

Is less more? Patients' preferences for drug information leaflets

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ABSTRACT

Purpose Present package information leaflets do not fulfil the needs of many patients. The objective of this study was to investigate patients' preferences towards content and presentation of drug information leaflets using prepared medication brochures in a discrete choice experiment.

Methods 6 binary attributes relating to content and presentation of drug information were used to define and design alternative leaflets. Choice sets between alternative leaflets were created based on an orthogonal design. 1,000 participants aged at least 50 years were presented 8 choice sets of drug information leaflets in a personal interview. The reliability of choices was assessed with a duplicate of one original choice. Regression analysis was used to model the impact of attributes on choices and interactions with responders' age and education.

Results Participants slightly preferred colored over black-white leaflets, no visual presentation of side effects by the use of smiles, the provision of a brief summary, and general health tips, but no information on what-to-do in case of side-effects. All attributes except the "extent of side-effects presented" significantly affected participants' choices. Older and less educated participants preferred less information. Of the repeated (duplicate) choices, 84% were replicates of the original choice. Interrater agreement was moderate ($K=0.67$, CI 0.6 - 0.7). 235 subjects (23.5%) followed an optimization strategy and did not trade attributes, i.e., exhibited dominant preferences.

Conclusions In general, participants preferred condensed, plain information in a clear and moderately colored design, but preferences towards drug information are affected by age and level of education. Copyright © 2011 John Wiley & Sons, Ltd.

KEY WORDS—Drug information; Preference assessment; Patient Education

Received 19 March 2011; Revised 20 June 2011; Accepted 22 June 2011

INTRODUCTION

Patients' understanding of their medicines, benefits and side effects has been identified as a prerequisite for safe and effective drug therapy.^{1,2} Non-adherence and errors regarding mode of administration, timing and duration of therapy result in sub-optimal treatment effects.^{3–5} Moreover, the majority of patients wants to be well-informed and participate in decision-making.^{6,7} Information about drugs is expected from the prescribing physician or nurse, however, patients' understanding and memory is frequently erroneous.^{8,9}

On the other hand, pharmaceutical manufacturers are obliged by national drug regulations to provide package information leaflets (PILs). Whereas the prescribing physician will inform the patient briefly and in an individualized manner about the expected benefits and some „noteworthy“ side effects,⁸ PILs include a wealth of information about even very rare side effects.^{10,11} Elderly patients with polypharmacotherapy in particular need to be informed in a comprehensive way, but are frequently confronted with long text passages in small letters, non-comprehensible medical terms¹¹ and risk figures, which are neither adapted to their individual needs nor to their general „numeration“. ¹² As a result, patients may feel alienated and frightened. Reading of package inserts has been described as a frequent cause for non-compliance. For example, approximately one third of participants in a

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German survey on PILs stated that they stopped their medications after reading about side effects in the PIL, i.e., intentional non-compliance.¹³ Apparently, present PILs do not fulfil the needs of many patients. An alternative way to convey drug information to patients is to generate additive medication brochures that meet patients' requirements and preferences and improve patient education. The objective of this study was to investigate consumers' preferences towards content and presentation of drug information leaflets. A discrete choice experiment, an economic technique for benefit estimation, was conducted among members of the general public. Participants were presented series of choices between alternative drug information leaflets to quantify the relative value of characteristics of information provision and the trade-offs between competing objectives.

METHODS

General design

To assess consumers' preferences for drug information leaflets, a discrete choice experiment (DCE) was conducted. DCE is a preference measurement technique rooted in economic theory. It rests on the premise that goods and services can be described by a number of attributes (e.g., 'waiting time') and their levels (e.g., '1 week'). The utility attached to a particular service is a function of subjects' preferences towards these attributes and levels.¹⁴ Combinations of attributes and levels are used to describe scenarios. Participants are confronted with a series of hypothetical choices between alternative scenarios. As the levels of attributes differ within choice sets respondents are required to trade-off attributes each time they make a choice. By observing multiple preference statements from each individual the degree to which differences in attribute levels influences choices becomes observable. One of the main characteristics of DCEs is that subjects exhibit their preferences towards *holistic entities*, and the *relative contribution* of each attribute is decomposed and derived *post hoc*. DCEs have been applied to measure preferences towards a wide range of aspects of health care, e.g., surgical care provision^{15–19}. In conventional DCEs, participants are presented *theoretical descriptions* of scenarios. Contrary, in our study, attributes and levels were translated to alternative drug information leaflets, i.e., *real products*. That is, participants chose between sets of prepared leaflets rather than between descriptions of these leaflets. Low dose acetylsalicylic acid served as example drug to generate clinical information. Discrete choice analysis involves the four steps of a) selecting the attributes and

levels to characterize scenarios; b) generating scenarios (combinations of attribute levels); c) preference measurement, and d) data analysis.

