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A Point-of-Sale Communications Campaign to Provide Consumers Safety Information on Drug-Dietary Supplement Interactions: A Pilot Study

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Abstract

Concurrent use of dietary supplements with over-the-counter and prescription pharmaceuticals has become increasingly common, and with this trend, so has the incidence of adverse drug–supplement interactions. In the current market, consumers have no way to distinguish between safe and potentially harmful supplements. Thus, the primary objective of this study was to test the hypothesis that messages designed to increase consumers' awareness of potential health risks of concurrent use of dietary supplements with over-the-counter and prescription pharmaceuticals would promote further consideration and action, as evidenced by (a) seeking additional information from an authoritative source or qualified health care professional and (b) changing dietary supplement usage patterns. To test this hypothesis, an innovative consumer information delivery system, referred to as the *Buyer Information Network* (BuyIN), was utilized. BuyIN uses currently available, Web-enabled point-of-sale (POS) technology to provide up-to-date, evidence-based, health- and safety-related messages to consumers at the retail checkout counter. Results showed that more than one-fourth (27.1%) of consumers ($n = 199$) who purchased targeted items reported they were aware of the messages. Of this subgroup of aware consumers, 11.2% reported that they sought additional information from a physician or pharmacist, 11.5% reported that they visited the website listed on the coupon, and 10.5% indicated that they changed their dietary supplement usage patterns as a result of the messages. Future research should include a large-scale study of a fully implemented and capable system at multiple test sites around the country, including investigating the utility of BuyIN in different retail settings.

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Interest in and use of dietary supplements, including vitamins, minerals, botanicals, amino acids, and other oral substances intended as an addition to the diet, have increased tremendously in recent years. Approximately one-half of adults aged 57–85 years in the United States reported using at least one dietary supplement in the previous 12 months to treat medical conditions and/or to maintain their health (Qato et al., 2008). This is more than double the rate of use documented a decade earlier (Ni, Simile, & Hardy, 2002). Furthermore, the most recent nationally representative data show that U.S. adults spent \$2.9 billion out-of-pocket for vitamins, minerals, and other natural products (Nahin & National Center for Health Statistics [U.S.], 2009).

As use of dietary supplements becomes increasingly prevalent, their concurrent use with pharmaceuticals has become more common (Bent & Ko, 2004; Graham, Gandhi, Borus, Phillips, & Weingart, 2008; Huang & Lesko, 2004; Qato et al., 2008), and the potential for adverse drug–supplement interactions has escalated (Huang & Lesko, 2004; Izzo & Ernst, 2001; Kaufman, McKenzie, & Kirakosyan, 2009; Sood et al., 2008; Timbo, Ross, McCarthy, & Lin, 2006; Wold et al., 2005). Most consumers regard dietary supplements as safe and are unaware of the known pharmacologic activity that can lead to adverse interactions when taken together with prescription and over-the-counter (OTC) drugs (Hu et al., 2005). For example, ginkgo biloba, one of the seven most popular herbs sold in the United States, has been shown to negatively interact with central nervous system agents, proton pump inhibitors, analgesics, cardiovascular agents, and hematological agents (Bressler, 2005). The full extent of the problem is unclear, but research suggests that the prevalence of serious adverse drug–supplement interactions among the general adult population is around 6%, with the range between 4% and 15% (Peng, Glassman, Trilli, Hayes-Hunter, & Good, 2004; Qato et al., 2008; Sood et al., 2008; Wanjari et al., 2011). However, it is likely that these estimates are low; Hurley (2007) suggested that less than 1% of serious adverse events of this type are reported to the Food and Drug Administration (FDA). A survey of 132 pharmacists in Canada underscores this conclusion. Nearly half of the pharmacists sampled had seen a potential drug–supplement interaction or adverse event, but only two respondents had reported the interaction to Health Canada as required (Douaud, 2006; Hurley, 2007).

In the current market, consumers have no way to distinguish between safe and potentially harmful supplements (Ashar, 2010). Dietary supplements are not required to undergo the same stringent approval process to prove safety and efficacy that pharmaceuticals are (Food and Drug Administration, 2006). Inserts describing possible adverse events or drug interactions are not packaged with dietary supplements either, often due to the lack of systematically evaluated premarket data (Ashar, 2010). Further, few users (5.2%) consult with a health care practitioner before using a dietary supplement and only 33.4% report their supplement use to a regular provider (Kennedy, 2005). Thus, there exists the need for a reliable, cost-effective way to communicate information about potential supplement–pharmaceutical interactions to empower consumers to make informed decisions about using dietary supplements and avoiding unintended reactions.

