for sugary beverages. As part of an effort aimed at reducing health problems linked to consumption of high-calorie drinks, new legislative trends are emerging to incorporate warning labels on prepared food products that are similar to those on tobacco or alcohol products. It may only be a matter of time before these changes go nationwide (or worldwide). The warnings read: "Drinking beverages with added sugar(s) contributes to obesity, diabetes, and tooth decay. This is a message from the City and County of San Francisco" (Steinmetz 2015). This is an opportunity for policy makers to be reminded that traditional moderation/cessation labels are hardly the silver bullet to eliminate such harmful consumptions, given the weaker impact on compliance, threat credibility issues, and the self-consistent cognitions that they evoke.

A greater public policy challenge is that it seems virtually impossible for policy makers to imagine a safe-use type of warning message for product categories such as food, beverages, cigarettes, or alcohol. In other words, policy makers have not yet imagined a warning that suggests safer consumption of a potentially harmful product while at the same time respecting users' consumption choices of legally purchased products. In the light of our results, we suggest that warning labels reframed in a safe-use format could better contribute to reducing harmful consumptions as such.

The following illustrates the difference between moderation/cessation and safe-use warning messages. Rather than alerting of a future health problem within 50 years (e.g., drinking sugary soda will cause diabetes), a warning label on a sugary beverage might suggest that "to burn the current amount of sugar intake (in calories), consumer must run for 20 minutes or partake in 30 minutes of average to high levels physical activity." In this manner, users are told how to consume the product safely: by monitoring their activity level, they can ensure that their energy intake is balanced with their energy expenditure. An added benefit resides in the transposition of calories (an abstract quantification of energy) into equivalent quantities that most consumers can relate to, such as time spent exercising. Indeed, in early 2016, the George Institute for Global Health in Australia issued a list of the worst offenders in the junk food category, with the equivalent running time necessary to burn them off (Alexander 2016).

Importance of Contextual Moderators

Our second theoretical contribution in this meta-analysis is that we account for contextual parameters. Two major contextual moderators (i.e., promotional preactivation and social influence for socially consumed products such as food, tobacco, or alcohol) yield medium effect sizes compared with a range of small effect sizes yielded by label characteristics parameters. In other words, we can conclude that although label characteristics can affect the effectiveness of the warning labels, they do not enable warning labels to reach their full potential. Curiously, a quick look at the published primary studies reveals that despite this enhancement, less than 19% (one in five) of the primary studies have included contextual parameters in investigating warning labels. Thus, we suggest that researchers and policy makers alike should expand their span of focus from the physical design of the label to include contextual moderators.

Our results show that social influence is a moderate driver of effectiveness (compared with mostly small effect sizes of label characteristics). The low number of primary studies investigating social influences (five effect sizes) proves that this aspect of warning labels is greatly understudied (compared with more than 50 effect sizes for health-related warning messages). One avenue for researchers is to compare the effectiveness of social cues and health-related cues in terms of cognitive change and behavioral compliance. Much human behavior is influenced by immediate feedback from social cues. In a trade-off between immediate social consequences and long-term health issues, social cues usually prevail (Hari 2015). At the time of consumption, consumers are more likely to discount future health consequences than an immediate, socially wired consequence. Thus, social cues can be used to emphasize shorter-term negative effects of consumption. Policy makers can benefit from forming warning messages around building negative social consequences (immediate effect) rather than long-term negative health consequences. This shift in approach is especially important for products that are commonly consumed in social contexts such as cigarettes, alcohol, soft drinks, and food products. In particular, policy makers should note that social consequences play an even more critical role among young smokers and women, who are the most vulnerable consumers in the face of health challenges (Denscombe 2001).

Such social cues may not be effective for products that do not have a social element to their consumption. For a domestically consumed chemical product, a warning on the immediate consequences (e.g., burn of skin, eye damage) would suffice. A good example of a warning message using social influence (threat of erectile dysfunction due to smoking) can be found in O'Hegarty et al.'s (2007) discussion of six Canadian health warning labels placed on cigarette packages. They show that consumers find the image incorporating the social disadvantages of smoking to be more effective in creating compliance than other labels (health related only).

We also find a substantive effect size for promotional preactivation. Promotional preactivation (i.e., incorporating warnings into integrated marketing campaigns) can be as important and powerful as on-package warnings. Indeed, a body of research shows that an integrated approach is more persuasive than an isolated communication (Dillman 2000; Haggett and Mitchell 1994; Neslin 2002). Including warning messages in marketing campaigns prompts and activates the information in consumers' minds in advance and influences their judgment more effectively. In fact, under the U.S. Family Smoking Prevention and Tobacco Control Act (2009), smokeless tobacco products are already required to bear warning labels in their advertisements and promotional campaigns. Our findings provide support for this course of action.

However, in integrating warnings in promotional campaigns, policy makers must consider three possible barriers: (1) there is a high cost in convincing producers to run marketing campaigns in compliance with warning requirements, and this strategy increases (2) the frequency of message exposure, potentially leading to overexposure and wear-out effects as well as (3) exacerbation of the false-alarm effect (Chowdhury et al. 2014).

Convincing producers to include warning messages discouraging consumption of their products in their marketing campaigns only seems possible through forceful legislation (and litigation). Producers in the food industry do not include sensitive nutritional facts and warning labels in their advertisements and promotional campaigns, thus holding customers responsible for their consumption choices. The industry's position so far has been to refuse the obligation to activate warning labels, arguing that no food has been proved to be inherently good or bad or to cause obesity per se (Seiders and Petty 2004).

The type of influence that frequency of exposure exerts is difficult to ascertain. The literature is divided between two opposite perspectives; indeed, we did not observe a significant aggregate-level effect size for frequency of exposure. Some researchers prescribe increasing exposure to reassure attention and message retention, whereas others are concerned with the negative overexposure effect and suggest that it could result in message wear-out (Beltramini 1988; Hassan et al. 2007; Rooke, Malouff, and Copeland 2012; Thrasher et al. 2010). This debate warrants further investigation, given that integrating warnings in advertisements would naturally increase message exposure. Frequency of exposure is believed to follow an inverse U-shaped function (for a meta-analysis on exposure effect, see Bornstein 1989). The literature is mute on the turning point at which the positive reaction is expected to switch to a negative reaction. The challenge is that the measurements of frequency that are currently available are not consistent in their definitions (see Table 1), and the existing studies are at either the very high or very low extremes of frequency, thus failing to explore the necessary range of the frequency variable to examine this hypothesis.

