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Development of Prescription Drug Information Leaflets: Impact of Cognitive Effort and Patient Involvement on Prescription Medication Information Processing

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Abstract

Objective: The objective of this study was to develop a one-page (1-page) prescription drug information leaflet (PILs) and assess their impact on the information processing variables, across 2 levels of patient involvement. *Methods:* One-page PILs were developed using cognitive principles to lower mental effort and improve comprehension. An experimental, 3 × 2 repeated measures study was conducted to determine the impact of cognitive effort, manipulated using leaflet type on comprehension across 2 levels (high/low) of patient involvement. Adults (≥18 years) in a university setting in Houston were recruited for the study. Each participant was exposed to 3 different types of prescription drug information leaflet (the current practice, preexisting 1-page text-only, and 1-page PILs) for the 3 drugs (Celebrex, Ventolin HFA, Prezista) for a given involvement scenario. A prevalidated survey instrument was used to measure product knowledge, attitude toward leaflet, and intention to read. *Results:* Multivariate analysis of variance indicated significant positive effect of cognitive effort, involvement, and their interaction effect across all measured variables. Mean scores for product knowledge, attitude toward leaflet, and intention to read were highest for PILs ($P < .001$), indicating that PILs exerted lowest cognitive effort. Univariate and post hoc analysis indicate that product knowledge significantly increases with high involvement. *Conclusion:* Patients reading PILs have higher comprehension compared with the current practice and text-only prototype leaflets evaluated. Higher levels of involvement further improve participant knowledge about the drug, increase their intention to read the leaflet, and change their attitude toward the leaflet. Implementation of PILs would improve information processing for consumers by reducing their cognitive effort.

Keywords

prescription drug information leaflet, information processing, comprehension, cognitive effort

Introduction

Accuracy and relevance in written communication is vital for the appropriate use of prescription drugs.[1] Prior studies have highlighted the importance of patients' comprehension of the written prescription drug information provided along with their medications.[2] The need for designing more appropriate written prescription drug information, especially for prescription medications used by the elderly, has often been emphasized.[2] A systematic review on written information from a patient perspective indicated that written information was valued by patients and used in decision making. This further contributed to improved patient compliance with medication.[3] Another review focusing on physician patient communication highlighted that the content and format of prescription medication labels facilitate communication and comprehension by patients.[4]

Over the years, prescription drug labeling has been updated to ensure patient safety. By 1979, the FDA proposed regulations to require educational leaflets to accompany all prescription drugs.[4] The patient package inserts (PPIs), medication guides, and consumer medication information (CMI) are supplementary forms of medication information provided to patients as leaflets with their prescription medications.[5] For the

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current study, medication information sources/leaflets are supplementary medication leaflets. There is a need to determine the correct content and layout of statutory medicine leaflets to best meet patients' needs.[6] In this study, Prescription drug Information Leaflets (PILs) were developed and evaluated to help consumers comprehend prescription information better.

When written communication is easily comprehensible, it may benefit patient understanding, and this may eventually contribute to the improved health outcomes.[7] Standardization in prescription medication information sources provides manufacturers with clarity in developing the necessary patient-directed information and avoid any litigations. In February 2009, the Food and Drug Administration (FDA) Risk Communication Advisory Committee recommended adoption of a single standard document for communicating essential information regarding prescription medications.[8] FDA's efforts continue to request research on how new forms of patient information can more effectively communicate essential medication information to patients.

In this study, 2 variables were manipulated, namely, cognitive effort and patient involvement. Cognitive effort was defined as difficulty to read and understand the prescription medication information provided to the patient. In 1899, John Sweller developed cognitive load theory (CLT) while studying problem solving.[9] Cognitive load refers to the total amount of mental activity imposed on working memory at an instance in time. The major factor that affects cognitive load is the number of elements that need to be considered [10] This concept of designing content to reduce cognitive load with reference to the CLT was used in this study to design PILs.[9,11,12] The goal was to develop PILs with the least amount of cognitive load possible. Theoretical ideas explaining how to reduce cognitive effort by incorporating color and other information content was involved in this process and are described in the Methods section.

It is known that involvement plays a major role in processing information.[13] Patient involvement is a concept that is borrowed from the motivation theory. Motivation explains the process of individual behavior. Involvement can be viewed as the motivation to process information and refers to "the level of perceived personal importance and/or interest evoked by a stimulus (or stimuli) within a specific situation."[13,14] An individual's level of involvement affects product-related information searching and decision making and resultant attitude change.[13,15,16] Patient involvement can be classified as situational and intrinsic involvement. Situational factors are more easily manipulated and hence considered in this study.

The objective of this study was to develop and test a 1-page PIL having a uniform format, with patient-friendly content, and clinically relevant information to improve prescription medication comprehension and use. Next, using the PILs in comparison with current practice leaflets and preexisting 1-page text-only leaflets reported in literature, empirical tests would be conducted to investigate the impact of cognitive effort exerted and patient involvement on comprehension and information-processing variables, product knowledge, attitude toward leaflet, and intention to read. In this study, a research model was developed to study patient processing of prescription drug information across various levels of cognitive load and patient involvement. The main outcome variables in the model were product knowledge as an indicator of comprehension, attitude toward the leaflet, and intention to read the leaflet.[17,18]

Material and Methods

Study Design

In this experimental field study, data were collected in and around University of Houston, from individuals 18 years or older. The Committee for the Protection of Human Subjects at the University of Houston reviewed and approved the study procedures.

