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Effect of presentation modality in direct-to-consumer (DTC) prescription drug television advertisements

Michael S. Wogalter [a,*], Eric F. Shaver [a], Michael J. Kalsher [b]

[a] North Carolina State University, Psychology Department, 640 Poe Hall, Raleigh, NC 27695-7650, USA
[b] Rensselaer Polytechnic Institute, Department of Cognitive Science, Troy, NY 12180-3590, USA

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ABSTRACT

Direct-to-consumer (DTC) drug advertising markets medications requiring a physician's script to the general public. In television advertising, risk disclosures (such as side effects and contraindications) may be communicated in either auditory (voice) or visual (text) or both in the commercials. This research examines presentation modality factors affecting the communication of the risk disclosures in DTC prescription drug television commercials. The results showed that risk disclosures presented either visually only or both visually and auditorily increased recall and recognition compared to no presentation. Risk disclosures presented redundantly in both the visual and auditory modalities produced the highest recall and recognition. Visual only produced better performance than auditory only. Simultaneous presentation of non-risk information together with risk disclosures produced lower recall and recognition compared to risk disclosures alone—without concurrent non-risk information. Implications for the design of DTC prescription drug television commercials and other audio-visual presentations of risk information including on the Internet, are discussed.

1. Introduction

Effective warnings and labeling are essential for pharmaceutical products. These products need warnings because the characteristics and effects are not readily determined from examination of the products themselves. Without labeling information, health care professionals and consumers would not likely know very much about the drug, and thus not having important information about the potential risks, side effects, and contraindications. The benefits of medications are usually well presented in a short indications section, but the risks are generally less well conveyed in the labeling (e.g., Kaiser Family Foundation, 2001). Given the serious consequences that may result from inappropriate and potentially dangerous use of prescription drugs, there is a need to systematically investigate the factors that facilitate or hinder effective communication of risk information.

Historically, information about prescription drugs was directed to physicians and other health care professions. Yet despite the importance of drug information for health and safety, there have been relatively few experimental studies manipulating factors that could facilitate or hinder the communication of prescription drug information to consumers. Determining what laypersons understand from exposure to drug advertisements could benefit knowledge towards improving risk communication.

In recent years, drug information is being provided through popular media such as television (TV), radio, and the World Wide Web (WWW). The purpose of direct-to-consumer (DTC) prescription drug advertising is to market a prescription drug directly to the public even though users cannot purchase it directly. To purchase a prescription drug, users must get a script from a licensed provider who has determined that the drug is needed. In the United States (U.S.), the Food and Drug Administration's (FDA) prescription drug regulations require that DTC prescription drug television ads giving benefit information must include also information relating to the major side effects and contraindications. According to the FDA, there must be a balanced presentation of benefit and risk information in DTC prescription drug advertisements (U.S. FDA, 2011).

Few countries allow DTC prescription drug advertisements. Currently only the U.S. and New Zealand allow presentation of DTC prescription drug advertising (Frosch et al., 2010; Mintzes et al., 2002). Other countries are considering allowing them (e.g., Canada) but others have explicitly prevented their use (e.g., in the

* Corresponding author.
E-mail address: WogalterM@Gmail.com (M.S. Wogalter).

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European Union). Moreover, some countries are considering allowing some DTC advertising for certain kinds of drugs (e.g., diabetes, asthma, AIDs) (Frosch et al., 2010).