Finally, a discussion of "false alarms" (i.e., warning customers about an incorrect assessment of hazard) has recently gained prominence in the light of new scientific findings. For example, a recent study has challenged the accepted wisdom that saturated fat is inherently correlated with heart disease, potentially exposing previous nutritional guidelines as "false alarms" (Chowdhury et al. 2014). To address concerns that the increasing reliance on warning labels may have led to a false alarm effect whereby labels have become less trusted over time (Breznitz 2013), we carried out a post hoc analysis using year of study as a moderator. The results do not support a false alarm or saturation effect over the 40-year time span of our meta-analysis, suggesting that the effectiveness of warning labels has remained constant over time ($\beta = -.0052$, SE = .0032; t-value = -1.61, $p > .10$).

Guidelines for Label Design

The current meta-analysis also provides a thorough investigation of the label characteristics that affect warning label effectiveness. Argo and Main (2004) find that the conspicuousness of a label increases its effectiveness. Our results support their finding, but our larger pool of effect sizes enables us to break down this category into subdimensions and emphasize the important role of each moderator. Notably, content and location of the label have the strongest effect sizes, whereas conspicuous images showed a marginal effect on label effectiveness. The marginal effect size reflects the large heterogeneity across studies of pictorial warnings and insufficient evidence for or against their use, in line with a recent systematic review on the effects of pictorial warnings (Monárrez-Espino et al. 2014).

Our results distinguish between the more effective pictorial warnings coupled with fear appeal (as seen on cigarette packages) and those displaying only conspicuous pictures. This finding is consistent with a central/peripheral perspective to persuasion (Cacioppo and Petty 1982). Accordingly, the central route to persuasion is more cognitively intense and step by step, whereas affective cues, particularly fear, may have a complementary effect on compliance through a peripheral route. The peripheral route is less cognitively demanding in that it eschews attention, comprehension, recall, and judgment and targets behavioral compliance directly. From a public policy perspective, however, a fear appeal is not a guarantee of success, because, in addition to their limited effect, such pictorials have not yet been tested on any product category other than cigarettes.

Methodological Concerns for Academia and Public Policy

From a methodological standpoint, our analyses offer guidelines for measuring public policy effectiveness, including pretest evaluations and postintervention measurements. A public policy decision should generally follow the "SMART" criteria (i.e., results that are specific, measurable, achievable, results-focused, and time-bound; Doran 1981; Shahin and Mahbod 2007). Measuring the success of a campaign is important. To be measurable, a campaign must have appropriate expectations that are realistic, whether in evaluating the efficacy of a

campaign or in pretesting an upcoming intervention. Our results show that if policy makers are using surveys, the effect size should naturally be smaller than when they run an experiment because experiments have better control over the variables in question and the external noise.

Selecting research design sets the expectation for the effect size magnitude level that will be obtained. Policy makers are recommended to correct and adjust their interpretations of research results as a function of the methodology used. For instance, when assessing the effectiveness of a new policy, the comparison with previous experimental studies could be less favorable than with survey-based studies simply because their methodologies differ. In this case, such a comparison may unwittingly disappoint or mislead policy makers into thinking that the policy is not successful enough or compel authorities to stop an intervention that actually works.

We also find support for the claim that the difference in effect size magnitude between research designs is not due to publication bias. We ran three different tests for publication bias. Our tests did not reveal a major publication bias in the warning labels literature. Our tests in their present form make an important inference about the current state of the literature with the following policy-making implications: if published studies were a biased sample of all studies that had been conducted, then the validity of any public policy inference or conclusion drawn from scientific publications would have been threatened.

For public policy purposes, we invite policy makers to design a combination of methods (including lab experiments, field experiments, surveys, etc.) in multiphase integrative research to minimize the probability of skewed interpretation of scientific reports. This of course can make public policy research more expensive to design and more time consuming to implement, but we expect this approach to increase the validity of the conclusions and effectiveness of legislations. The second-best way to increase validity is to base public policy decisions on structurally integrative works such as meta-analyses.

Limitations and Further Research

This meta-analysis includes a wide range of studies across the literature. However, some studies may have not been included because of shortcomings in data or design. For example, we excluded a prospective longitudinal cohort survey in four countries by Partos et al. (2013) because of their definition of dependent variable and their sample: they examined ex-smokers (nonusers) who relapsed (returned to smoking after a period of improvement rather than moderating or ceasing this behavior). In another instance, we excluded from the database a doctoral thesis by Muñoz as well as its subsequent article (i.e., Muñoz, Chebat, and Suissa 2010) because coders were unable to ascertain whether the focal message was in fact a warning label or was simply evoked in the form of a statement/question within the questionnaire.

The theory-testing capacity of a meta-analysis is directly affected by the research design of its original studies (Miller and Pollock 1994). According to Sharpe (1997), one of the three threats to the validity of meta-analysis work is inclusion of poor-quality studies. In our work, we tried to eliminate this threat by carefully selecting the studies. We also took into account potential publication biases by including appropriate tests.

We could not collect enough eligible studies on the physical cost of compliance to be able to include it as a moderator. We understand that it is a particularly notable descriptor of behavioral compliance. Understanding the nature of such costs, combined with the information cost existing in the information processing model, can further shed light on the underlying differences between safe-use and moderation/cessation types of warnings. We hope that future endeavors will delve into this parameter in more detail. For a discussion on the importance of cost of compliance in warning effectiveness, see Stewart and Martin (1994, p. 12).

Frequency of exposure is another important topic of discussion in warning labels that requires more attention in primary studies. While our observations could be interpreted as a sign favoring overexposure and wear-out, it is important to emphasize that frequency was operationalized very heterogeneously in the literature (e.g., substance use, alcohol use, number of cigarettes per day, lifetime cigarette use, smoking habits, familiarity, frequency of noticing a warning, product knowledge). Further research with a more stable set of measures of exposure frequency is warranted. Researchers may also detect the mechanisms in use by contrasting high and low frequencies of exposure.