Health communications campaigns to motivate individuals and communities to take more responsibility over their health have a long history in the United States. One approach that has shown promise is targeted communications (Evans & McCormack, 2008). Over the last 10 years, targeted message strategies at the point of sale (POS) have been used successfully in antismoking campaigns (Hammond, 2011; Kees, Burton, Andrews, & Kozup, 2010), adolescent obesity prevention (Andrepoint, Cullen, & Taylor, 2011; Uyeda, Bogart, Hawes-Dawson, & Schuster, 2009), and prevention of alcohol use during pregnancy (Ospina, Moga, Dennett, & Harstall, 2011). The purpose of targeted communications is to use product purchase and other market research data to generate messages that align with individuals'

needs and preferences to initiate desired health behavior change (Evans & McCormack, 2008).

Given the widespread use of dietary supplements and the increasing possibility of adverse events or drug interactions associated with concurrent use with pharmaceuticals, we designed for pilot testing a targeted communications strategy using McQuire's communication/persuasion matrix (CPM) as a theoretical framework (McGuire, 1984; McGuire, Rice, & Atkin, 2001). The CPM is often used as the basis for constructing persuasive community-based campaigns where a primary goal is to examine consumer behavior in response to messages (Corcoran, 2007). According to the CPM, there is a series of health communication inputs (variables) that can be connected to desired behavioral outputs (processes) based on the likelihood of the input influencing the output. The input variables include: (a) source of the information (credibility, expertise, trust, attractiveness); (b) message variables (style, type of information, inclusions/omissions, and repetition); (c) channel or medium (direct vs. mediated, nonverbal, context, number and type of sensory modalities); (d) receiver variables (amount of participation required, demographics, abilities); and (e) destination/target variables (knowledge vs. action vs. attitudes, immediate vs. delayed response, change vs. resistance). The output processes include: (a) exposure to communication/tuning in; (b) attending to the communication; (c) liking or being interested in the information; (d) understanding it (learning what); (e) skill acquisition (learning how); (f) yielding to the information/changing one's attitude; (g) remembering the new attitude; (h) retrieving the new attitude; (i) deciding to act according to the new attitude; (j) acting in accordance; and (k) reinforcing/maintaining the new actions. Based on the expected connection between the input and output variables, a tentative communication strategy can be developed, analyzed, and refined according to the degree to which the input variables elicit the output processes desired.

Our targeted communications strategy was an innovative consumer information delivery system, referred to as the *Buyer Information Network* (BuyIN). BuyIN uses currently available, Web-enabled POS technology and client/server computing to deliver messages (input variable) to the cash-register terminal and print them either to coupons or directly to receipts. The POS delivery was selected because it specifically targets message receivers of interest—consumers who purchase supplements. In a typical BuyIN POS scenario, a customer arrives at the checkout counter to purchase a supplement. The cashier scans the product's Universal Product Code (UPC) and the system checks the bar-code number against a list of targeted products. If the number appears on the list, the system links to a corresponding Internet address, downloads a message to the cash-register terminal, and prints the message. Consumers receive the equivalent of an extended and accurate (i.e., based on the best current data available) label at the POS. These messages can be manipulated to provide more or less information based on the characteristics and needs of the receiver population, as well as the desired output process (e.g., increase awareness, action). Additionally, the message directs consumers to follow up with one of three possible actions (output process)—talking to their physician, talking to their pharmacist, or learning more from a website.

Given that awareness of adverse events and drug interactions associated with concurrent use of dietary supplements and pharmaceuticals is low (Hu et al., 2005), and a minority of supplement users report use to their providers (Kennedy, 2005), we hypothesized that comprehensible messages from a credible source via a familiar channel designed to increase awareness and consideration of dietary supplement use by alerting consumers to potential risks of concurrent use of dietary supplements and OTC and prescription pharmaceuticals would (a) promote further consideration and action specifically to seek additional information from an authoritative source and/or consultation from qualified health care

professionals, and (b) ultimately empower consumers to make well-informed decisions concerning usage of dietary supplements. To test this hypothesis, we used mixed methods to develop and evaluate the BuyIN communications strategy across three CPM (McGuire et al., 2001) *input variables*—(a) *source*: how do consumers rate the believability or trustworthiness of the information provided through the BuyIN mechanism?; (b) *message*: what are the attitudes of consumers toward the language alerting the buyer to the message and the level of specificity of information provided?; and (c) *channel*: what are the attitudes of consumers toward how the messages are delivered at the POS (coupon vs. receipt)?—and three *output processes*: (a) *awareness*: does the BuyIN approach increase awareness of dietary supplement–pharmaceutical interactions?; (b) *readability/comprehension*: are messages delivered at the POS effective in communicating the key information?; and (c) *action*: does the approach influence consumer behavior in ways that may reduce the incidence of drug–supplement interactions, including seeking more information and changing usage patterns? We also examined the feasibility of the approach, including the capabilities, technical requirements, and possible hidden costs for implementing the system.