Information Leaflets

Cognitive effort was manipulated at 3 levels and operationalized by the development of the 3 information sources, current practice leaflets (multiple pages—high cognitive effort), preexisting 1-page text-only leaflets (medium cognitive effort), and PILs (low cognitive effort).

The newly developed PILs were pretested to exert the lowest cognitive effort followed by preexisting 1-page text-only leaflet from literature review (medium), and current practice leaflets (high) in our pilot studies. Reduced cognitive effort was achieved by using well-known cognitive principles to develop PILs and pretesting PILs to check if the manipulations were effective with respect to cognitive load. Manipulation for the cognitive effort was measured using a 7-point semantic differential scale having the anchors colorful/colorless, easy to read/difficult to read, and more effort/less effort. Each of the 3 leaflet types are described below.

PILs were developed to operationalize the cognitive effort variable. The design and the content of a particular information source would be indicative of the cognitive effort. Concepts from cognitive load theory (CLT) were used to develop the PILs.[9]

For the purpose of this research, PILs were developed for 3 drugs, namely, Celebrex (celecoxib), Ventolin HFA (albuterol), and Prezista (Darunavir). Three different drug products were used to improve the repeated measures experimental design and minimize any carryover effect. For example, to measure product knowledge, if a participant saw the same drug product in 3 different formats, it could artificially inflate the product knowledge variable as a result of the learning effect. In addition, a survey of preexisting leaflets both in literature and currently available in the marketplace was conducted.[19,20] Since we found one study that had developed a 1-page leaflet before, we thus decided to develop PILs to test them in comparison and kept the same drug products used in the previous study.[21]

The OTC drug facts panel format was adopted while developing the PILs, as this format has been used on OTC packages and patients are familiar with it.[22] A red box was included to represent important clinical information required by patients to use the medication appropriately. (See Appendix A1 for an example of a PIL developed for the drug Celebrex.) The content of drug information was considered from an FDA-approved label and was tested for content validity by 3 academic researchers with clinical backgrounds and 2 physicians. The PILs were developed and printed on an A4 size paper.

Cognitive principles of weeding, off-loading, signaling, clustering, chunking, coding, and color were used in the development of PILs.[11,23-26] Off-loading was defined as providing information in a different manner, that is, via use of pictures or symbols.[11,24,27] In PILs, universally accepted symbols were used to indicate important safety information and when not to take the medication. Further, an actual picture of the medication was included at the right top corner to help the patient identify the medication and avoid medication errors.[11,24] Weeding and signaling was done by excluding unnecessary information (weeding) while important safety warnings were highlighted (signaling) to improve cognitive effort.[24] By keeping like information together, the principles of clustering were followed.[18] Information was further chunked into segments. Based on the concepts of coding/naming, each section was titled to provide context to the information.[18,26]

The preexisting 1-page text-only leaflets from literature were developed by a group of researchers led by Catalina Health as a quality improvement (QI) initiative[28] with the goal of providing patients clearer medication information when they fill prescriptions at the pharmacy. These were used as is without any modifications. Further, these leaflets did not use color, symbols/pictures, and had inconsistent font size across different medications (Appendix A2).

Current practice leaflets for the 3 medications considered for this study included patient leaflets that a patient would receive in a pharmacy at that time. These current practice leaflets were collected from four major chain pharmacies, specifically Kroger, Target, Walgreens, and CVS. The current practice leaflets from the above four pharmacies were compared and leaflets that had the least amount of information load (number of pages) for lowest possible anticipated effort were adopted in this study. The main reason for this step was to make the experiment as appropriate as possible without introducing selection bias.

Development of Involvement Scenarios

Patient involvement was manipulated at 2 levels, low and high. Scenarios were developed based on past literature and responses from five practicing pharmacists. Situational scenarios were used to manipulate patient involvement. For the high-involvement scenario, the participant was asked to imagine that they had a life-threatening disease and that reading the leaflet was important because the medication had significant side effects. Conversely, in the low-involvement scenario, the participant was informed that the prescription they were picking was a refill for a medicine that they had used for a year and never experienced any problems. Further, they had to reach home quickly as they were hosting a party (Appendix B). These scenarios were pilot tested. Manipulation check for patient involvement was conducted using 7-point semantic differential scale in terms of involvement, interest, and motivation.

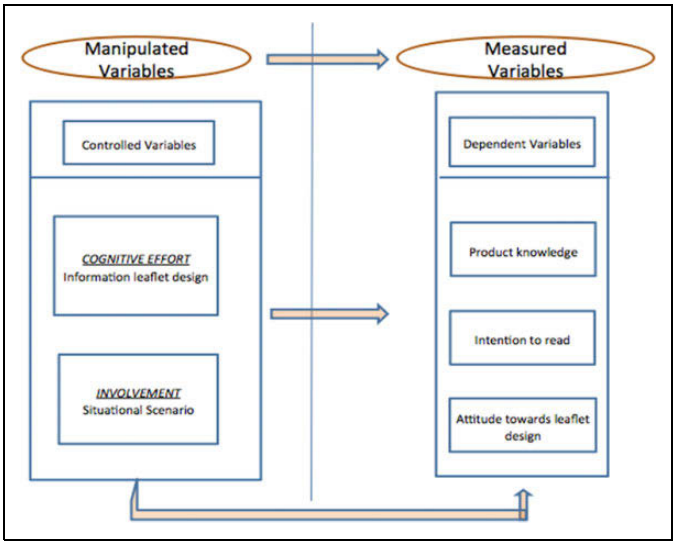


Figure 1. Proposed research model.