Although our meta-analysis offers a comprehensive take on the drivers of the effectiveness of warning labels to date, it also highlights promising research avenues for the future. Promotional preactivation seems to be an important moderator in terms of warning effectiveness, explaining approximately one-quarter of the variance. However, because cost effectiveness is an important attribute of warning labels, future studies should evaluate the benefits afforded by promotional preactivation in the light of its extra cost.

The research on warning labels is highly product specific. In the current meta-analysis, most labels of moderation/cessation type were associated with tobacco and alcohol. A confound of product type with message type is thus likely. However, post hoc analyses reveal that labels used for tobacco and alcohol display similar patterns of effect sizes across the effectiveness dimensions. We ran separate analyses on each step of the decision-making model. For the first four effectiveness dimensions (attention, comprehension, recall, and judgment), the effect sizes did not differ between labels associated to tobacco, alcohol, or other product categories. However, labels for tobacco and alcohol were consistently less effective in terms of behavior when compared with other product categories (t(cig) = 2.93, t(alcohol) = 2.94; ps < .01). Moreover, we observed no significant difference between tobacco and alcohol in the effect size of behavior measures (t-value = .149, p-value = .251). This does not exclude the possibility of a confounding effect, but it does suggest that labels for tobacco and alcohol products share the same basic properties regarding how they influence behaviors. Future studies should compare the effect of moderation/cessation on behavior modification across product categories to exclude the prospect of a confounding effect.

Our analysis on the difference between including a "no warning label" control group in lab experimental designs, as opposed to only having treatment group comparisons (i.e., varying conditions with warning labels), did not reach significance. We anticipated that a true control group would increase the strength of the effect sizes by disentangling the impact of a label versus no label from manipulations of specific label features. However, the difference was not statistically significant (t-value = 1.72, p = .0877). We invite other researchers to follow up on this question. Finally, future studies

may also test and compare a curvilinear hypothesis with our proposed linear cascade of effects.

Appendix: Studies Included in the Meta-Analysis

- Adams and Edworthy (1995)
- Azagba and Sharaf (2013)
- Bansal-Travers et al. (2011)
- Barlow and Wogalter (1993)
- Bhalla and Lastovicka (1984)
- Borland (1997)
- Braun and Silver (1995)
- Braun, Silver, and Stock (1992)
- Cantrell et al. (2013)
- Chowwanapoonpohn et al. (2005)
- Cvetkovich and Earle (1995)
- Decock and Van Looy (2011)
- Desaulniers (1987)
- Dingus, Hunn, and Wreggit (1991)
- Dingus, Wreggit, and Hathaway (1993)
- Effertz, Franke, and Teichert (2014)
- Ezer et al. (2006)
- Frantz (1992)
- Frantz (1994)
- Frantz and Rhoades (1993)
- Gardner-Bonneau et al. (1989)
- Glock, Müller, and Ritter (2012)
- Godfrey, Rothstein, and Laughery (1985)
- Goldberg et al. (1999)
- Goldhaber and DeTurck (1988)
- Goldhaber and DeTurck (1989)
- Goodall and Appiah (2008)
- Hammond et al. (2004)
- Hammond et al. (2006)
- Hammond et al. (2007)
- Hassan et al. (2007)
- Hatem (1993)
- Hatem (1995)
- Hoek et al. (2010)
- Jaynes and Boles (1990)
- Kalsher, Clarke, and Wogalter (1991)
- Karnes and Leonard (1986)
- Kaskutas (1993)
- Kees et al. (2006)
- Kees et al. (2010)
- Kennedy et al. (2012)
- MacKinnon and Fenaughty (1993)
- MacKinnon et al. (2001)
- Magurno and Wogalter (1994)
- Malouff et al. (1993)
- Mazis, Morris, and Swasy (1991)
- McDougald and Wogalter (2011)
- Mendel et al. (2010)
- Moreno-Vasquez (2014)
- Orr and Hughes (1988)
- Otsubo (1988)
- Peters et al. (2007)
- Racela and Thoumrungroje (2012)
- Sabbane, Bellavance, and Chebat (2009)
- Sabbane, Lowrey, and Chebat (2009)
- Schucker et al. (1983)
- Strawbridge (1986a)
- Strawbridge (1986b)
- Torres, Sierra, and Heiser (2007)
- Tugrul (2013)
- Wogalter, Allison, and McKenna (1989)
- Wogalter, Fontenelle, and Laughery (1985)
- Wogalter, Jarrard, and Simpson (1994)
- Wogalter, Kalsher, and Racicot (1992)
- Wogalter, Kalsher, and Racicot (1993)
- Wogalter et al. (1987)
- Young and Wogalter (1990)
- Zhao et al. (2014)

References

Abelson, Robert P. (1976), *Script Processing in Attitude Formation and Decision Making*, Mahwah, NJ: Lawrence Erlbaum Associates.

Adams, Austin S., and Judy Edworthy (1995), "Quantifying and Predicting the Effects of Basic Text Display Variables on the Perceived Urgency of Warning Labels: Tradeoffs Involving Font Size, Border Weight, and Color," *Ergonomics*, 38 (11), 2221–37.

Alexander, Harriet (2016), "Zabrero Nachos Tops List of Fast Food Overloads," *Sydney Morning Herald* (February 17), http://www.smh.com.au/national/health/zambrero-nachos-tops-list-of-fast-food-overloads-20160216-gmvbhw.html.

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

Ariely, Dan, and Jonathan Levav (2000), "Sequential Choice in Group Settings: Taking the Road Less Traveled and Less Enjoyed," *Journal of Consumer Research*, 27 (3), 279–90.

Arthur, Winfred, Jr., Winston Bennet Jr., and Allen I. Huffcutt (2001), *Conducting Meta-Analysis Using SAS*. Mahwah, NJ: Lawrence Erlbaum Associates.

Azagba, Sunday, and Mesbah F. Sharaf (2013), "The Effect of Graphic Cigarette Warning Labels on Smoking Behavior: Evidence from the Canadian Experience," *Nicotine & Tobacco Research*, 15 (3), 708–17.