METHODS

We conducted a pilot study to test the effectiveness of tailored health communications on possible drug–dietary supplement interactions delivered at the POS for the supplement. We hypothesized that by implementing a POS messaging campaign focused on three primary CPM input variables (source, message, and channel) we would observe positive outcomes in three primary CPM output variables (awareness, readability, and action). We conducted this research in five stages consistent with the widely used “Pink Book” of health communications planning (National Cancer Institute, 2002): (1) selecting sites and subjects, (2) tailoring technology and materials, (3) pretesting materials in focus groups, (4) implementing the 8-week field trial, and (5) evaluating effectiveness. The study was approved by the University of Medicine and Dentistry of New Jersey (UMDNJ) Institutional Review Board (IRB).

Selecting Sites and Subjects

After exploring a number of possible locations for the study, Wakefern's ShopRite Supermarkets (Newark, NJ) was selected as the commercial partner. Based on an analysis of demographic and sales data provided by ShopRite, three stores were chosen that met all site selection criteria: (a) proximity to the New Jersey-based research team, (b) an existing POS system compatible with the BuyIN system, (c) a mechanism for identifying shoppers who purchased targeted items, (d) adequate sales volume of dietary supplements, and (e) socioeconomically diverse customer demographics. The target population for the survey study was defined as all members of the ShopRite frequent shopper club who (a) were registered at one of the three test sites, (b) had given ShopRite previous permission to contact them with promotional and other information, and (c) had purchased one or more of the targeted items during the trial period. Consumers under the age of 18 years were excluded.

Tailoring Technology and Materials

Input Variables

Source: How a receiver perceives the credibility of a message source will influence the way in which the receiver attends to, responds to, and changes behavior as a result of the message (McGuire, 1984; McGuire et al., 2001). All messages were developed by the research team based at UMDNJ and approved by representatives of ShopRite. The main issue was whether to include UMDNJ on the message to inform consumers about the source. To assess this, messages were prepared for focus-group review both with and without

UMDNJ acknowledgment to determine whether source credibility was affected and how it might be maximized.

Message: Two main issues were critical in the design and preparation of messages. First, supplements for which messaging would be provided had to be selected. Based upon sales volume in the ShopRite stores and potential for adverse interactions with drugs identified via a comprehensive review of peer-reviewed journal articles, six supplements were selected for the field trial: echinacea, garlic, ginkgo, ginseng (i.e., Panax, Siberian, and, American), saw palmetto, and Saint-John's-wort. Multi-ingredient products were eliminated to avoid message design complications that arise as the amount of content increases.

Once the supplements were selected, generation of accurate messages with high readability for individuals with variable rates of health literacy was the second critical goal, considering that BuyIN, when fully implemented, will be required to generate focused messages for thousands of products, including many with multiple ingredients. We developed messages that had two primary output goals. First, easily comprehensible messages would alert consumers to both the attributes and possible consequences of using the dietary supplement in conjunction with certain medications (increase *awareness*). Second, messages would encourage the consumer to discuss supplement use with a pharmacist and/or doctor or obtain more information from a website that provided a more detailed monograph on the product (stimulate *action*). Four message styles with different content and levels of detail were produced (see Figure 1) with the idea that different message types may be more or less accessible to individuals of varying health literacy levels. The Flesch–Kincaid reading level (Kincaid, 1975) for these messages ranged from fourth grade to college level. The “strong” message included a list of drug class types with a description of specific drug–supplement interactions, such as bleeding, seizures, or coma. The “light” message included a list of drug class types with a general message of “may increase side effects or decrease effectiveness.” The “light generic” message included a general message about the supplement causing side effects or decreasing effectiveness with some (unspecified) medications. The “important safety alert” simply noted that the supplement may “cause a severe reaction” with certain (unspecified) medication.