Instrument Design

There were 3 measured variables for the research model, namely, product knowledge, attitude toward leaflet, and intention to read (Appendix C). Figure 1 provides details of the proposed model. Product knowledge was operationalized as patient's interpretation and retention of information viewed. This construct was measured using an 11-item, 7-point Likert-type scale where a greater amount of information leads to poor comprehension or product knowledge.[29] Attitude toward information was considered as the predisposition to respond in a favorable or unfavorable manner to a particular format.[30] The attitude toward the leaflet would be formed based on the evaluations performed. A 5-item, 7-point semantic differential scale was used for attitude toward leaflet. Please note that items were recoded where a higher score indicated a more positive attitude toward the leaflet. Intention to read was the likelihood that the patient will read the information. Many studies in the past have used validated scales to measure intention.[30,31] A 2-item, 7-point semantic scale having anchors "very likely" and "not at all likely" was used in this study, where a higher score indicated a higher intention to read the information. In addition, the survey instrument also contained questions on patient characteristics (age, gender, race, and education level), prescription medication use, health-related training, involvement in health improvement, if they read leaflets received with prescription medications, general health status,

and health literacy. Prescription medication use and health-related training was measured on a dichotomous yes/no scale. Involvement in health improvement was measured on a 7-point, not at all involved to very involved, scale. General health status was measure on a 5-point, excellent to poor, scale. Reading leaflets and if they seek help from others to read leaflets (health literacy) were measured on a 5-point, never to always, scale. Pilot studies were conducted as a replica of the experiment to determine the logistics and gather information that can improve the quality and efficiency of the questionnaire. A summary of all the queries was prepared and the questionnaire was edited accordingly. Appendix C provides all items used to measure variables.

Data Collection Process

Each participant evaluated 3 different leaflets (current practice, text-only, and PILs) before elaborating based on both levels of involvement. Although involvement had 2 levels, each participant was exposed to the involvement scenarios 3 times. Each participant thus reviewed one involvement scenario either high or low at least twice during the experimental process. First the participant read a general introduction to the experiment followed by an involvement scenario, after which they evaluated the leaflet. The participant was informed that she or he would have as much time as she or he needed to evaluate the leaflet information. However, the time she or he was taking to review each leaflet was recorded. After the participant completed the evaluation she or he responded to the questionnaire. This process was repeated for the remaining 2 leaflets. Finally, participants responded to demographic questions and sample practice characteristics.

The order in which the participant evaluated each leaflet was randomized. Further the order in which each product was reviewed was randomized as well as the order of the involvement scenario. Participants were thanked for their participation and were provided a gift as a token of appreciation. Note that the participants were not informed about the gift before they completed the survey because that would increase their involvement. For this study, repeated measures multivariate analysis of variance (MANOVA) was conducted. For MANOVA, an effect size of 0.10 was considered as small (n=1721), 0.25 as medium (n=360), and 0.40 as large (n=112).[32] A priori sample size calculations revealed that 360 completed surveys would be required to test the objective.

Data Analysis

Data obtained were coded using a codebook made in Excel. Frequency distributions and measures of central tendency and dispersions were used to describe the sample and participant responses on the instrument. Reliability analyses were performed for all the domains by calculating inter-item correlations along with Cronbach's alpha. Given the within-subjects nature of the experiment, a 3x2 repeated measures multivariate analyses of variance (MANOVA) was used to analyze the impact of cognitive effort (3) and involvement (2) on measured variables. Post hoc analyses were conducted to determine which of the means in 1-way analyses of variance (ANOVAs) were significantly different. Within-subjects ANOVA and paired *t* tests were conducted for manipulation check. Statistical analyses were performed using SAS, version 9.2, set at an a priori significance level of 0.05.

Table 1. Participant Characteristics.

Characteristic	Frequency (%) (n=360)
Gender	
Males	136 (37.99)
Females	222 (62.01)
Race/ethnicity	
White	146 (40.56)
Hispanic	97 (26.94)
African American	32 (8.89)
Asian	60 (16.67)
Other/mix	25 (6.95)
Education level	
High school	29 (8.08)
College	286 (79.67)
Masters	28 (7.80)
Doctoral	16 (4.46)
Currently taking or in past have taken prescription medication	
No	99 (27.50)
Yes	261 (72.50)
Self-reported health status	
Excellent	91 (25.28)
Very good	183 (50.83)
Good	71 (19.72)
Fair	15 (4.17)
Received professional training in health-related field	
No	302 (83.89)
Yes	58 (16.11)
Read the information leaflets provided along with prescription	
Never	31 (8.61)
Rarely	76 (21.11)
Sometimes	118 (32.78)
Often	95 (26.39)
Always	40 (11.11)
Poor health literacy	
No	262 (72.78)
Yes	98 (27.22)

Results

Of a total of 581 participants who were approached, 366 agreed to participate in the study, and 6 had incomplete responses. A total of 360 usable surveys were finally considered for analyses. The response rate of the study was 61.9%. A summary of participant characteristics can be viewed in Table 1. The mean age of all respondents was 23.6 ($\pm$6.04) years. The majority of respondents were female (62.0%). The sample had a majority of whites (40.5) followed by Hispanics (26.9%), Asians (16.6%), and African Americans (8.8%). About (72.5%) of the

Table 2. Effect of Cognitive Effort and Involvement Level on Mean Scores of Product Knowledge, Attitude Toward Leaflet and Intention to Read.