Bansal-Travers, M., David Hammond, Philip Smith, and K. Michael Cummings (2011), "The Impact of Cigarette Pack Design, Descriptors, and Warning Labels on Risk Perception in the U.S.," *American Journal of Preventive Medicine*, 40 (6), 674–82.

Bargh, John A., Mark Chen, and Lara Burrows (1996), "Automaticity of Social Behavior: Direct Effects of Trait Construct and Stereotype Activation on Action," *Journal of Personality and Social Psychology*, 71 (2), 230–44.

Barlow, Todd, and Michael S. Wogalter (1993), "Alcoholic Beverage Warnings in Magazine and Television Advertisements," *Journal of Consumer Research*, 20 (1), 147–56.

Belk, Russell W. (1974), "An Exploratory Assessment of Situational Effects in Buyer Behavior," *Journal of Marketing Research*, 11 (May), 156–63.

Beltramini, Richard F. (1988), "Perceived Believability of Warning Label Information Presented in Cigarette Advertising," *Journal of Advertising*, 17 (2), 26–32.

Bhalla, Gaurav, and John L. Lastovicka (1984), "The Impact of Changing Cigarette Warning Message Content and Format," in *Proceedings of the Human Factors Society 29th Annual Meeting*, Mary Jane Alluisi, Dybil de Froot, and Warl Sl. Slluisi, eds. Santa Monica, CA: Human Factors Society, 305–10.

Bijmolt, Tammo H.A., and Rik G.M. Pieters (2001), "Meta-Analysis in Marketing When Studies Contain Multiple Measurements," *Marketing Letters*, 12 (2), 157–69.

Borland, Ron (1997), "Tobacco Health Warnings and Smoking-Related Cognitions and Behaviors," *Addiction*, 92 (11), 1427–35.

Bornstein, Robert F. (1989), "Exposure and Affect: Overview and Meta-Analysis of Research, 1968–1987," *Psychological Bulletin*, 106 (2), 265–89.

Braun, Curt C., and N. Clayton Silver (1995), "Interaction of Signal Word and Color on Warning Labels: Differences in Perceived Hazard and Behavioral Compliance," *Ergonomics*, 38 (11), 2207–20.

Braun, Curt C., N. Clayton Silver, and Barry R. Stock (1992), "Likelihood of Reading Warnings: The Effect of Fonts and Font Sizes," in *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*. Santa Monica, CA: Human Factors Society, 926–30.

Breznitz, Shlomo (2013), *Cry Wolf: The Psychology of False Alarms*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Bryk, A., and Stephen W. Raudenbush (1992), *Hierarchical Linear Models: Applications and Data Analysis Methods*. Thousand Oaks, CA: Sage Publications.

Cacioppo, John T., and Richard E. Petty (1982), "The Need for Cognition," *Journal of Personality and Social Psychology*, 42 (1), 306–07.

Cacioppo, John T., Richard E. Petty, and Katherine J. Morris (1983), "Effects of Need for Cognition on Message Evaluation, Recall, and Persuasion," *Journal of Personality and Social Psychology*, 45 (4), 805–18.

California Center for Public Health Advocacy (2015), "Senate Majority Leader Introduces Legislation Calling for Warning Labels on Sugary Drinks," press release, http://www.publichealthadvocacy.org/resources/warninglabel/SB203_PressRelease_2-11-15.pdf.

Cantrell, Jennifer, Donna M. Vallone, James F. Thrasher, Rebekah H. Nagler, Shari P. Feirman, Larry R. Muenz, et al. (2013), "Impact of Tobacco-Related Health Warning Labels Across Socioeconomic, Race and Ethnic Groups: Results from a Randomized Web-Based Experiment," *PLoS One*, 8 (1), e52206.

Chen, Yubo, Shankar Ganesan, and Yong Liu (2009), "Does a Firm's Product-Recall Strategy Affect Its Financial Value? An Examination of Strategic Alternatives During Product-Harm Crises," *Journal of Marketing*, 73 (November), 214–26.

Chowdhury, Rajiv, Samantha Warnakula, Setor Kunutsor, Francesca Crowe, Heather A. Ward, Laura Johnson, et al. (2014), "Association of Dietary, Circulating, and Supplement Fatty Acids with Coronary Risk: A Systematic Review and Meta-Analysis," *Annals of Internal Medicine*, 160 (6), 398–406.

Chowwanapoonpohn, Hathaikan, Chidchanok Ruengorn, Yongyuth Ruanta, and Ratanaporn Awiphan (2005), "Warning Disclosures in Televised Over-the-Counter Drug Advertisements," *CMU Journal*, 4 (2), 219–30.

Cohen, Jacob (1988), *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Cooper, Harris M. (1998), *Synthesizing Research: A Guide for Literature Reviews*. Thousand Oaks, CA: Sage Publications.

Cox, Eli P., 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), 195–205.

Cvetkovich, George, and Timothy C. Earle (1995), "Product Warnings and Information Processing: The Case of Alcohol Beverage Labels," *European Review of Applied Psychology*, 45 (1), 17–20.

Decock, Jan, and Jan Van Looy (2011), "Forbidden or Promising Fruit? An Experimental Study into the Effects of Warning Labels on the Purchase Intention of Digital Gamers," in *Think Design Play: 5th International DiGRA Conference (DIGRA-2011)*. Ghent, BE: Ghent University, Department of Communication Studies.

Denscombe, Martyne (2001), "Uncertain Identities and Health-Risking Behaviour: The Case of Young People and Smoking in Late Modernity," *British Journal of Sociology*, 52 (1), 157–77.

Desaulniers, David R. (1987), "Layout, Organization, and the Effectiveness of Consumer Product Warnings," in *Proceedings of the Human Factors Society 31st Annual Meeting*. Santa Monica, CA: Human Factors Society, 56–60.

Dickson, Peter R. (1996), "The Static and Dynamic Mechanics of Competition: A Comment on Hunt and Morgan's Comparative Advantage Theory," *Journal of Marketing*, 60 (October), 102–06.

Dillman, Don A. (2000), *Mail and Internet Surveys: The Tailored Design Method*. New York: John Wiley & Sons.