Advocates of DTC prescription drug advertising argue that this communication through manufacturer-paid advertising can be a useful way to provide prescription drug information to the public. DTC ads can alert people to new treatment options and newly marketed prescription drugs and encourage them to talk to their physician or pharmacist about drugs they have seen advertised (Pharmaceutical Research and Manufacturers of America, 2002; Redmond, 2002; Rosenthal et al., 2002). Proponents further posit that DTC prescription drug advertising can enhance the patient–physician relationship by encouraging people to take an active role in their own health. However, some physicians and insurance companies criticize DTC advertisements for potentially being harmful. For example, the commercials could negatively influence the patient–physician relationships. Physicians must spend time dissuading patients that they do not need an advertised drug (Calfee, 2002; Lyles, 2002; Pinto et al., 1998). As a result, physicians need to resist patients' pressure to prescribe patient-suggested drug products (Reissman, 1998), which could put a strain on the relationship. A related problem is that DTC prescription drug advertising may inadvertently increase the number of unnecessary physician visits (Redmond, 2002). Also, advertised drugs likely cost more than comparable, less advertised drugs. With greater use of medications, some people may be helped but some may be led to take medications unnecessarily and others may be harmed.

Another argument leveled against DTC prescription drug advertising is that the ads do not adequately communicate the risks of the advertised drug (National Health Council, 2002). This negative aspect is supported by research findings. For example, using trained pharmacists to assess 39 DTC prescription drug ads given in the print modality, Roth (1996) determined that one-third of the DTC prescription drug ads did not present a fair balance of risk and benefit information. Other research has shown an imbalance of risk information versus benefits in DTC drug advertisements on the web (Hicks et al., 2005). Exposure to advertisements that do not present a fair balance of a drug's risks and benefits could lead people to believe that a drug is safer to use than it is in actuality.

Since risk information may not be communicated well, it is important to find ways to enhance communication. Current U.S. law restricts certain ways to communicate risk information. According to the U.S. FDA regulations (U.S. FDA, 2011), "advertisements broadcast through media such as radio, television, or telephone communications systems shall include information relating to the major side effects and contraindications of the advertised drugs in the audio or audio and visual parts of the presentation…" (p. 98). Thus, this rule restricts the method of presentation of risk information. It does not allow risk information to be presented only in the visual modality, but it allows auditory-only presentation or both modalities. It is not clear whether FDA's guidance about presentation methods is optimal for conveying risk information. Current U.S. FDA policy has no requirement that manufacturers demonstrate the efficacy of their risk disclosures in DTC drug ads or even have them be approved by government authorities. Thus, simple adherence to legal requirements governing the content and format of these ads may not translate into effectiveness.

Existing evidence from the warning literature casts doubt on FDA guidance of the relative effectiveness of auditory-only presentation (e.g., see review in Cohen et al., 2006). Some research indicates that auditory-only presentation would be better than visual-only presentation (e.g. Wogalter and Young, 1991; Conzola and Wogalter, 1999). However, when presented in a context of watching television programming, research suggests the opposite. For example, visual (print) warnings presented in television ads for alcoholic beverages are better remembered than the same information presented auditorily (spoken)(e.g., Barlow and Wogalter, 1993). Other research on modality differences suggests that when the information is complex and difficult to process, information given in visual print is better than auditorily, possibly due to the ability to review the material more than once in the former than in the latter modality (see e.g., Wickens et al., 2012). However, when presenting a short simple message, the auditory channel appears to be more effective than the visual channel (Penny, 1989). Investigated in the present research was whether visually presented risk information in television drug ads produces better memory than auditorily presented risk information, or the reverse. Given that the FDA allows auditory only presentation, one expectation is that auditory only would be better than visual only presentation. But as note above, the opposite would be predicted from previous research (Barlow and Wogalter, 1993).

Using both visual and auditory modalities to communicate risk information would likely be better than just one modality (e.g., see Cohen et al., 2006; Glinert and Schommer, 2005). If dual modality is better than either modality individually then this pattern would support two well-known theoretical frameworks. One is Paivio's (1975) Dual-Code theory which says that presentation formats that result in two different codes (e.g., modalities) available at encoding improves retrieval from long-term memory. Another major framework is the redundant coding principle (Wickens et al., 2012), which says presentation in more than one modality forms a stronger signal for conceptual awareness and understanding. Additionally, if dual-modality presentation is better than single modality presentation then this finding could inform future rule making in the U.S. and other countries.