Attributes and assigned levels

The selection of attributes and levels was based on a literature review and prior qualitative research.²⁰ We conducted six focus groups with patients with diabetes, arterial hypertension and hypercholesterolemia to elicit their wishes for written drug information. Attributes and levels were derived by content analysis in a multidisciplinary team including patients. Six attributes, four relating to content of drug information leaflets and two relating to presentation of information, were identified to be of great importance: Use of color to accentuate important information, use of symbols to signal quantitative estimates of risk of side-effects, inclusion of a summary of main drug characteristics, extent to which information about side-effects is included, inclusion of a "what to do in case of side-effects" section, and inclusion of disease-specific non-drug related health tips (Table 1).

Generation and presentation of scenarios

The number of attributes and levels results in 64 possible scenarios. As this number is not manageable in a survey, the experimental design software SPEED was used to produce an orthogonal fractional factorial, main effects design.²¹ This resulted in 8 scenarios. To create choice sets, each of these 8 scenarios was paired with its foldover.²² A foldover is obtained by shifting the levels of each attribute of the original scenario such that the levels are reversed. This technique resulted in a 100% efficient design. All attributes are uncorrelated, have minimal overlap, i.e., no attribute appears with the same level within a choice set, and all levels occur with equal frequency.²³ In addition to the 8 choice sets constructed this way, we included an extra choice set that exactly replicated one of the original sets to test the reliability of choices. This duplicate was selected at random for each individual participant. The sequence of choice sets and the orientation of scenarios within choice sets were also randomly rotated to avoid order effects. In summary, each participant was presented 9 choices (8 from the original orthogonal design and 1 random duplicate).

Preference measurement

The 16 combinations of attributes and levels were used to prepare different drug information leaflets. For each

PREFERENCES FOR DRUG INFORMATION

Table 1. Attributes, their levels and codings

| Label | Attribute | Levels | Example of textual presentation | Codings |
|--------------|---|---|--|---------|
| Color | Accentuation of important information by colour or typeface | Black-white presentation; boldface and underlining of text for emphasis | -- | 0 |
| | | Use of colored text and symbols | -- | 1 |
| Symbol | Use of "smilie" language to quantify side-effects | No | -- | 0 |
| | | Yes | -- | 1 |
| Summary | Summary of main drug characteristics included | No | No text | 0 |
| | | Yes | Numbered key words relating to special chapters in the brochure to ease navigation: 1. Details on the drug: active agent, indications; 2. What you should know before drug-usage: contraindications, interactions; 3. Information about drug taking, over dosage and omitted doses; 4. Possible side effects; 5. General health tips | 1 |
| Side-effects | Extent to which information about side-effects is included | All common but only serious, rare side-effects | Common side effects: Less than one out of 10 treated persons. Stomach ache, nausea, vomiting, diarrhea. Serious rare side effects: Less than one out of 1,000 treated persons. Gastric bleeding, rapid heartbeat, breathlessness. | 0 |
| | | All side-effects (including individual cases) | Common side effects: Less than one out of 10 treated persons. Stomach ache, nausea, vomiting, diarrhea. Serious rare side effects: Less than one out of 1,000 treated persons. Gastric bleeding, rapid heartbeat, breathlessness. Rare but not serious side effects: Increased value of uric acid, attack of gout, skin rash. | 1 |
| What to do | "What to do in case of side-effects or adverse drug reactions" paragraph included | No | No text | 0 |
| | | Yes | Call an emergency doctor immediately in case of respiratory distress, tachycardia or when your stool is black colored. | 1 |
| Tips | General health tips provided | No | No text | 0 |
| | | Yes | You should exercise for half an hour a day and avoid salt in your diet. Stop smoking and avoid stress. | 1 |