Channel: Before messages were tested in the focus groups, specifications for the messages to fit both receipt and coupon formats were developed (e.g., dimensions of the printable areas, number of characters allowed given different font sizes, types of fonts available, and graphic capabilities of printers). Coupons and receipts with messages were presented to the focus groups for review and feedback, resulting in the final design of messages for the field trial implementation. Software compatibility issues arose when BuyIN was integrated with the existing POS hardware and software used at the ShopRite test sites. Thus, a coupon delivery mechanism was selected for the pilot rather than printing to receipts. However, focus-group participants were asked about coupon and receipt delivery for future studies.

Output Processes

Build website for consumer access to additional information: A desired effect of the BuyIN messages was to motivate consumers who are at risk of adverse interactions to take action by seeking additional information. To support this goal, BuyIN messages included the recommendation to contact a physician or pharmacist or access a special website. For the current study, a website was produced in collaboration with Natural Standard (www.naturalstandard.com), a popular online database focused on dietary supplements and natural products. The website included a home page with a brief introduction and links to the Natural Standard consumer monographs for each targeted item. When a consumer

accessed this URL and clicked on a link to an item, the monograph for the item would open on the section concerned with drug–supplement interactions.

Draft survey instrument to assess awareness, understanding, and action: We designed a survey questionnaire to: (1) collect background information on each participant to potentially assess differences in output variables based on receiver demographics; (2) identify the effects of the campaign on awareness of the BuyIN messages; and (3) among consumers who reported noticing the messages, assess any behavioral changes (actions) based on their understanding of the messages. The survey began with a set of background questions and then established whether or not the participant noticed receiving a coupon with information related to potential drug–supplement interactions. For those who responded affirmatively to the last question, additional questions were asked on such issues as how the subject used the contents of the message information and general feelings about the messages and delivery mode. As an example, Table 1 presents questions 7 and 7a from the survey instrument about how and in what way product usage changed as a result of the message. Note that “INSERT” refers to one of the eight targeted items.

Pretesting Materials in Focus Groups

Focus groups were conducted to address a number of uncertainties about consumer attitudes related to *input variables* (e.g., source credibility, preferred message format, readability/literacy, design, and medium of information presented) and overall feasibility (e.g., privacy concerns and impact on attitudes toward the retailer providing the BuyIN service). An independent research company with expertise in conducting focus groups helped to organize and run two 2-hour focus groups. Eligibility criteria for participation in the focus groups included all members of the ShopRite frequent shopper club age 18 years and older who: (a) were registered at one of the three test sites; (b) had given ShopRite previous permission to contact them with promotional and other information; and (c) had purchased one or more of the targeted items during the previous three months. Participants were recruited through a list from ShopRite's frequent shopper club. A moderator's guide outlined the topics to cover during each session (Table 2). Additionally, participants were shown the different message formats with varying content for review, comment, and input on the degree to which they understood the messages. Focus-group sessions were audio-recorded and transcribed. The moderator also took notes on participant responses. From the data, a coding guide (Strauss & Corbin, 1998) regarding all input variables, expected output processes, and feasibility concerns was created to assist with identifying major recurring patterns and themes based on frequency in responses. To bolster credibility, transferability, and dependability of the findings, evidence from the two focus groups was triangulated and we presented discrepant information in the results (Lincoln & Guba, 2000). Findings related to source credibility, message content/readability, and medium were utilized to guide revisions to the messages.

Implementing the Field Trial

The primary research method for the field trial was a telephone survey of consumers who purchased one or more targeted dietary supplements from one of three test sites during the 8-week trial. An independent research company with expertise in conducting telephone surveys was employed to administer the survey. Following a brief pilot at one site, the field trial was expanded to all three store sites and continued until the goal of reaching approximately 200 surveys over 8 weeks. In total, 566 calls were made to obtain 199 completed surveys (response rate = 35.2%). All participants were contacted within 2 weeks of the purchase date. Following verbal consent, participants completed the ~15-minute survey. Participants were given \$25 remuneration for participation.

Evaluating Effectiveness of BuyIN

To evaluate the influence of BuyIN on consumer behavior, we performed descriptive statistics related to key *output processes*. We calculated the proportion of respondents who (1) indicated they were aware of the messages, (2) understood the message as evidenced by seeking more information from a physician, pharmacist, or the BuyIN website, and (3) changed their dietary supplement usage patterns as a result of reading the BuyIN message. Chi-squared (for categorical data) or Pearson correlation coefficients (for continuous data) were used to test whether message penetration varied as a function of demographic characteristics. Data were analyzed with SPSS Version 10 (Chicago, IL).