Another important issue investigated in this research concerns the potential for interference when non-risk information is given simultaneously with the risk information. This might occur when non-risk information is given in one modality and the risk information in the other modality (e.g., visual non-risk information presented concurrently with auditorily presented risk information, or vice versa). This is commonly done in practice in real DTC drug commercials where considerable non-risk information may be given in the visual modality while the risk information is concurrently presented in the auditory modality. Thus, a main question in the present research is whether concurrently presenting non-risk information in one modality negatively affects risk communication by distracting people from focusing on concurrently presented risk information.

Cross modal risk versus non-risk information has been investigated in some early research by Morris and colleagues (e.g., Morris et al., 1989). They found a reduction in risk communication when non-risk information is simultaneously presented with the risk information. Glinert and Schommer (2005) found that when pharmacy school students were presented redundant risk information in both print and voice *after* the commercial was over (i.e., following it) produced higher risk recall than when the risk information was integrated into the commercial (where other non-risk information was concurrently presented). In the Glinert and Schommer study the best risk information condition was presented after the commercial was over. This separate presentation does not reflect current practice of integrating the risk information within the television advertisements. Also, the general public (most users) is less knowledgeable on the topic of prescription drugs than pharmacy school students, the group of participants that Glinert and Schommer used.

In the present research, persons without specialized training are exposed to systematically-manipulated risk presentations integrated within television advertisements. Redundant presentation of risk information in both modalities is compared to only one

modality (without concurrent non-risk information). Also examined was whether concurrently-presented non-risk information in one modality and risk information in the other modality negatively affects risk communication. If concurrent non-risk information reduces memory of risk information presented in a different modality, it would support a general limited resource theory of attention (Kahneman, 1973).

Research on the effects of DTC prescription advertisements could provide input into decisions on the issues associated with the kinds of risk presentations that might be valuable through the television medium. In recent years, the Internet has become an increasingly used source of information on drugs (e.g., Vigilante and Wogalter, 2005). Many websites include video clips, and thus, these Internet videos can serve as a potential advertising and risk information source. Indeed, the U.S. FDA considers manufacturer's websites with information on prescription drugs as DTC advertising. Moreover, video can be broadcast or streamed across international boundaries. DTC ads intended for country-specific audiences can be seen by people across borders.

Beyond the realm of drug information, the present research is likely relevant to warning and risk communications for other kinds of products. Television and the Internet have become pervasive in most countries of the world. Better ways to present risk disclosures and warnings in these media could be useful for promoting safety and health, and may be generalizable to audio/video presentations beyond DTC prescription drug ads (e.g., web videos, risks for other products).

This study examines potential factors that may influence the communication of risk disclosures in DTC prescription drug television commercials. Manipulated were the modality of presentation of risk information and the presence of concurrently presented non-risk information. Recall and recognition after incidental exposure to the ads embedded in television programs are assessed.

2. Method

2.1. Participants

Participants were 180 ($M = 20.6$ years, SD = 4.6) undergraduate students attending North Carolina State University in Raleigh, North Carolina. Fifty-seven percent ($n = 103$) of the participants were male. The average education level was 13.2 years (SD = 1.4) or that of a beginning sophomore in college.

2.2. Materials and design

Television commercials for six prescription drugs, 12 consumer products (distractors), and six primetime news programs were recorded from cable television using a digital video camera and then uploaded and stored on a Macintosh computer. Table 1 gives the names of the drugs in the drug advertisements, a list of the other consumer products that were also advertised, and the titles of the news program excerpts. Note that when the study was conducted, all of the drugs required a doctor's script. Some have been switched to over-the-counter (OTC) sales since that time.

Digital video-editing software was used to alter the means by which risk and non-risk disclosures were presented in the prescription drug commercials. Initially, the six prescription drug commercials were stripped of all auditory and visual content besides the name of the drug. The stripped commercials served as the control condition for each drug commercial and were used as the foundation for developing the other five experimental conditions. A description of the type of information included in each of the manipulated conditions is presented in Table 2. Visual content presented on the top and/or bottom of the screen in the original drug commercial was removed by adding black bars, while content in the middle was removed by deleting scenes. Auditory content was removed by turning off the auditory track.