Dingus, Thomas A., Bruce P. Hunn, and Steven S. Wreggit (1991), "Two Reasons for Providing Protective Equipment as Part of Hazardous Consumer Product Packaging," in *Proceedings of the Human Factors Society 35th Annual Meeting*. Santa Monica, CA: Human Factors Society, 1039–42.

Dingus, Thomas A., Steven S. Wreggit, and Jill A. Hathaway (1993), "Warning Variables Affecting Personal Protective Equipment Use," *Safety Science*, 16 (5), 655–73.

Doran, George T. (1981), "There's a S.M.A.R.T. Way to Write Management's Goals and Objectives," *Management Review*, 70 (11), 35–36.

Earle, Timothy C., and George Cvetkovich (1995), *Social Trust: Toward a Cosmopolitan Society*. Westport, CT: Praeger.

Effertz, Tobias, Marie-Kristin Franke, and Thorsten Teichert (2014), "Adolescents' Assessments of Advertisements for Unhealthy Food: An Example of Warning Labels for Soft Drinks," *Journal of Consumer Policy*, 37 (2), 279–99.

Egger, Matthias, George Davey Smith, Martin Schneider, and Christoph Minder (1997), "Bias in Meta-Analysis Detected by a Simple, Graphical Test," *BMJ*, 315 (7109), 629–34.

Erdem, Tülin, and Michael P. Keane (1996), "Decision-Making Under Uncertainty: Capturing Dynamic Brand Choice Processes in Turbulent Consumer Goods Markets," *Marketing Science*, 15 (1), 1–20.

Ezer, Neta, Arthur D. Fisk, C. Travis Bowles, and Wendy A. Rogers (2006), "The Use of Similes to Enhance Inferencing and Memory of Unfamiliar Product Hazards," in *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*. Santa Monica, CA: Human Factors Society, 2321–25.

Foxall, Gordon R., and M. Mirella Yani-de-Soriano (2005), "Situational Influences on Consumers' Attitudes and Behavior," *Journal of Business Research*, 58 (4), 518–25.

Frantz, J. Paul (1992), "Effect of Location, Procedural Explicitness, and Presentation Format on User Processing of and Compliance with Product Warnings and Instructions," doctoral dissertation,

Department of Industrial and Operations Engineering, University of Michigan.

Frantz, J. Paul (1994), "Effect of Location, Procedural Explicitness, and Presentation Format on User Processing of and Compliance with Product Warnings and Instructions," *Human Factors*, 36 (3), 532–46.

Frantz, J. Paul, and Timothy P. Rhoades (1993), "A Task-Analytic Approach to the Temporal and Spatial Placement of Product Warnings," *Human Factors*, 35 (4), 719–30.

Fryar, Cheryl D., Margaret D. Carroll, and Cynthia L. Ogden (2012), *Prevalence of Overweight, Obesity, and Extreme Obesity Among Adults: United States, Trends 1960–1962 Through 2009–2010*. Hyattsville, MD: National Center for Health Statistics.

Gallopel-Morvan, Karine, Patrick Gabriel, Marine Le Gall-Ely, Sophie Rieunier, and Bertrand Urien (2011), "The Use of Visual Warnings in Social Marketing: The Case of Tobacco," *Journal of Business Research*, 64 (1), 7–11.

Gardner-Bonneau, Daryle, Fawzi Kabbara, Minjohn Hwang, Hans Bean, Marilyn Gantt, Kevin Hartshorn, et al. (1989), "Cigarette Warnings: Recall of Content as a Function of Gender Message Content, Smoking Habits and Time," in *Proceedings of the Human Factors Society 33rd Annual Meeting*. Santa Monica, CA: Human Factors Society, 928–30.

Glock, Sabine, Barbara C.N. Müller, and Simone Ritter (2012), "Warning Labels Formulated as Questions Positively Influence Smoking-Related Risk Perception," *Journal of Health Psychology*, 18 (2), 252–62.

Godfrey, Sandra S., Pamela R. Rothstein, and Kenneth R. Laughery (1985), "Warnings: Do They Make a Difference," in *Proceedings of the Human Factors Society 29th Annual Meeting*, Robert W. Swezey, ed. Santa Monica, CA: Human Factors Society, 669–73.

Goldberg, Marvin E., John Liefeld, Judith Madill, and Harrie Vredenburg (1999), "The Effect of Plain Packaging on Response to Health Warnings," *American Journal of Public Health*, 89 (9), 1434–35.

Goldhaber, Gerard M., and Mark A. deTurck (1988), "Effectiveness of Warning Signs: Familiarity Effects," *Forensic Reports*, 1, 281–301.

Goldhaber, Gerard M., and Mark A. deTurck (1989), "A Developmental Analysis of Warning Signs: The Case of Familiarity and Gender," in *Proceedings of the Human Factors Society 33rd Annual Meeting*. Santa Monica, CA: Human Factors Society, 1019–23.

Goodall, Catherine, and Osei Appiah (2008), "Adolescents' Perceptions of Canadian Cigarette Package Warning Labels: Investigating the Effects of Message Framing," *Health Communication*, 23 (2), 117–27.

Green, Leonard, Astrid F. Fry, and Joel Myerson (1994), "Discounting of Delayed Rewards: A Life-Span Comparison," *Psychological Science*, 5 (1), 33–36.

Greenwald, Anthony G. (1975), "Consequences of Prejudice Against the Null Hypothesis," *Psychological Bulletin*, 82 (1), 1–20.

Haggett, Sarah, and Vincent-Wayne Mitchell (1994), "Effect of Industrial Prenotification on Response Rate, Speed, Quality, Bias, and Cost," *Industrial Marketing Management*, 23 (2), 101–10.

Hammond, David, Geoffrey T. Fong, Paul W. McDonald, K. Stephen Brown, and Roy Cameron (2004), "Graphic Canadian Cigarette Warning Labels and Adverse Outcomes: Evidence from Canadian Smokers," *American Journal of Public Health*, 94 (8), 1442–45.

Hammond, David, Geoffrey T. Fong, Ron Borland, K. Michael Cummings, Ann McNeill, and Pete Driezen (2007), "Text and Graphic Warnings on Cigarette Packages: Findings from the International Tobacco Control Four Country Study," *American Journal of Preventive Medicine*, 32 (3), 202–09.