RESULTS

Results From Analysis of the Focus Group Data: Input Variables

Two focus groups of 19 total consumers were conducted. Focus-group participants were demographically similar to the survey study sample; the majority were female, White, and had attended some college. A primary goal of the focus groups was to ensure that the BuyIN POS messages were designed in such a way that message source, content, and channel would elicit positive changes in the output processes of interest regarding supplement use. Three key themes emerged from the focus-group sessions, including source credibility, attitudes toward message styles and content, and attitudes toward message format (channel). Hypothesized concerns that may have influenced feasibility included how receiving BuyIN messages at the POS might compromise privacy and whether participants could read and understand the messages (literacy). However, no study participants expressed concerns over invasion of privacy with the BuyIN program. Participants reported understanding the messages provided and participated in focus groups demonstrating understanding.

Source Credibility—Each sample coupon included the ShopRite logo and the statement that all copy was approved by ShopRite. To assess whether credibility concerns may arise from this format, the moderator asked participants what they thought was motivating ShopRite to take part in this research. Initially, most respondents thought ShopRite was “on the defensive” and “trying to avoid liability.” As one participant stated, “Why else would they tell me information that might make me not buy their product? That’s not in their best interest, since they are in business to sell me this product.”

The focus-group moderator then asked participants to consider whether printing the UMDNJ logo on the coupons would influence their attitudes about the credibility of the messages. All agreed that the messages were more believable with the UMDNJ logo attached. Respondents felt the logo was a credential that signified that the information was based on scientific research. With the UMDNJ logo displayed alongside the ShopRite logo, respondents felt that ShopRite was being responsible toward their customers. Attitudes changed from one of suspicion to trust, as reflected by such statements as “I would expect ShopRite to do something like this” and “They do a lot of community service programs.” One respondent made the connection that “the coupons are really like the white sheets I get from my pharmacist when I pick up a prescription.”

Message Content—Most participants reported that the information provided on drug–supplement interactions was new to them. Some participants were completely unaware of drug interaction issues with dietary supplements. After review and discussion about the different message styles, participants eventually agreed that they preferred the *strong* message to *light* and *light generic* messages (see Figure 1). In particular, the *strong* message was rated “very appealing” due to its specificity. Participants wanted as much information as they could get about a product in order to make an informed decision regarding its use.

Participants also found the *important safety alert* message appealing. For both the *strong* and *important safety alert* messages, participants viewed the communication as more detailed and believable than the *light* and *light generic* formats. They also thought these formats would be more likely to motivate customers to explore the product further. One point of disagreement among participants was what to include under the “possible consequences” section. A minority of respondents reported feeling uncomfortable with some of the terminology, such as internal bleeding, unintended pregnancies, and organ transplant. Most respondents, however, felt that the detailed list of possible consequences was important for generating a sense of urgency to research the product further.

Channel: Coupon Versus Receipt Format—All respondents preferred the message on coupons as opposed to the receipt. In general, respondents thought that the important safety information on the receipt was not as apparent as on the coupon. One promising suggestion for future use of the receipt format was to print a bold message stating “Important Safety Alert Below” close to the total amount spent, since all respondents indicated they look at this location on the receipt. Of note, some respondents speculated that once they became aware of the message system, they would know to look for the messages on subsequent visits.

Several recommendations for messaging contents and format emerged from the focus groups. First, to have the most impact on consumer behavior, use the *strong* message style with the *important safety alert* message on top, but avoid certain graphic terminology. Second, given the potential for customers to question a company's motives and/or assume information is being provided for liability reasons only, consider communicating with customers in some way why the company implementing BuyIN is distributing this information. Third, add the logo of a medical authority to the message for increased credibility and responsibility toward consumers. Finally, if using a receipt to communicate these messages, print an eye-catching graphic on the receipt near the total amount as a way to cue the consumer to look further. As part of the field test, we implemented the first three recommendations. We did not use the receipt format, so the final recommendation was not applicable.

Results From Analysis of the Survey Data: Receiver Characteristics and Output Processes

Characteristics of Survey Respondents (Receivers)—The 199 survey participants were predominately female (80.4% female, 19.6% male). The median and mean age fell in the 55–59 age category, with a large percentage (39.2%) age 65+. Most were White (80.4%), with the next largest racial group identified as Black/African American (13.1%). Most (69.3%) had attended at least some college.

Of the six general types of targeted supplements purchased by survey participants, the most frequently purchased was garlic (60.8%), followed by echinacea (19.6%), ginkgo (15.6%), saw palmetto (15.1%), some variety of ginseng (12.5%), and Saint-John's-wort (8%). Most survey participants (78.4%) indicated that they purchased only one of the targeted supplements, with the remainder (21.6%) purchasing two or more in the 4 weeks prior to the survey.