attribute level, textual or visual elements were composed with the help of clinicians and visual design experts. These elements were combined to create alternative and realistic leaflets. For example, a color composition was developed and applied to all leaflets that should be colorized (attribute 1). An example leaflet is presented in figure 1. The choice task was presented within a personal interview. Trained research assistants used customized preference elicitation protocols for each participant. The protocols included the arrangements and order of showcards, the number of the choice to be duplicated, and its position. Participants were presented the nine binary choices between leaflets. They were asked to imagine that they were prescribed the new medicine by their doctor and that they could choose between two types of drug information leaflets. It was clearly stated that this leaflet would come as a *supplement* to the package insert. Participants were then asked to select the leaflet they personally would prefer. Participants were also asked a number of questions relating to their demographic background. Data were recorded on prepared sheets and entered to a database.

Data analysis

DCE data are analyzed under the framework of random utility theory. The observed choices between scenarios (binary dependent variable) are interpreted as resulting from the difference in utility associated with the scenarios that in turn can be explained by differences in attribute levels (independent variables)²⁴. As each respondent provided multiple choices, a random effects model was estimated to account for the correlated error structure:

$$\Delta U_{i,t} = \beta_1 \Delta Color_t + \beta_2 \Delta Symbol_t + \beta_3 \Delta Summary_t + \beta_4 \Delta Side_t + \beta_5 \Delta What_t + \beta_6 \Delta Tips_t + u_i + v_{i,t}$$

ΔU denotes the difference in utility between scenarios of a choice set which is observed indirectly via the choice of the respondent. The subscripts i and t refer to the individual and the number of choice set respectively. $\Delta Color$, $\Delta Symbol$, $\Delta Summary$, $\Delta Side$, $\Delta What$, $\Delta Tips$ are the differences in attribute levels within each choice set. u_i is the individual specific error term whereas $v_{i,t}$ is the random error term due to differences amongst observations. Alternative models (e.g., conditional fixed effects logit, random parameter logit) were

2B Ergänzende Medikamentenbeilage
ASS 100 TABLETTE

Lieber Patient!

Bitte lesen Sie diese Gebrauchsinformation aufmerksam durch, bevor Sie das Medikament zum ersten Mal einnehmen. Sie enthält wichtige Informationen über die richtige Anwendung des Arzneimittels.

Behalten Sie diese Information gut auf, möglicherweise brauchen Sie sie zu einem späteren Zeitpunkt erneut.

Zusammenfassung

- Angaben zum Medikament: Wirkstoff, Wirkweise, Anwendungsgebiete
- Was Sie vor der Behandlung wissen sollten: Wer darf das Medikament nicht einnehmen? Wann sollten Sie vor der Behandlung Ihren Arzt fragen? Wechselwirkungen mit anderen Medikamenten und Nahrungsmitteln
- Informationen zur Einnahme, Überdosierung und vergessener Einnahme
- Mögliche Nebenwirkungen
- Wie können Sie die Therapie zusätzlich unterstützen?

Das Medikament

Wirkstoff: Acetylsalicylsäure 100 mg.
Weitere Inhaltsstoffe: Maisstärke, mikrokristalline Cellulose, Cellulosepulver.

Wirkweise
ASS 100 TABLETTE wirken blutverdünnend. Der Wirkstoff von ASS 100 TABLETTE vermindert das Zusammenhaften und Verklumpen von Blutplättchen und beugt dadurch der Entstehung von Blutgerinnseln vor.

Wann werden ASS 100 Tabletten verschrieben?
Ihr Arzt hat Ihnen ASS 100 TABLETTE zur Vorbeugung oder Behandlung bestimmter Herz- und Gefäßerkrankungen verschrieben:

- Zur Vorbeugung eines (erneuten) Herzinfarktes,
- eines Schlaganfalls
- oder nach Eingriffen bzw. Operationen an arteriellen Blutgefäßen.
- Zur Behandlung bestimmter Herzerkrankungen wie z.B. Herzinfarkt oder Herzschmerzen aufgrund von Durchblutungsstörungen in den Herzkranzgefäßen (*Angina pectoris*).

Was Sie vor der Behandlung wissen müssen

Beachten Sie die folgenden Hinweise bevor Sie ASS 100 TABLETTE einnehmen.