Table 1
Program content, name, and topic for the prescription drug and distractor advertisements and program excerpts.

Program content	Name	Topic
Prescription Drug Advertisements	Advair	Asthma
	Ambien	Sleep aid
	Elidel	Eczema
	Paxil	Anxiety
	Prevacid	Acid reflux
	Zyrtec	Allergies
Distractor Advertisements	Charmin	Toilet paper
	Clorox	Bleach
	Colgate	Toothpaste
	Equal	Sweetener
	Gain	Laundry detergent
	Glad	Trash bags
	Merita	Bread
	Pledge	Furniture polish
	Quaker	Breakfast cereal
	Stouffers	Ready to eat meals
	Suave	Lotion
	Visine	Eye drops
Primetime News Excerpts	Colin Powell	
	Down the drain	
	Dr. Sharistani	
	Lionel Tate	
	Moving violations	
	Top Cop	

The five conditions that included risk disclosures (all except the Control) had content consisting of four side effects and two contraindication statements. The two conditions that included non-risk disclosures, Visual Risk & Auditory Non-Risk (VR & ANR) and Auditory Risk & Visual Non-Risk (AR & VNR), had content consisting of five indications and one adequate provision statement. The adequate provision statement consisted of (a) an Internet web page (URL) address, (b) a toll-free number to contact the manufacturer, or (c) an instruction to contact their physician for further information.

Visual disclosures (both risk and non-risk) were presented such that only one statement was on the screen at a time. They were present in the top or bottom third of the screen, placed to avoid obscuring the visual background scene. Orally presented risk disclosures conveyed the same information as their visual counterparts and were presented by a male voice at an average rate of 92 words per minute.

To prevent participants' familiarity with certain prescription drug commercials from affecting their memory of the information, the risk disclosures consisted of fictitious content. This was done to ensure that participants were recalling and recognizing risk disclosures from this study and not from past exposures to the actual commercials.

The re-configured commercials and news excerpts were combined to create six different programs. Each program contained six segments (i.e., pairings of a primetime news excerpt with a commercial cluster). Each commercial cluster was comprised of three

Table 2
Description of conditions.

Condition	Description
Control	No visual (text) or auditory (voice) disclosures
AR	Auditory risk disclosures only
VR	Visual risk disclosures only
VR & AR	Visual + auditory risk disclosures
VR & ANR	Visual risk + auditory non-risk disclosures
AR & VNR	Auditory risk + visual non-risk disclosures

30-second commercials, one of which was a prescription drug commercial. Prescription drug commercial placement within the cluster was randomized to control for order effects. The pairings were arranged to ensure that all six drugs and all six experimental conditions were represented in each segment. No participant saw more than one disclosure version for each drug. Moreover, no participant saw a specific disclosure version more than once. A 5 s blank section was inserted after each segment to provide the experimenter with time to stop the program so the participants could rate the preceding segment. The completed programs were exported to DVD to allow presentation on a 48.3 cm (19 inch) diagonal color television.

2.3. Procedure

After reading and signing a consent form, participants completed an initial questionnaire asking basic demographics (e.g., age and gender). After the questionnaire was completed, the experimenter next read a set of scripted instructions that told participants they would be asked about their perceptions of several primetime news programs.

Participants then viewed one of the programs described previously, one segment at a time. After each segment, the program was stopped and participants were asked to rate the segment's importance and appeal. After all six segments were viewed and rated, participants completed three questionnaires in sequence that measured recognition and recall about the information presented, including the names of the drugs and risks associated with them. Upon completing the above procedure, participants were debriefed and thanked.