Variable	Levels	DF	*F* Value	*P* Value
Product knowledge[a]	Cognitive effort	2	9.59	<.0001
	Involvement	1	26.53	<.0001
	Cognitive effort × involvement	2	6.35	.0018
Attitude toward the leaflet[b]	Cognitive effort	2	231.18	<.0001
	Involvement	1	1.50	.2209
	Cognitive effort × involvement	2	26.72	<.0001
Intention to read the leaflet[c]	Cognitive effort	2	87.73	<.0001
	Involvement	1	67.63	<.0001
	Cognitive effort × involvement	2	2.45	.0871

Abbreviation: DF, degree of freedom.
[a]Product knowledge was measured using a 11-item, 7-point Likert scale.
[b]Attitude toward the leaflet was measured using a 5-item, 7-point semantic differential scale.
[c]Intention to read the leaflet was measured using a 2-item, 7-point semantic scale.

participants had taken or were currently taking prescription medications at the time of the survey. Only 16.1% of the respondents had received professional training in a health-related field. Only 1% indicated they always read prescription information leaflets provided along with their prescription. Participants on average took the most amount of time (127.6 [±115.1] seconds) to review the current process leaflets followed by preexisting 1-page text-only leaflets (79.48 [±56.2] seconds) ($P < .001$). Participants took the least amount of time to review PILs (65.78 [±42.5]) seconds compared to both the other leaflets ($P < .001$).

Standardized Cronbach alpha was found to be greater than 0.7 for all the domains. Attitude toward the leaflet had a Cronbach alpha of 0.82, and intention to read the label had an alpha of 0.73. Product knowledge was assessed for reliability using dummy questions. Hence, the domains were considered reliable. The results of the manipulation check indicated a significant difference in means across the various levels, indicating a successful manipulation.

The MANOVA, which was used to help identify the effect (overall main effects and interaction effect) of cognitive effort and involvement on the outcome variables (product knowledge, attitude toward the leaflet, and intention to read), indicated that all effects of cognitive effort, involvement, and interaction effects were significant on the dependent variables ($P < .001$)

An ANOVA followed by post hoc Scheffe test was thus preformed to test all individual effects. The ANOVAs (Table 2) indicated a significant ($P < .05$) effect of cognitive effort across product knowledge, attitude, and intention. Further, the effect of involvement was significant ($P < .05$) for product knowledge and intentions to read variables. The interaction effect of cognitive effort and involvement was significant ($P < .05$) only for product knowledge and attitude toward the leaflet variables. The differences in means in knowledge, attitude, and intention between the 3 types of leaflets and between the 2 involvement scenarios were statistically significant ($P <.0001$) (Table 2).

Scheffe post hoc tests indicated some interesting results at the .05 significance level (Table 3). PILs had significantly better mean scores for product knowledge, attitude, and intention compared with the text-only and current process leaflets. Further, the text-only leaflet was significantly better than the current process leaflets for all 3 variables (Table 3). The results of involvement remained the same, where significant differences were seen for high and low involvement for product knowledge and intention only.

Since involvement was significant and we had interaction effects, we did a subgroup analyses by involvement to see which leaflets performed better during the high- and low-involvement situation (Table 4). For product knowledge, we found PILs to be significantly different from the other 2 leaflets for both high- and low-involvement situations. However, there was no significant difference between text-only and current process leaflets for either of the 2 involvement situations. With respect to attitude and intention, all 3 leaflets significantly were different from each other for both high- and low-involvement situations, but PILs had consistently the best scores between the 3 leaflets.

With reference to the analyses of the extraneous variables, we ran 3 regression models and included all the extraneous variables provided in Table 1 in the model for each of the dependent variables of product knowledge, attitude, and intention. When product knowledge was the dependent variable, none of the extraneous variables were significant. When the dependent variable was attitude toward the leaflet, the following variables were significant ($P < .05$): general health status, health training, and reading leaflets. When intention to read was the dependent variable, only general health status, reading leaflets, and involvement in health improvement was significant ($P < .05$).

Discussion

The current study results indicate that to improve product knowledge, efforts should be made to improve patient involvement. Improving product knowledge is the most important aspect of a prescription drug information leaflet. A significant interaction effect indicates that improving involvement is especially important in leaflets that exert high cognitive effort, that is, the current process leaflets. In the high cognitive effort formats such as text-only and current process leaflets as compared to low-cognitive effort formats such as the PILs, product knowledge scores were the best for PILs irrespective of the involvement situation.

Since the Risk Communication Advisory Committee has recommended the FDA to adopt 1-page patient-friendly formats, efforts should now be directed toward improving patient

Table 3. Effect of Cognitive Effort and Involvement Level on Mean Scores of Product Knowledge, Attitude Toward Leaflet and Intention to Read.

		Outcome Variables (Mean ± SD)		
Variable	Level	Product Knowledge	Attitude	Intention
Involvement	High	5.51 (±0.74)[a]	4.55 (±1.59)	4.97 (±1.94)[b]
	Low	5.29 (±0.67)[a]	4.46 (±1.23)	4.08 (±1.89)[b]
Cognitive effort	PILs	5.52 (±0.71)[ce]	5.35 (±1.14)[fh]	5.23 (±1.70)[ik]
	Text only	5.39 (±0.72)[cd]	4.65 (±1.21)[gf]	4.79 (±1.83)[ij]
	Current process	5.29 (±0.69)[de]	3.49 (±1.23)[gh]	3.54 (±1.94)[jk]