Hammond, David, Geoffrey T. Fong, A. McNeill, R. Borland, and K. Michael Cummings (2006), "Effectiveness of Cigarette Warning Labels in Informing Smokers About the Risks of Smoking: Findings from the International Tobacco Control (ITC) Four Country Survey," *Tobacco Control*, 15 (Suppl III), iii19–25.

Hari, Johann (2015), *Chasing the Scream: The First and Last Days of the War on Drugs*. New York: Bloomsbury.

Hassan, Louise M., Edward Shiu, James F. Thrasher, Geoffrey T. Fong, and Gerard Hastings (2007), "Exploring the Effectiveness of Cigarette Warning Labels: Findings from the United States and United Kingdom Arms of the International Tobacco Control (ITC) Four Country Survey," *International Journal of Nonprofit and Voluntary Sector Marketing*, 13 (3), 263–74.

Hatem, Aida Therese (1993), "The Effect of Performance Level on Warning Compliance," master's thesis, Department of Industrial Engineering, Purdue University.

Hatem, Aida Therese (1995), "Effectiveness of Glue Odour as a Warning Signal," *Ergonomics*, 38 (11), 2250–61.

Hieke, Sophie, and Charles R. Taylor (2012), "A Critical Review of the Literature on Nutritional Labeling," *Journal of Consumer Affairs*, 46 (1), 120–56.

Hoek, Janet, Christiane Wong, Philip Gendall, Jordan Louviere, and Karen Cong (2010), "Effects of Dissuasive Packaging on Young Adult Smokers," *Tobacco Control*, 20 (3), 183–88.

Hunter, John E., and Frank L. Schmidt (2004), *Methods of Meta-Analysis: Correcting Error and Bias in Research Findings*. Thousand Oaks, CA: Sage Publications.

Jaramillo, Fernando, François A. Carrillat, and William B. Locander (2005), "A Meta-Analytic Comparison of Managerial Ratings and Self-Evaluations," *Journal of Personal Selling & Sales Management*, 25 (4), 315–28.

Jaynes, Linda S., and David B. Boles (1990), "The Effect of Symbols on Warning Compliance," in *Proceedings of the Human Factors Society 34th Annual Meeting*. Santa Monica, CA: Human Factors Society, 984–87.

Kalsher, Michael J., Steven W. Clarke, and Michael S. Wogalter (1991), "Posted Warning Placard: Effects on College Students Knowledge of Alcohol Facts and Hazards," in *Proceedings of the Human Factors Society 35th Annual Meeting*. Santa Monica, CA: Human Factors Society, 456–60.

Karnes, Edward W., and S. David Leonard (1986), "Consumer Product Warnings: Reception and Understanding of Warning Information by Final Users," in *Trends in Ergonomics/Human Factors III*, W. Karwowski, ed. Amsterdam: Elsevier Science Publishers, 995–1003.

Kaskutas, Lee A. (1993), "Changes in Public Attitudes Toward Alcohol Control Policies Since the Warning Label Mandate of 1988," *Journal of Public Policy & Marketing*, 12 (Spring), 30–42.

Kees, Jeremy, Scot Burton, J. Craig Andrews, and John Kozup (2006), "Tests of Graphic Visuals and Cigarette Package Warning Combinations: Implications for the Framework Convention on Tobacco Control," *Journal of Public Policy & Marketing*, 25 (Fall), 212–23.

Kees, Jeremy, Scot Burton, J. Craig Andrews, and John Kozup (2010), "Understanding How Graphic Pictorial Warnings Work on Cigarette Packaging," *Journal of Public Policy & Marketing*, 29 (Fall), 265–76.

Kennedy, Ryan David, Marlee M. Spafford, Ilan Behm, David Hammond, Geoffrey T. Fong, and Ron Borland (2012), "Positive Impact of Australian 'Blindness' Tobacco Warning Labels: Findings from the ITC Four Country Survey," *Clinical & Experimental Optometry*, 95 (6), 590–98.

Kerlinger, Fred N., and B. Lee Howard (2000), *Foundations of Behavioral Research*, 4th ed. New York: Harcourt Brace.

Laughery, Kenneth R., and Michael S. Wogalter (2014), "A Three-Stage Model Summarizes Product Warning and Environmental Sign Research," *Safety Science*, 61, 3–10.

Lipsey, Mark W., and David B. Wilson (2001), *Practical Meta-Analysis*. Thousand Oaks, CA: Sage Publications.

MacKinnon, David P., and Andrea M. Fenaughty (1993), "Substance Use and Memory for Health Warning Labels," *Health Psychology*, 12 (2), 147–50.

MacKinnon, David P., Liva Nohre, JeeWon Cheong, Alan W. Stacy, and Mary Ann Pentz (2001), "Longitudinal Relationship Between The Alcohol Warning Label and Alcohol Consumption," *Journal of Studies on Alcohol*, 62 (2), 221–27.

Magurno, Amy Barlow, and Michael S. Wogalter (1994), "Behavioral Compliance with Warnings: Effects of Stress and Placement," in *Proceedings of the Human Factors and Ergonomics Society 38th Annual Meeting*. Santa Monica, CA: Human Factors Society, 26–30.

Malouff, John, Nicola Schutte, Kimara Wiener, Christine Brancazio, and Darla Fish (1993), "Important Characteristics of Warning Displays on Alcohol Containers," *Journal of Studies on Alcohol*, 54 (4), 457–61.

Mandler, George (1982), "The Structure of Value: Accounting for Taste," in *Affect and Cognition: The 17th Annual Carnegie Symposium*, Margaret S. Clark and Susan T. Fiske, eds. Hillsdale, NJ: Lawrence Erlbaum Associates, 203–30.

Mazis, Michael B., Louis A. Morris, and John L. Swasy (1991), "An Evaluation of the Alcohol Warning Label: Initial Survey Results," *Journal of Public Policy & Marketing*, 10 (Spring), 229–41.

McDougald, Brannan R., and Michael S. Wogalter (2011), "Increased Comprehension of Warning Pictorials with Color Highlighting," *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 55 (1), 1769–72.