2.4. Measures

The dependent variables included responses to three questionnaires that assessed participants' ability to recall and recognize information from the drug ads. The first questionnaire was comprised of open-ended items among them was the request to recall everything they remembered about the preceding drug commercials by writing this information on a response sheet. The second questionnaire included items that asked participants to recall all risk disclosures that they heard given each of the drug names. A third questionnaire consisted of multiple-choice items intended to measure participants' ability to recognize information about the commercials' risk disclosures. Of the two risk recognition items, one asked participants to identify the side effects they saw or heard in a given prescription drug commercial by choosing items from a list of six side effects. The other item asked them to identify the warning statements they saw or heard by choosing from a list of three warning statements. Distractor responses were included as alternatives in the side-effect and warning-statement lists as a check for guessing in the recognition tests.

3. Results

3.1. Scoring procedures

Correct responses ("hits") received a "1" and incorrect responses received a "0." Responses were scored by a judge blind to the conditions. The data in the analyses were the proportion correct. Reported are means of these data.

3.1.1. Drug recall

Responses to the open-ended recall items were considered correct if the participant identified either the drug's name or what the drug treated.

3.1.2. Risk recall

For each drug, a total of six correct risk disclosures could be reported. A proportion was calculated for each drug using the reported number of correct risk disclosures divided by the six possible correct risk disclosures. Scoring was lenient in the sense that the exact wording for each risk was not necessary to earn a point, although the participant's response needed to be synonymous with the correct answer to receive credit.

3.1.3. Risk recognition

For the risk recognition questionnaire, participants were presented with two questions dealing with risk disclosures for each of the six prescription drugs. One item required participants to recognize the side effects they saw or heard in a given prescription drug commercial by choosing from a list of six side effects. The other item required participants to recognize the warning statements they saw or heard by choosing from a list of three warning statements. For both items, participants were asked to check all response options they believed were applicable. Of the six side effects, four of the response options were actually present in the commercials, whereas the other two were distractors and were not presented in the commercials. Of the three warning statements, two of the response options were present in the commercials and the third was not (a distractor). For purposes of scoring, the side effects and warnings responses for the two items were combined. Thus, there was a possibility of six correct responses and three incorrect responses per drug. The hit scores were calculated by summing the number of correct risks divided by the six possible correct risks available. Additional analyses were conducted to correct for guessing. Corrected hit scores were calculated by subtracting participants' false alarm scores. The false alarms were calculated from participants' selections of distractor alternatives. Since the findings for the corrected hits closely paralleled those for the hit data, only the hit data are reported here.

3.2. Analyses

3.2.1. Drug recall

A one-way ANOVA with six levels produced a significant effect of risk disclosure conditions, $F(5, 895) = 15.79$, $p < .0001$. Mean drug recall for the six risk disclosure conditions is provided in the first column of Table 3. Comparisons among means using Tukey's HSD test showed that all 5 the experimental risk disclosure conditions produced significantly higher drug recall than the control condition (in which no warning or indications information was given). The VR & AR ($M = .31$) condition produced the highest mean drug recall, and this condition produced significantly higher recall than the AR & VNR ($M = .19$) condition.

3.2.2. Risk recall

A one-way ANOVA with six levels produced a significant effect of conditions, $F(5, 895) = 5.55$, $p < .0001$. Mean risk recall for the six conditions was quite low as shown in the second column of Table 3. Comparisons using Tukey's HSD test showed that risk recall was

Table 3
Proportion correct measures as a function of condition.

Condition	Drug recall	Cued risk recall	Risk recognition
Control	.00	.00	.00
AR	.26	.01	.47
VR	.27	.02	.50
VR & AR	.31	.03	.52
VR & ANR	.29	.01	.44
AR & VNR	.19	.01	.44

significantly higher in the experimental conditions than in the control (no risk information) condition. VR & AR ($M = .03$) produced the highest mean cued recall and this condition produced significantly higher risk cued recall than the AR ($M = .01$) or AR & VNR ($M = .01$) conditions.