Abbreviation: SD, standard deviation.
Scheffe test was conducted to test for significant difference between levels. The alpha level considered is 0.05.
[a]Significant difference between high and low involvement for Product Knowledge.
[b]Significant difference between high and low involvement for Intention.
[c]Significant difference between PILs and text only for Product Knowledge.
[d]Significant difference between text only and current process for Product Knowledge.
[e]Significant difference between PILs and current process for Product Knowledge.
[f]Significant difference between PILs and text only for Attitude.
[g]Significant difference between text only and current process for Attitude.
[h]Significant difference between PILs and current process for Attitude.
[i]Significant difference between PILs and text only for Intention.
[j]Significant difference text only and current process for Intention.
[k]Significant difference between PILs and current process for Intention.

involvement in reading the prescription information leaflets to improve product knowledge.[8] Past research has established that involvement enhances recall and recognition.[15] Highly involved individuals use the central route of elaboration, that is, thoughtful and critical consideration of the information. Thus, they are more likely to understand and evaluate the information to make an informed decision. The findings suggest that irrespective of the leaflet format, improving individuals' involvement will improve their intention to read the leaflet. A project on Investigating Consumer Medicine Information (I-CMI) was conducted to analyze and evaluate the different forms of written medicine information.[33] The project summary mentions that providing information about medicines to patient can increase knowledge about medicines.[33] Participants in another study receiving information about their medicine had greater knowledge of the medicine at the end of 1 month than those not receiving information.[34] These studies highlight the importance of product knowledge as highlighted in our study.

To increase patients' intention to read prescription drug leaflets, the cognitive load should be decreased, that is, a 1-page format should be adopted. As the cognitive effort required to read the leaflet is reduced, more positive effects were seen on the attitude toward the leaflet. In addition, as the involvement increased, the attitude toward leaflets improved for the PIL and text-only leaflets, but not for the current process leaflets. For attitude toward leaflets, as observed, there was a significant difference in attitude scores across the 3 leaflets, indicating that increasing involvement further improves the attitude toward leaflets.

This research would enhance the understanding of information processing with regard to prescription medication leaflets as an information source. The order randomization and repeated nature of the study appeared to be very effective to produce reliable results. The extraneous variables tested (like health status, health literacy, health training, general involvement, and reading leaflets) had no effect on the measured variables (product knowledge, intention to read, and attitude toward leaflet design). A study analyzing the factors influencing patient satisfaction with the utilization of leaflets demonstrated that age, gender, and education influence patients' information-seeking behavior. Younger, female, and better educated patients were more involved in information seeking. However, in our study, age, gender, and education level did not have any significant effect on the attitude toward leaflets or other variables.[35]

Further, the study results indicate that more than 70% of the population had taken prescription medications in the past, reflecting that the respondents were not naïve to the prescription medication process in the US. However, most of the respondents were naïve to the study medication. This was necessary to reduce the effect of prior knowledge in our study, as prior knowledge could affect the variables measured such as product knowledge. Respondents could have learned the medication information through his or her prior experience of taking the medication, or from discussing it with health care professionals. Finally, most of the respondents did not belong to a health-related field or had not received any professional health related training. This is important because it would be natural for individuals from the field of health care to have a higher understanding of prescription medications compared with the general population. In addition, the data collected were ethnically diverse and the sample had a good representation of different racial/ethnic groups, giving the study a good external validity.

Table 4. Effect of Cognitive Effort on Mean Scores of Product Knowledge, Attitude to Read Leaflets, and Intention to Read Leaflets at High and Low Involvement Levels.

Cognitive Effort	Product Knowledge	
	Involvement Level	
	High	Low
PILs	5.73 ($\pm$0.67)[ab]	5.30 ($\pm$0.68)[cd]
Text only	5.45 ($\pm$0.75)[b]	5.32 ($\pm$0.68)[d]
Current process	5.34 ($\pm$0.75)[a]	5.24 ($\pm$0.63)[c]
	Attitude to read leaflets	
	Involvement Level	
	High	Low
PILs	5.69 ($\pm$1.12)[gi]	5.02 ($\pm$1.06)[hj]
Text only	4.75 ($\pm$1.25)[eg]	4.56 ($\pm$1.18)[fh]
Current process	3.2 ($\pm$1.26)[ei]	3.79 ($\pm$1.12)[fj]
	Intention to read leaflets	
	Involvement Level	
	High	Low
PILs	5.74 ($\pm$1.38)[mo]	4.72 ($\pm$1.83)[np]
Text only	5.33 ($\pm$1.67)[km]	4.24 ($\pm$1.82)[ln]
Current process	3.82 ($\pm$2.12)[ko]	3.26 ($\pm$1.71)[lp]

Abbreviation: SD, standard deviation. Scheffe's test was conducted to test for significant difference between levels.
No significant difference seen between current process and text only at both levels of involvement. The alpha level considered is 0.05.
[a]Significant difference between current process and PILs for Product Knowledge for individuals with high involvement.
[b]Significant difference between text only and PILs for Product Knowledge for individuals with high involvement.
[c]Significant difference between current process and PILs for Product Knowledge for individuals with low involvement.
[d]Significant difference between text only and PILs for Product Knowledge for individuals with low involvement.
[e]Significant difference between current process and text only for Attitude for individuals with high involvement.
[f]Significant difference between current process and text only for Attitude for individuals with low involvement.
[g]Significant difference between text only and PILs for Attitude for individuals with high involvement.
[h]Significant difference between text only and PILs for Attitude for individuals with low involvement.
[i]Significant difference between current process and PILs for Attitude for individuals with high involvement.
[j]Significant difference between current process and PILs for Attitude for individuals with low involvement.
[k]Significant difference between current process and text only for Intention for individuals with high involvement.
[l]Significant difference between current process and text only for Intention for individuals with low involvement.
[m]Significant difference between text only and PILs for Intention for individuals with high involvement.
[n]Significant difference between text only and PILs for Intention for individuals with low involvement.
[o]Significant difference between current process and PILs for Intention for individuals with high involvement.
[p]Significant difference between current process and PILs for Intention for individuals with low involvement.