McGuire, William J. (1976), "Some Internal Psychological Factors Influencing Consumer Choice," *Journal of Consumer Research*, 2 (4), 302–19.

Mendel, Jeremy, Christopher B. Mayhorn, Jefferson B. Hardee, Ryan T. West, and Richard Pak (2010), "The Effect of Warning Design and Personalization on User Compliance in Computer Security Dialogs," in *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*. Santa Monica, CA: Human Factors Society, 1961–65.

Meyers-Levy, Joan, and Alice M. Tybout (1997), "Context Effects at Encoding and Judgment in Consumption Settings: The Role of Cognitive Resources," *Journal of Consumer Research*, 24 (1), 1–14.

Miller, Norman, and Vickie E. Pollock (1994), "Meta-Analysis and some Science-Compromising Problems of Social Psychology," in *Social Psychology of Science*, William R. Shadish and Steve Fuller, eds. New York: Guilford Press, 230–61.

Mischel, Walter, and Joan Grusec (1967), "Waiting for Rewards and Punishments: Effects of Time and Probability on Choice," *Journal of Personality and Social Psychology*, 5 (1), 24–31.

Monárrez-Espino, Joel, Bojing Liu, Felix Greiner, Sven Bremberg, and Rosaria Galanti (2014), "Systematic Review of the Effect of Pictorial Warnings on Cigarette Packages in Smoking Behavior," *American Journal of Public Health*, 104 (10), e11–30.

Moreno-Vasquez, Tomas (2014), "Graphic Cigarette Warning Labels: The Effect of Arousal on Long Term Memory," undergraduate thesis, Ohio State University.

Muñoz, Yaromir, Jean-Charles Chebat, and Jacob Amnon Suissa (2010), "Using Fear Appeals in Warning Labels to Promote Responsible Gambling Among VLT Players: The Key Role of Depth of Information Processing," *Journal of Gambling Studies*, 26 (4), 593–609.

Neslin, Scott A. (2002), "Sales Promotion," in *Handbook of Marketing*, Barton Weitz and Robin Wensley, eds. Thousand Oaks, CA: Sage Publications, 310–38.

O'Hegarty, Michelle, Linda L. Pederson, Gayane Yenokyan, David Nelson, and Pascale Wortley (2007), "Peer Reviewed: Young Adults' Perceptions of Cigarette Warning Labels in the United States and Canada," *Preventing Chronic Disease*, 4 (2), A27.

Orr, Madeleine, and Stanley T. Hughes (1988), "Effectiveness of Product Safety Warnings over Time, and the Generalization of Warning Signs," in *Proceedings of the Human Factors Society 28th Annual Meeting*. Santa Monica, CA: Human Factors Society, 897–900.

Otsubo, Shirley M. (1988), "A Behavioral Study of Warning Labels for Consumer Products: Perceived Danger and Use of Pictographs," in *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*. Santa Monica, CA: Human Factors Society, 536–40.

Palmatier, Robert W., Rajiv P. Dant, Dhruv Grewal, and Kenneth R. Evans (2006), "Factors Influencing the Effectiveness of Relationship Marketing: A Meta-Analysis," *Journal of Marketing*, 70 (October), 136–53.

Park, Whan C., Deborah J. MacInnis, Joseph Priester, Andreas B. Eisingerich, and Dawn Iacobucci (2010), "Brand Attachment and Brand Attitude Strength: Conceptual and Empirical Differentiation of Two Critical Brand Equity Drivers," *Journal of Marketing*, 74 (November), 1–17.

Partos, Timea Reka, Ron Borland, Yong Hua-H., James Thrasher, and David Hammond (2013), "Cigarette Packet Warning Labels Can Prevent Relapse: Findings from the International Tobacco Control 4-Country Policy Evaluation Cohort Study," *Tobacco Control*, 22 (e1), e43–50.

Pedhazur, Elazar J., and Liora Schmelkin (1991), *Measurement, Design, and Analysis: An Integrated Approach*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Peters, Ellen, Daniel Romer, Paul Slovic, Kathleen Hall Jamieson, Leisha Wharfield, C.K. Mertz, et al. (2007), "The Impact and Acceptability of Canadian-Style Cigarette Warning Labels Among U.S. Smokers and Nonsmokers," *Nicotine & Tobacco Research*, 9 (4), 473–81.

Racela, Olimpia C., and Amonrat Thoumrungroje (2012), "The Perceived Ethicality and Efficacy of Fear Appeals: The Use of Graphic Warning Labels in Thailand," *Journal of International Business & Economics*, 12 (4), 106–13.

Rachlin, Howard, and Leonard Green (1972), "Commitment, Choice and Self-control," *Journal of the Experimental Analysis of Behavior*, 17 (1), 15–22.

Ratner, Rebecca K., and Barbara E. Kahn (2002), "The Impact of Private Versus Public Consumption on Variety-Seeking Behavior," *Journal of Consumer Research*, 29 (2), 246–57.

Raudenbush, Stephen W., and Anthony S. Bryk (2002), *Hierarchical Linear Models*. Newbury Park, CA: Sage Publications.

Rogers, Wendy A., Nina Lamson, and Gabriel K. Rousseau (2000), "Warning Research: An Integrative Perspective," *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 42 (1), 102–39.

Rooke, Sally, John Malouff, and Jan Copeland (2012), "Effects of Repeated Exposure to a Graphic Smoking Warning Image," *Current Psychology*, 31 (3), 282–90.

Sabbane, Lalla Ilhame, Francois Bellavance, and Jean-Charles Chebat (2009), "Recency Versus Repetition Priming Effects of Cigarette Warnings on Nonsmoking Teenagers: The Moderating Effects of Cigarette-Brand Familiarity," *Journal of Applied Social Psychology*, 39, 656–82.

Sabbane, Lalla Ilhame, Tina M. Lowrey, and Jean-Charles Chebat (2009), "The Effectiveness of Cigarette Warning Label Threats on Nonsmoking Adolescents," *Journal of Consumer Affairs*, 43 (2), 332–45.

Schucker, Raymond E., Raymond C. Stokes, Michael L. Stewart, and Douglas P. Henderson (1983), "The Impact of the Saccharin Warning Label on Sales of Diet Soft Drinks in Supermarkets," *Journal of Public Policy & Marketing*, 2, 46–56.