3.2.3. Risk recognition

A one-way ANOVA with six levels produced a significant effect of risk disclosure conditions, $F(5, 895) = 204.71$, $p < .0001$. Mean risk recognition for the six risk disclosure conditions are provided in the last column of Table 3. According to comparisons using Tukey's HSD test, risk recognition was significantly higher for the experimental conditions than in the control (no risk information) condition. VR & AR ($M = .52$) produced the highest mean risk recognition of all conditions. It was significantly higher than the two conditions with concurrent risk and non-risk disclosure presentation, AR & VNR ($M = .44$) and VR & ANR ($M = .44$), respectively. VR ($M = .50$), which was not significantly different from VR & AR, also produced significantly higher risk recognition than the two conditions with concurrently presented risk and non-risk disclosures, VR & ANR and AR & VNR.

4. Discussion

4.1. Summary and comment

This research examined how recall and recognition of risk information in prescription drug DTC television advertisements is affected by how the information is presented. Several important findings regarding the presentation of risk information in DTC prescription drug TV ads emerged.

The 'combined' modality risk disclosure (i.e. the VR & AR condition) produced better performance than any of the other conditions. This condition, which presents the risk information in both the visual and auditory modalities, was significantly better than the two conditions in which non-risk information was given in one modality and risk information in the other modality. While some current DTC drug commercials give risk information in both modalities, many others give non-risk information in the visual modality and risk information in the auditory modality. The present research shows that when non-risk and risk information is presented concurrently, subsequent memory performance is reduced as compared presentation of risk information in both modalities (i.e. the VR & AR conditon). This difference is probably due to processing interference in the former and not in the latter condition. Additionally, dual-modality presentation would benefit persons who may have sensory modality limitations in one or the other sensory modality. Presentation in the visual modality would allow persons who are hearing impaired to read the risk disclosures, whereas presentation in the auditory modality would allow the vision impaired to hear the risk disclosures. The findings support previous research by Barlow and Wogalter (1993) who, using alcohol-beverage commercials, showed that risk disclosures are better conveyed by concurrent presentation in both visual and auditory modalities. The beneficial effect also supports other research in this area (e.g., Grimes, 1990; Glinert and Schommer, 2005) as well as the dual modality (Paivio, 1975) and redundant coding (Wickens et al., 2012) principles.

Although the single modality visual presentation was consistently higher than the single modality auditory presentation across the dependent variables, the small difference between the two conditions was not statistically significant when directly compared. However, other comparisons provide indirect support that visual presentation is better than the auditory presentations of risk disclosures in DTC prescription drug commercials. This is supported by two findings. First, VR produced significantly greater cued risk recall compared to the control condition, whereas no significant difference was found between AR and the control. Second, VR produced significantly greater risk recognition than VR & ANR and AR & VNR, whereas AR was not significantly different from these two.

These results show that current presentation of risk and non-risk information hurts recall and recognition of risk information compared to visual only and both modality presentation. The exception to this is the lack of significance between the auditory risk and visual non-risk information condition compared to the auditory only risk information condition. This might due to performance being so low for auditory presentation that the addition of non-risk information was restricted in going any lower. However, in general the pattern of results show that when risk disclosures are presented in DTC prescription drug commercials, there ought not be other information presented simultaneously. One way to limit presentation of lesser important information concurrently with risk information is to present risk information in both visual and auditory modalities.

The dual modality condition did a slightly better job in communicating the risks compared to the other conditions. The advantage was small but statistically significant.

This finding supports FDA guidelines allowing this method of presentation in DTC drug advertisements. However, another method allowed by the FDA is auditory only presentation of risks, which was not supported by the data. The results showed that auditory only was significantly deficient compared to redundant dual-modality presentation of risks, and was also somewhat lower (though not significantly) than visual only presentation. A similar pattern of results to this study was shown in Barlow and Wogalter (1993) who presented risk information in one or both modalities in alcoholic beverage advertisements. Given this, auditory only presentation of risks in DTC television commercials probably should be discouraged.

In general, consumers do not have a favorable opinion of DTC drug ads (Kim et al., 2010). The results of a *Prevention* magazine survey suggest that consumers have a more favorable opinion of DTC ads that present risk information well (Prevention, 2002). Thus, another good reason for using better risk communications methods is the potential for favorable perceptions by consumers.