An important message from the results was that approximately 30% of respondents do not generally read prescription leaflets. This number indicates that policy makers and manufacturers are not successful in capturing patient's attention/interest to these leaflets. Attention is the first and one of the many important steps of information comprehension. Attempts should be made to make the leaflets attractive specifically borrowing from literature where color and pictures are used to attract patient attention.[11,24,27] Past research has shown that chunking, segmentation, pictures, and colors have helped individuals' information processing and recall.[18,22,26,36] The model tested could be worked on further to enhance its applicability. It can be used in the future to evaluate various other prescription information sources used for patients specifically in educational interventions, medication therapy management programs, and patient adherence programs.

The results of this study can be built upon and considered for various future research projects. Since the sample was mainly from a young population at a university, it would be extremely important to validate the study results in general patients at the national level. Future research can identify information processing of prescription medication in specialized groups like the elderly or the non-English-speaking individuals. Based on the results of this study, an effective educational intervention/leaflet could be developed and tested in medication therapy management programs to improve health outcomes. Finally, the results of this study can be used by the FDA to compare different 1-page formats and develop the most effective standardized patient-directed prescription information leaflet after testing within the general population.

Limitations

The findings of this study should be viewed in the context of certain limitations. This study was a field-experiment where although the intent was to mimic natural processes, in reality, the participant activities and results would have been generated in a controlled environment. This study was conducted in a university setting, and the sample consisted of students and not general consumers. Thus, the generalizability of the study findings may be limited to younger populations having characteristics similar to the sample. The data were collected using a self-administered survey. Respondents' tendency to report misleading responses due to social desirability could be possible. Of the respondents, 16.11% had received professional training in a health-related field. This could potentially introduce bias into the results.

Conclusions

Both the cognitive effort exerted to read and understand the information and the individual's involvement had a significant impact on information-processing variables such as product knowledge, attitude toward leaflets, and intention to read. PILs had significantly higher patient comprehension as compared to the current practice and text-only prototypes tested.

Involvement can be viewed as the motivation to process information, and increasing it further improves product information processing. The FDA could consider these findings for further testing and eventually provide guidelines to design a concise prescription drug information leaflet to improve the expected outcomes associated with these information sources.

Appendix A1: Prescription Information Leaflet (PILs) for Celebrex

CELEBREX® (celecoxib) Capsules **Patient Medication Information**

Active Ingredient	***Purpose***
Celecoxib	Non-steroidal anti-inflammatory drug (NSAID)

Uses

To relieve signs and symptoms of:

- Acute pain
- Osteoarthritis
- Rheumatoid arthritis
- Ankylosing spondylitis
- Juvenile rheumatoid arthritis
- Menstrual pain

Important Safety Information

Cardiovascular risk:

- Celebrex may increase chance of heart attack or stroke
- Chance of cardiovascular risk increases
  - With long-term use of NSAIDs
  - In people who already have heart disease

Gastrointestinal risk:

- Celebrex may cause ulcers and bleeding in stomach or intestine
- Chance of ulcers and bleeding increases
  - With long-term use of NSAIDs
  - Older age, alcohol use and smoking

These events can occur at any time of treatment, without prior symptoms

Do not take Celebrex

- Before or after heart bypass surgery (coronary artery bypass graft)
- In late pregnancy (greater than 30 weeks)
- If you are allergic to aspirin, sulfa drugs or other NSAID

Side Effects

- **Common**:
  Stomach pain, diarrhea, gas, heartburn, nausea, dizziness, constipation.
- **Potentially serious**:
  Heart attack, stroke, high blood pressure, kidney problems, liver problems, asthma attacks, rash.

Get Medical Help Right Away

- If you experience shortness of breath, chest pain, weakness in one side of your body, slurred speech, swelling of face or throat.

Directions for Use

- Take Celebrex exactly as your doctor/pharmacist told you and for the shortest time possible.
- You can take Celebrex with or without food.
- Take your dose every day at the same time.
- Swallow the capsule whole or if you have difficulty swallowing the capsule, the content of Celebrex capsule can be added to applesauce and swallowed.

Tell Your Healthcare provider

- About all your existing medical conditions.
- About all medicines you take.
- About any history of ulcers or bleeding in the stomach and intestines, high blood pressure or heart failure, kidney or liver problems.
- If you are pregnant or breast feeding.
- If you take medicines called corticosteroids and anticoagulants, smoke or drink or are in poor health as these may increase the chance of bleeding or ulcers.