Output Processes: Awareness, Comprehension, and Action—Overall, the penetration rate, or the percentage of participating consumers who were *aware* of the messages, was 27.1%. It was similar among those who purchased the supplement for themselves (28.2%) versus another individual (24.3%). The penetration rate did not significantly differ as a function of gender ($\chi^2 = .065, p > .10$), race ($\chi^2 = 0.69, p > .10$), marital status ($\chi^2 = 3.82, p > .10$) or level of income ($r = .59, p > .10$). There was a

nonsignificant trend for older participants to be more aware of the message than younger participants ($r = -.154$, $p = .057$). Those who indicated that they had attended at least some college were more likely to be aware of the coupon (34.3%) than those who did not indicate attending some college (15.7%), ($\chi^2 = 5.86$, $p < .05$).

Aggregated across all supplements, 7.4% of the consumers aware of messages indicated that they saw a physician as a result of viewing the coupon information. Fewer of those who were aware of the message (3.8%) indicated that they spoke with the on-site pharmacist as a result of viewing the coupon information. A larger proportion of aware consumers (11.5%) said that they visited the website listed on the coupon. Aggregated across all supplements, 10.5% of consumers aware of the coupon message indicated that they had changed their product use since their most recent purchase. This rate is consistent with a meta-analysis of health communications campaigns on behavior change (Witte & Allen, 2000). Among all consumers aware of messages, only one respondent reported returning a targeted item for a refund. Finally, over 80% of all consumers surveyed responded that they would like to see safety alert information about dietary supplements and other products printed to receipts.

DISCUSSION

Findings from this study provide support for using a Web-enabled POS consumer information delivery system designed based on McGuire's CPM to deliver health and safety messages about potential drug-supplement interactions and adverse effects. Feedback from individuals representing target receivers indicated that when the source of the messages was clearly delineated with a logo from a reliable entity, the content provided a clear and descriptive message about potential risk, and the channel made the message easy to notice and read, action on the message content was more likely.

Input Variables

Source—McGuire notes that source credibility, or the trustworthiness of the origin of the health message, is a critical input variable for most effective health communications campaigns (McGuire, 1984; McGuire et al., 2001), and this was identified as an issue for focus-group members. Participants reported that co-branding with a medical authority was important for giving credence to the information as a real health concern, as opposed to simply liability protection when the company alone was perceived to be the source of the message. When the UMDNJ logo was printed alongside the ShopRite logo, participants stated the message was more believable and more likely to influence their attitudes and behaviors. This is consistent with other studies that have shown that sources that are perceived as more credible have greater impact on health behaviors (Rimer & Kreuter, 2006; Snyder, 2007). How this is attended to nationally and/or regionally will require careful consideration.

Message—Most focus-group participants noted that strong, clear messages with detailed information on potential dietary supplement-drug interactions were most appealing, and they reported understanding these messages. However, the wording in the preferred messages was graded at a higher level according to the Flesch-Kincaid rating (~12 years), and the moderator read the message to focus-group participants, while they reviewed the actual coupon. Additionally, post-campaign data showed that the only statistically significant demographic difference between consumers who were aware and unaware of messages was educational status. Thus, the lack of penetration among consumers with lower educational levels may reflect low rates of literacy/numeracy and health literacy (Greene, Hibbard, & Tusler, 2005; Paasche-Orlow, Parker, Gazmararian, Nielsen-Bohlman, & Rudd, 2005). Future studies of the approach will need to incorporate strategies to promote

awareness of the health and safety messages in different receiver groups (e.g., lower education, ethnic minorities), as well as developing messages that still present as “strong” at lower reading levels. Provision of POS messages with graphics and/or in Spanish also should be considered for future research.