Risk recall was very low, ranging from .00 in the control condition to .03 in the combined visual and auditory risk (VR & AR) condition. Several potential explanations for the low levels of recall across all conditions can be offered. First, recall generally produces lower information retrieval than recognition because the former is generated almost entirely from memory (without many cues), whereas the latter includes more visual cues that facilitate retrieval. In this research, no (or very few) cues were provided in the risk recall test, which had they been present would have assisted the participants' retrieval of specific risk disclosures for a given drug.

Second, participants were exposed to a total of 36 risk disclosure statements (six for each of the six drugs). Assuming that all the risk disclosure statements were encoded using some level of attention using working memory into long-term memory (an assumption based on a large body of cognitive psychology research), participants would be required at the time of the testing to retrieve from memory and match (or associate) each risk disclosure statement with a corresponding drug name. Given that a large amount of information was presented only once and given the likelihood that some of participants' attention was probably focused on irrelevant information or other program material, then this may have combined to adversely affect risk information retrieval.

Finally, it should be noted that an incidental exposure paradigm was used in this research. This refined and important

procedure is intended to provide realism in the task that participants were doing. The instructions and information provided to participants did not tell them that the study was actually concerned about their memory of risk information in DTC prescription drug commercials. Instead, the study's instructions informed participants that they would be asked about their perceptions of primetime news programs. Thus participants were never told anything or cued in any way that the DTC prescription drug commercials were the focus of the study or informed that they would be asked to recall information about drug risks. The relatively low scores may simply be a result of a single incidental exposure to medication information for which they saw and/or heard but might not have given specific directed attention. The limited focus of attention probably mirrors the conditions of everyday life in that people generally do not have a reason to give their fullest attention to DTC prescription drug commercials, except in instances when they have or know someone who has the condition that the drug is used to treat. Nevertheless, the easier risk recognition test did show that exposure to the ads produced some positive effects on memory.

4.2. Exploratory analyses

Additional analyses of other aspects of the study are summarized in the sections that follow.

4.2.1. Six drug commercials

Exploratory analyses examined whether the results were consistent across the 6 different drug commercials. Extensive analyses showed a few notable and interpretable patterns across the dependent variables for conditions in the different drug commercials. The clearest pattern was that three of the six drug commercials had higher relative scores. The drugs "Advair," "Paxil," and "Zyrtec" were consistently recalled more than the others and this was consistent across the three dependent variables. One explanation is that these three drugs had greater relevance to participants than the other drugs. Many people suffer from allergies or know someone who does, so the Zyrtec commercial would have been more relevant to more people than a drug commercial for Elidel (eczema cream). The Elaboration Likelihood Model (Petty and Cacioppo, 1986) suggests that people more readily attend to and centrally process information that they find personally relevant.

As one might expect, different advertisements garnered differential memory because of a host of differences among the particular drug advertisements including frequency (how many times it has been presented), familiarity (how many times the person has seen the ad), salience (aspects and peculiarities that stand out), and relevance (whether the advertised drug might be indicated for a condition that they have or someone else they know has). This information was not collected in the present study, but future studies ought to determine how it could affect risk communication. One important aspect to note about the current study is that six different drug commercials were included. Had only one or two drugs been assessed, the results might be less likely to generalize to the population of varied kinds of DTC drug advertisements.

4.2.2. Gender

Additional analyses examined whether gender differences existed for drug recall, risk recall, and risk recognition. Overall, the results indicate that females recalled and recognized a greater number of risk disclosures than males, but they also produced more incorrect (false positive) responses. The effects attributable to gender were small, and there was some indication of criterion differences between genders rather than a difference in memory.

4.3. Limitations

In order to properly interpret the study's findings, it is important to consider some potential limitations. First, the study included only undergraduate students as participants. Although they were majoring in numerous disciplines, all were taking an introductory psychology course that had a research participation requirement. The results might be different with other populations. Thus, future research should examine whether these findings generalize to other populations.