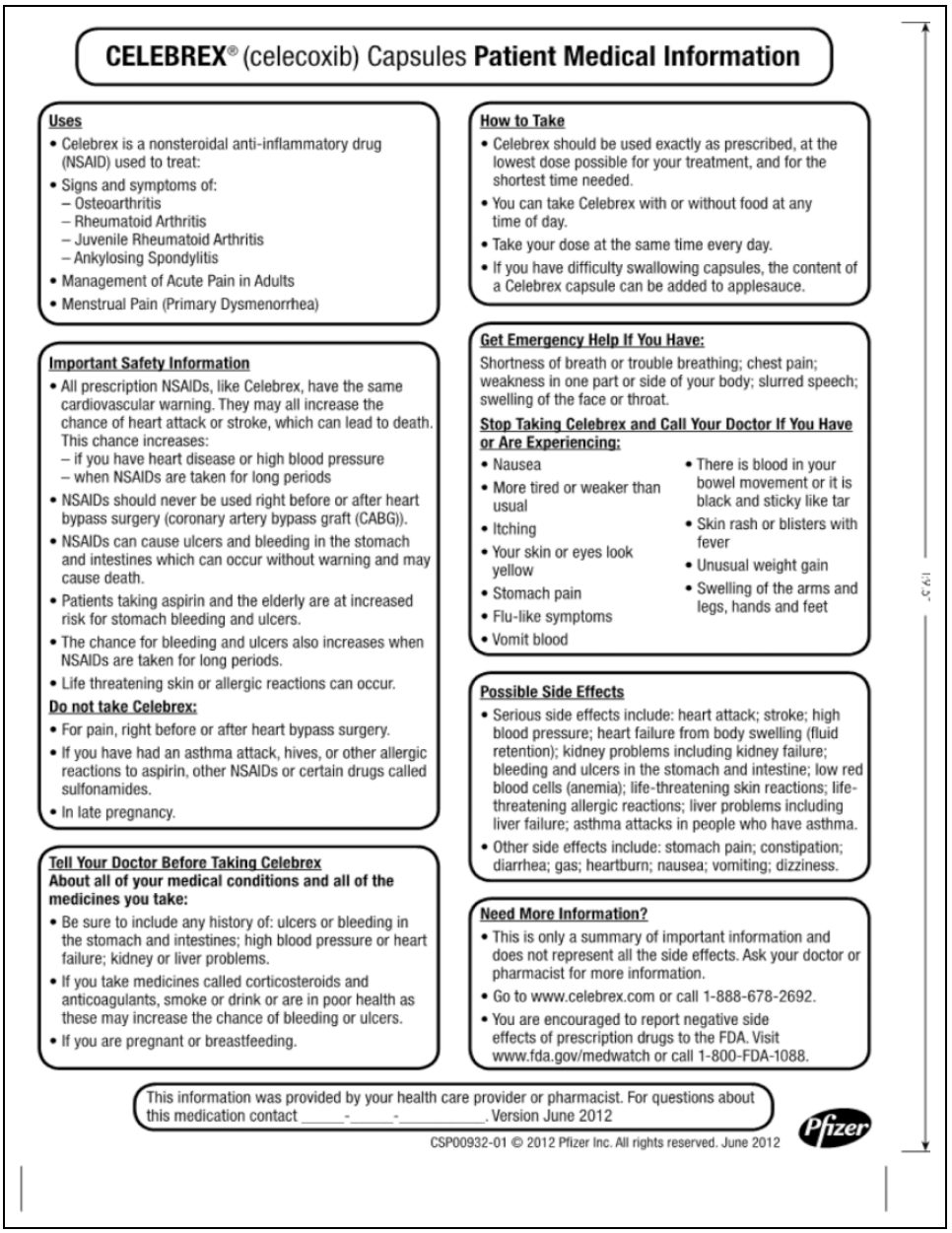
Pharmacists' Recommendation

If you miss a dose, take it as soon as you remember. If it is close to the next dose then skip the missed dose. Do not double the dose to catch up.

Your next refill is on 10/12/2013. Please call the pharmacy at (800) 123-4567.

This information is not complete or comprehensive. This leaflet does not take the place of talking to your doctor or pharmacist. For more information go to www.celebrex.com or call 1-888-000-0000. You are encouraged to report negative side effects of prescription drugs to the FDA at www.fda.gov/medwatch or call 1-800-FDA-0000.

Appendix A2: Text-Only Leaflet for Celebrex



CELEBREX® (celecoxib) Capsules **Patient Medical Information**

Uses
- Celebrex is a nonsteroidal anti-inflammatory drug (NSAID) used to treat:
- Signs and symptoms of:
  - Osteoarthritis
  - Rheumatoid Arthritis
  - Juvenile Rheumatoid Arthritis
  - Ankylosing Spondylitis
- Management of Acute Pain in Adults
- Menstrual Pain (Primary Dysmenorrhea)

Important Safety Information
- All prescription NSAIDs, like Celebrex, have the same cardiovascular warning. They may all increase the chance of heart attack or stroke, which can lead to death. This chance increases:
  - if you have heart disease or high blood pressure
  - when NSAIDs are taken for long periods
- NSAIDs should never be used right before or after heart bypass surgery (coronary artery bypass graft (CABG)).
- NSAIDs can cause ulcers and bleeding in the stomach and intestines which can occur without warning and may cause death.
- Patients taking aspirin and the elderly are at increased risk for stomach bleeding and ulcers.
- The chance for bleeding and ulcers also increases when NSAIDs are taken for long periods.
- Life threatening skin or allergic reactions can occur.

Do not take Celebrex:
- For pain, right before or after heart bypass surgery.
- If you have had an asthma attack, hives, or other allergic reactions to aspirin, other NSAIDs or certain drugs called sulfonamides.
- In late pregnancy.

Tell Your Doctor Before Taking Celebrex
About all of your medical conditions and all of the medicines you take:
- Be sure to include any history of: ulcers or bleeding in the stomach and intestines; high blood pressure or heart failure; kidney or liver problems.
- If you take medicines called corticosteroids and anticoagulants, smoke or drink or are in poor health as these may increase the chance of bleeding or ulcers.
- If you are pregnant or breastfeeding.

How to Take
- Celebrex should be used exactly as prescribed, at the lowest dose possible for your treatment, and for the shortest time needed.
- You can take Celebrex with or without food at any time of day.
- Take your dose at the same time every day.
- If you have difficulty swallowing capsules, the content of a Celebrex capsule can be added to applesauce.