Channel—The channel through which messages are provided (McGuire et al., 2001) is an important input variable when considering expectations for changes in output processes. A single channel—POS coupons—was utilized in this pilot study and proved to be effective, but it will be important to assess the relative effectiveness of the receipt method as a medium for delivering health and safety messages. Printing to the receipt likely will be a more effective way to achieve high levels of penetration and a more scalable approach than printing to coupons, because many stores lack coupon printers and costs associated with printing coupons are much higher than receipts. That more than 80% of consumers who purchased targeted items responded positively to the idea of printing health and safety messages on the receipt suggests that the receipt delivery method would be a broadly acceptable channel to consumers. Further, although ShopRite posted a number of signs about the pilot project in prominent locations at each store, no broad-scale campaign was initiated. Health communications campaigns that use multiple communication channels simultaneously and clearly state the desired behavioral goal have been shown to have better outcomes due to their mutual reinforcement (Evans & McCormack, 2008; Snyder, 2007). Thus, a large-scale implementation that included multiple channels and message variables (McGuire et al., 2001), as through simultaneous store-level (e.g., weekly sales advertisement fliers, signs) and POS messaging, likely would find more consumers reviewing their supplement use with a provider or pharmacist or seeking information from designated websites. Future studies should investigate a multichannel campaign.

Output Processes: Awareness, Understanding, and Action

More than one quarter of consumers who purchased targeted items were aware of the messages. Within this subset of aware consumers, more than one in 10 sought additional information from a physician or pharmacist, visited the website listed on the coupon, and/or changed usage behavior, suggesting they understood the messages, and this understanding compelled action. These outcome processes are noteworthy considering that the majority of dietary supplement users do not seek advice from a practitioner prior to consumption and fail to report usage to physicians and other providers (Hu et al., 2005; Kennedy, Wang, & Wu, 2008). Further, this study influenced consumers' behaviors, despite the campaign limiting the channel to POS messaging versus a broader campaign using multiple messaging channels to increase buyers' awareness of the service. The campaign also remained in place for a relatively short period of time, thereby limiting the frequency of exposure, which is known to directly correlate with communication campaign outcomes (Snyder, 2007). Had ShopRite distributed the messages for an extended period, the frequency of exposure would have increased, likely resulting in greater awareness of the messages, particularly among shoppers who generally ignore coupons.

Future and broad-scale implementation of the BuyIN system will require testing of a number of considerations beyond what was examined in this pilot. Concern over how the message delivery system might affect sales and returns of dietary supplements is one future consideration. Only 1 of 54 consumers who were aware of the messages returned a targeted item for a refund. Thus, returns were not a significant issue in the present study, and product sales were not tracked. However, the campaign lasted only 8 weeks, and research suggests that campaigns between 6 and 12 months in length have the greatest effect on behaviors (Snyder & Hamilton, 2002). Thus, a longer campaign might have resulted in more returns and a trend downward in the sale of some items as consumers became more aware of

potential risks associated with use. Conversely, consumers might develop positive associations with the store implementing the POS campaign and increase purchase of other goods, counterbalancing any small decreases in specific supplement sales. Future studies will need to investigate trends in sales and returns after longer duration of the BuyIN system.

Technologically, our findings suggest the BuyIN system can be implemented at a larger scale for single product items. The BuyIN architecture has two separate structures. One provides the mechanism to link a product's UPC number to a database on a remote server. This part of the system is largely in place through existing POS systems, although in some cases the existing POS software will require some adaptations. The other structure provides an administrative mechanism that allows the content manager(s) to add, delete, update, and call up messages for products. The current study tested certain aspects of the administrative mechanism, and these worked well to deliver the health and safety messages about drug-supplement interaction. When fully implemented, BuyIN will necessitate a mechanism for purchases that require longer messages. Some dietary supplements have many attributes and possible consequences, many products have multiple targeted dietary supplements, and many consumers will purchase several products with targeted ingredients at the same time. A fully capable system must provide consumers with relevant health and safety information even when a single receipt includes many targeted items. Our preliminary work in message generation has laid the groundwork for this next important phase of development. Future investigations will need to attend to the relationship between message variables (type of information), receiver characteristics (literacy/educational levels and cultural preferences), and channel (coupon, receipt, storewide), especially for products that require extensive content. Relatedly, this system may have the potential to be more broadly applied to other products and/or to utilize other Web-enabled technologies, such as QR codes, for products with lengthy health and safety concerns.