A related limitation is relevance. An effort was made to include prescription drug commercials that were potentially relevant to undergraduate participants. These drugs were Advair (asthma), Ambien (sleep aid), and Zyrtec (allergies). Also, the prescription drug commercials used were taken from an existing set because of their content could be modified so they can be used in the study (i.e., removal of most print information). Relevance should enhance attentional focus to the commercials and thus enhance memory scores. This effect was not apparent in the risk recall measure but could have affected the recognition scores.

Additionally, evaluation did not take into account prior knowledge that participants might have had with the named drugs. Although we used fictitious risk information in the experimental conditions to assess what participants gleaned from exposure, actual prior knowledge about these drugs was not considered. However, as noted earlier, scoring that corrected for error responses mirrored the basic hit rate.

4.4. Future research

Future research in the area of prescription drug commercials should examine what features could enhance the saliency of the visual and auditory risk information in television commercials. For the former, past advertising research has shown that larger print size (Murray et al., 1993) and risk information dispersed through a commercial (Morris et al., 1989) produces greater recall and recognition compared to smaller print size and disclosures grouped at the end of the commercial. Additionally, increased contrast and duration of the print on the screen would enhance legibility and readability of the print. These modifications combined with different manners of placing print on the screen would likely improve attention to, encoding and retention of the risk information.

The present study only included risk disclosures at the top or bottom of the screen. If participants tended to focus their attention on the middle of the screen, then information presented on the top or the bottom of the screen would be at a disadvantage: participants may have missed some of the printed risk disclosure, thereby lowering their subsequent recall and recognition. Presentation of risk information in the middle of the screen might also serve to limit attention to competing non-risk disclosure that could cause distraction. Future research ought to examine other placements as well as varied commercial contexts.

With respect to auditory risk disclosures, previous research with auditory (vocal) warnings has shown that several different factors influence ratings of intended carefulness (Barzegar and Wogalter, 1998; Edworthy and Hellier, 2006). One factor is the speaker's gender. The warnings in the present study used all male voices. Several studies (see Edworthy and Hellier, 2006 for a review) have suggested that female voices evoke more rated urgency than male voices. The use of male voices in the present research possibly muted the level of auditory-presentation effects. Future research could look at whether the influence of risk disclosures changes depending on voice characteristics (e.g., Hollander and Wogalter, 2000) and whether risk disclosures presented in a female or male voice differ on cognitive outcome measures.

Finally these results could be useful for governments around the world who may be making decisions on whether to permit the use of DTC prescription drug advertising. Since there has been very little research on this topic, this study offers useful information on ways to benefit drug risk disclosure. It shows that risk disclosure in broadcast, audio-video communication is affected by the method of presentation used and whether there is concurrently presented information (redundant or other).

Lastly, there are a few final comments on this research's generality that are worth mentioning. First, video is broadcast over the air waves and across international borders through cable and satellite connections and through wired and wireless WWW. As a result, countries that have rules regarding DTC prescription drug ads may find that their efforts thwarted by technology's reach beyond borders. Even though some countries have restrictions about DTC advertising, the rules may be bypassed by other countries' leniency.

In general, most advertising generally does not present any risk information. FDA's requirements for prescription DTC advertising is thus rather unique. Over-the-counter (OTC) drugs that need no prescription to purchase also have risks to health and safety, yet few OTC medications provide warnings in advertising. Most OTC ads state little more than "Use as directed" or "Consult a physician." DTC drug advertising can serve as a model for advertising of other kinds of products such as OTC drugs, household chemicals, gas powered electrical generators, and possibly to other kinds of risks, such as car loans and, other kinds of financial investments involving risk. Thus, this research could generalize to video-presented risk disclosures and warnings for other kinds of consumer products, not just prescription drugs. And as a model that could be followed. Applying the FDA fair balance model to nonprescription drug products or any advertised product with risks would likely benefit consumers by providing them with balanced information concerning the benefits and risks.

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