Seiders, Kathleen, and Ross D. Petty (2004), "Obesity and the Role of Food Marketing: A Policy Analysis of Issues and Remedies," *Journal of Public Policy & Marketing*, 23 (Fall), 153–69.

Shahin, Arash, and M. Ali Mahbod (2007), "Prioritization of Key Performance Indicators: An Integration of Analytical Hierarchy Process and Goal Setting," *International Journal of Productivity and Performance Management*, 56 (3), 226–40.

Sharpe, Donald (1997), "Of Apples and Oranges, File Drawers and Garbage: Why Validity Issues in Meta-Analysis Will Not Go Away," *Clinical Psychology Review*, 17 (8), 881–901.

Steinhart, Yael, Ziv Carmon, and Yaacov Trope (2013), "Warnings of Adverse Side Effects Can Backfire over Time," *Psychological Science*, 24 (9), 1842–47.

Steinmetz, Katy (2015), "San Francisco Approves Warning Label for Sugary Drink Ads," *Time* (June 9), http://time.com/3915485/san-francisco-soda-warning-label/.

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.

Strawbridge, Jill Annette (1986a), "The Influence of Position, Highlighting, and Embedding on Warning Effectiveness," master's thesis, Department of Industrial and Systems Engineering, California State University, Northridge.

Strawbridge, Jill Annette (1986b), "The Influence of Position, Highlighting, and Embedding on Warning Effectiveness," in *Proceedings of the Human Factors Society 30th Annual Meeting*. Santa Monica, CA: Human Factors Society, 716–20.

Swann, William B., John J. Griffin, Steven C. Predmore, and Bebe Gaines (1987), "The Cognitive–Affective Crossfire: When Self-Consistency Confronts Self-Enhancement," *Journal of Personality and Social Psychology*, 52 (5), 881–89.

Thrasher, James F., Victor Villalobos, André Szklo, Geoffrey T. Fong, Cristina Pérez, Ernesto Sebrié, et al. (2010), "Assessing the Impact of Cigarette Package Health Warning Labels: A Cross-Country Comparison in Brazil, Uruguay and Mexico," *Salud Pública de México*, 52, 206–15.

Torres, Ivonne M., Jeremy J. Sierra, and Robert S. Heiser (2007), "The Effects of Warning-Label Placement in Print ADS: A Social Contract Perspective," *Journal of Advertising*, 36 (2), 49–62.

Tugrul, Tugba Orten (2013), "The Impacts of Fear and Disgust on the Perceived Effectiveness of Smoking Warning Labels: A Study on Turkish University Students," *Asia-Pacific Journal of Public Health*, 27 (2), NP506–12.

U.S. Food and Drug Administration (2014), "FDA Proposes Updates to Nutrition Facts Label on Food Packages," press release (February 27), http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm387418.htm.

Verlegh, Peeter W., and Jan-Benedict E.M. Steenkamp (1999), "A Review and Meta-Analysis of Country-of-Origin Research," *Journal of Economic Psychology*, 20 (5), 521–46.

Whitener, Ellen M. (1990), "Confusion of Confidence Intervals and Credibility Intervals in Meta-Analysis," *Journal of Applied Psychology*, 75 (3), 315–21.

Wogalter, Michael S., Scott T. Allison, and Nancy A. McKenna (1989), "Effects of Cost and Social Influence on Warning Compliance," *Human Factors*, 31 (2), 133–40.

Wogalter, Michael S., Vincent C. Conzola, and Tonya L. Smith-Jackson (2002), "Research-Based Guidelines for Warning Design and Evaluation," *Applied Ergonomics*, 33 (3), 219–30.

Wogalter, Michael S., Gail A. Fontenelle, and Kenneth R. Laughery (1985), "Behavioral Effectiveness of Warnings," in *Proceedings of the Human Factors Society 29th Annual Meeting*. Santa Monica, CA: Human Factors Society, 679–83.

Wogalter, Michael S., Sandra S. Godfrey, Gail A. Fontenelle, David R. Desaulniers, Pamela R. Rothstein, and Kenneth R. Laughery (1987), "Effectiveness of Warnings," *Human Factors*, 29 (5), 599–612.

Wogalter, Michael S., Stephen W. Jarrard, and S. Noel Simpson (1994), "Influence of Warning Label Signal Words on Perceived Hazard Level," *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 36 (3), 547–56.

Wogalter, Michael S., Michael J. Kalsher, and Bernadette M. Racicot (1992), "The Influence of Location and Pictorials on Behavioral Compliance to Warnings," in *Proceedings of the Human Factors Society 36th Annual Meeting*. Santa Monica, CA: Human Factors Society, 1029–33.

Wogalter, Michael S., Michael J. Kalsher, and Bernadette M. Racicot (1993), "Behavioral Compliance with Warnings: Effects of Voice, Context, and Location," *Safety Science*, 16 (5), 637–54.

Wogalter, Michael S. and Kenneth R. Laughery (1996), "WARNING! Sign and Label Effectiveness," *Current Directions in Psychological Science*, 5 (2), 33–37.

Wogalter, Michael S., and Kenneth R. Laughery (2006), "Warnings and Hazard Communications," in *Handbook of Human Factors/Ergonomics*, 3rd ed., G. Salvendy, ed. New York: John Wiley & Sons, 889–911.

Yang, Sha, Greg M. Allenby, and Geraldine Fennel (2002), "Modeling Variation in Brand Preference: The Roles of Objective Environment and Motivating Conditions," *Marketing Science*, 21 (1), 14–31.

Young, Stephen L., and Michael S. Wogalter (1990), "Comprehension and Memory of Instruction Manual Warnings: Conspicuous Print and Pictorial Icons," *Human Factors*, 32 (6), 637–49.

Zhao, Xiaoquan, Xiaoli Nan, Bo Yang, and Irina Alexandra Iles (2014), "Cigarette Warning Labels: Graphics, Framing, and Identity," *Health Education*, 114 (2), 101–17.

AUTHOR QUERIES

AUTHOR PLEASE ANSWER ALL QUERIES

There are no queries in this article.