The BuyIN approach appears to be a feasible solution to the problem of how to reduce adverse drug-dietary supplement interactions from a technical and cost perspective. However, this study has some limitations. First, the sample size was small, so we were unable to run multivariate models to identify independent correlates of changes in supplement usage patterns. Future studies should test the approach with larger samples to better characterize consumer behaviors regarding dietary supplement use after POS messaging on potential drug-supplement interactions. Second, the sample was majority White and English speaking. Message penetration may be different for minority and immigrant consumers, especially among groups with cultural traditions of using herbal medicines (Kennedy et al., 2008). Future studies should investigate message penetration and consumer behaviors among ethnic and language minorities, including the need for bilingual and/or pictographic messages, which were not feasible in this initial trial. Third, we conducted this trial over a relatively short period of time, so no long-term effects of the POS messaging system can be ascertained. Even with the short trial, penetration effects exceeded 25%, indicating the utility of the approach for increasing awareness and action. Fourth, although a website was developed for the project, we did not have data beyond self-report of site access. Future studies should investigate the role of the website as a channel for messaging information. Finally, future research will need to expand the investigation to include a closer examination of how different combinations of input variables influence output processes of interest, including looking at reinforcement/maintenance of behaviors over time. Despite its limitations, the current study has provided evidence that BuyIN has the potential to solve the problem of how to reduce the prevalence of adverse drug-dietary supplement interactions in the U.S. population. Future research should include a large-scale study of a fully implemented and capable system at multiple test sites around the country.

and should investigate the utility of BuyIN in different retail settings, for example, a supermarket versus a health food store versus a pharmacy.

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FIGURE 1.
Sample set of messages presented to focus groups.

TABLE 1**Sample Items From BuyIN Survey Instrument**

7. Since the most recent purchase of <i>(INSERT)</i> , has your use of this product changed?
1 – Yes
2 – No (<i>GO TO INSTRUCTS. AFTER Q. 7b</i>)
7a. Which of the following statements BEST describes how your usage of <i>(INSERT)</i> changed?
1 – I changed the amount or dosage of <i>(INSERT)</i> that I take,
2 – I stopped taking <i>(INSERT)</i> temporarily,
3 – I stopped taking <i>(INSERT)</i> altogether,
4 – I have never stopped or changed the amount of <i>(INSERT)</i> that I take,
5 – I have not yet begun to take <i>(INSERT)</i> , (specify reason)
6 – Some other type of change (specify)?
7 – (VOL) Don't Know
8 – (VOL) Refused

TABLE 2

Focus-Group Moderator Guide Questions and Follow-Up Probes

I. General Habits and Practices exploration of herbal supplement/vitamin purchases.
a. What types of herbal supplements do you currently buy?
b. Do you have any concerns regarding supplements? What? (Probe safety)
II. Do you currently take any prescription drugs?
a. Have you been given any information about what you can or cannot take your prescription with? (Probe whether they follow advice and level of information)
b. What are your biggest concerns regarding drug interactions?
c. Have you heard anything outside of your physician/pharmacist regarding drug interactions with herbal supplements/vitamins?
III. Format Exploration (First present strong version of coupon—review. Then present strong version of receipt—review. Proceed with moderate, mild, and Important to know.)
a. I now want to show you some coupons that you may receive at a ShopRite. We'll read through some of these coupons, and I want you to tell me what your overall thoughts are.
• Now that you've seen and read this, what are you overall impressions of this coupon?
• What do you like about this coupon? (Probe on <u>specific</u> things that they find appealing.)
• What do you dislike about this coupon? (Probe on <u>specific</u> things that they dislike and/or find unappealing.)
b. What, specifically, are these coupons communicating to you about some of the products that you typically use? (Probe what's understood, appropriateness, credibility)
c. These coupons mentioned some very specific interactions. What do you think about that?
• Why do you think they decided to mention the particular drugs that they did? (Probe for “general interactions” versus “they know what drugs I'm on”)
• Do you have any privacy concerns at all? Concerns about a young clerk running the register giving this to you?
d. How do these communications make you feel about ShopRite? (Probe change opinion, meaningful, reason why?)
e. [<i>Present Receipt example</i>] Instead of a coupon, you may receive a message on a register receipt like this.
f. What do you think about this sort of information being on the back of your receipt? (Probe on specifics)
g. How does this receipt communication compare to the coupon I previously showed you? Do you have a preference for one over the other? Why/Why not?
h. Would you need some sort of signal that there is a message on the back of your receipt?
i. Now I'd like to show you some other executions of a similar idea. [Moderate, mild and Important to Know]. Repeat key questions from above, then proceed below. What do you think about this receipt communication versus the previous one I showed you?
j. Do you have a preference for one over the other? Why/Why not?
k. You'll notice that this idea is shorter/longer. Why do you think this is? (Probe preference/comprehension/differences in what is being communicated)
l. Overall, which one do you prefer? Why?
IV. Overall Impressions
a. Based on what you learned to day, how does this impact your supplement purchases?
b. What have you learned about herbal supplements today? (probe potential dangers, impact use, feelings about information).
c. Did you ever get this information from your physician or pharmacist? (If no, probe thoughts about getting this information today.)