Get Emergency Help If You Have:
Shortness of breath or trouble breathing; chest pain; weakness in one part or side of your body; slurred speech; swelling of the face or throat.

Stop Taking Celebrex and Call Your Doctor If You Have or Are Experiencing:
- Nausea
- More tired or weaker than usual
- Itching
- Your skin or eyes look yellow
- Stomach pain
- Flu-like symptoms
- Vomit blood
- There is blood in your bowel movement or it is black and sticky like tar
- Skin rash or blisters with fever
- Unusual weight gain
- Swelling of the arms and legs, hands and feet

Possible Side Effects
- Serious side effects include: heart attack; stroke; high blood pressure; heart failure from body swelling (fluid retention); kidney problems including kidney failure; bleeding and ulcers in the stomach and intestine; low red blood cells (anemia); life-threatening skin reactions; life-threatening allergic reactions; liver problems including liver failure; asthma attacks in people who have asthma.
- Other side effects include: stomach pain; constipation; diarrhea; gas; heartburn; nausea; vomiting; dizziness.

Need More Information?
- This is only a summary of important information and does not represent all the side effects. Ask your doctor or pharmacist for more information.
- Go to www.celebrex.com or call 1-888-678-2692.
- You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch or call 1-800-FDA-1088.

This information was provided by your health care provider or pharmacist. For questions about this medication contact _____-_____-_____. Version June 2012

Pfizer

Appendix B: Scenarios Used for Involvement Manipulations

Note: The original font size of information in the scenarios during data collection was 16-point.

Low-Involvement Scenario

Imagine that you are hosting a **party** at your house. Your friends will be arriving in 30 minutes.

You are picking up last-minute party supplies at a grocery store. You happen to remember that you need to pick up a **refill prescription** from the pharmacy that has been ready since 5 days. You decide to quickly pick up the prescription.

You have now received the prescription bag along with the patient information leaflet that informs you about the medication and its side effects. You have been **using this medication regularly for 3 years**. You have not experienced any side effects with this medication in the past. Remember, you need to continue shopping for your party and quickly return to your home.

Keeping in mind the above situation; please turn the page to see the patient information leaflet you have received with the prescription bag.

High-Involvement Scenario

Imagine that you have been diagnosed with a **life-threatening illness**. Your doctor has prescribed a medication to manage this life-threatening illness.

You are taking this medication for the **"first time."** Your doctor told you that this medication **has some side effects,** but it is the only medication that can help you.

You have now filled your prescription from the pharmacy. After providing information on how to take the medication, your pharmacist has given you the medication along with the patient medication information leaflet. The pharmacist has told you to **read the patient information leaflet carefully**. Remember, if you **do not** take this medication as indicated, your illness could worsen; eventually leading to hospitalization and increased financial burden.

Please take a moment to think about the above situation.

Keeping the above situation in mind, please turn the page to view the patient information leaflet and answer the questions.

Appendix C: Survey Instrument

Prescription Drug Information Leaflet Questionnaire

A. Based on the information read, responses were then collected from the participants on the below-mentioned measures and using a 7-point semantic differential scale as seen below.

Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree
(SD)	(D)	(SoD)	(N)	(SoA)	(A)	(SA)
1	2	3	4	5	6	7

Product knowledge was measured using a 11-item, 7-point Likert scale.

The information sheet you have just seen indicates that Celebrex:

a. Is a chemotherapy drug
b. Contains celecoxib as its active ingredient
c. May cause ulcers and bleeding in stomach or intestine
d. Could be taken with or without food
e. Is used to relieve signs and symptoms of osteoarthritis
f. Is a nonsteroidal anti-inflammatory drug
g. May increase the chance of heart attack or stroke
h. Should be taken four times a day
i. Do not take Celebrex, right before or after heart bypass surgery
j. Stomach pain of gas is a common side effect while taking Celebrex
k. Get medical help right away, if you experience weakness in one side of the body

B. Attitude toward leaflet was measured using a 5-item, 7-point semantic differential scale with the following anchors:

Good	1	2	3	4	5	6	7	Bad
Like	1	2	3	4	5	6	7	Dislike
Uninteresting	1	2	3	4	5	6	7	Interesting
Attractive	1	2	3	4	5	6	7	Unattractive
Uninformative	1	2	3	4	5	6	7	Informative

C. Intention to read the prescription drug information leaflets was measured using a 2-item, 7-point semantic scale having anchors "very likely" and "not at all likely" as seen below.

Assuming that information would be provided in the format you last viewed, how likely is it that you would read the prescription drug leaflet?

Not at all likely	1	2	3	4	5	6	7	Very likely

Assuming that information would be provided in the format you last viewed, how likely is it that you would keep the leaflet for future reference?

Not at all likely	1	2	3	4	5	6	7	Very likely

D. Manipulation check for cognitive effort was measured using 7-point semantic differential scale having anchors:

Colorful	1	2	3	4	5	6	7	Colorless
Easy to read	1	2	3	4	5	6	7	Difficult to read
High mental effort required	1	2	3	4	5	6	7	Low mental effort required
Simple Language	1	2	3	4	5	6	7	Difficult language

E. Manipulation check for patient involvement was measured using a using 7-point semantic differential scale having anchors:

Not at all involved	1	2	3	4	5	6	7	Very involved
Not at all interested	1	2	3	4	5	6	7	Very interested
Very motivated	1	2	3	4	5	6	7	Not at all motivated

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