Wer darf ASS 100 Tabletten nicht einnehmen?
Schwangere Frauen sollten ASS 100 TABLETTE nicht einnehmen. Dies gilt ebenfalls für Menschen mit einer Allergie gegen den Wirkstoff, gegen verwandte Wirkstoffe (*Salicylate*) oder einen Hilfsstoff des Medikaments, Menschen die ein Magen- oder Zwölffingerdarmgeschwür haben oder hatten und Menschen mit krankhaft erhöhter Blutungsneigung.

Fragen Sie Ihren Arzt...

- wenn Sie eine Allergie gegen andere Schmerz-, oder Rheumamittel haben.
- wenn Sie eine vorgeschädigte Niere, schwere Leberfunktionsstörungen, Asthma oder wiederkehrende Magen- oder Zwölffingerdarmbeschwerden haben.
- wenn Sie demnächst eine Operation oder Zahnoperation planen.

Andere Medikamente
Informieren Sie Ihren Arzt über alle Erkrankungen und Arzneimittel, die Sie einnehmen, denn Medikamente können sich gegenseitig beeinträchtigen.

- Andere blutverdünnende Arzneimittel (z.B. *Phenprocoumon* und *Heparin*): ASS 100 TABLETTE können das Blutungsrisiko erhöhen
- Schmerz- und Rheumamittel (z.B. *Ibuprofen*, *Diclofenac*) und Medikamente, die Cortison oder cortisonähnliche Substanzen enthalten: das Risiko für Magen-Darm-Geschwüre und -Blutungen kann steigen
- Bestimmte blutzuckersenkende Arzneimittel (*Sulfonylharnstoffe*, z.B. *Glibenclamid*): der Blutzuckerspiegel kann stärker sinken
- ASS 100 TABLETTE können die Wirkungen und Nebenwirkungen bestimmter anderer Medikamente erhöhen: Schilddrüsenmedikament (*Triiodthyronin*), Medikament gegen Epilepsie (*Valproinsäure*), Methotrexat, Digoxin, Lithium

ASS 100 TABLETTE sollten daher nicht zusammen mit einem der o.g. Stoffe eingenommen werden, ohne dass der Arzt ausdrücklich die Anweisung gegeben hat.

Genusmittel, Speisen und Getränke
Bitte beachten Sie, dass das Arzneimittel nicht zusammen mit Alkohol eingenommen werden darf.

Die Einnahme

Nehmen Sie täglich eine Tablette ASS 100 möglichst nach einer Mahlzeit mit einem Glas Wasser ein. Diese Angabe gilt, soweit Ihnen Ihr Arzt ASS 100 TABLETTE nicht anders verordnet hat. Nicht auf nüchternen Magen einnehmen. Sollten Sie einmal die Einnahme vergessen haben nehmen Sie beim nächsten Mal nicht die doppelte Menge ein, sondern führen Sie die Einnahme wie gewohnt fort. Bitte unterbrechen Sie die Behandlung mit ASS 100 TABLETTE nicht, ohne dies vorher mit Ihrem Arzt abgesprochen zu haben.

Überdosierung
Schwindel und Ohrklingen können Zeichen einer ernsthaften Vergiftung sein. Bei Verdacht auf eine Überdosierung mit ASS 100 TABLETTE benachrichtigen Sie bitte sofort Ihren Arzt.

Die Behandlungsdauer
Über die Dauer der Einnahme entscheidet Ihr Arzt. Normalerweise werden ASS 100 TABLETTE dauerhaft eingenommen.

Mögliche Nebenwirkungen

Arzneimittel können neben den erwünschten Wirkungen auch andere Wirkungen haben. Solche Nebenwirkungen treten aber nicht bei jedem Menschen auf.

Häufige Nebenwirkungen
Weniger als einer von 10 Behandelten: Magenschmerzen, Übelkeit, Erbrechen, Durchfälle und geringfügige Blutverluste aus dem Magen-Darm-Bereich

Seltene aber gefährliche Nebenwirkungen
Weniger als einer von 1000 Behandelten: Magenblutungen, Magengeschwüre. Überempfindlichkeitsreaktionen (z.B. Anfälle von Atemnot, Hautreaktionen), in Einzelfällen Leber- und Nierenfunktionsstörungen, Verminderung der Blutzuckerwerte, schwere Hautausschläge, Blutarmut

Seltene, nicht so gefährliche Nebenwirkungen
Verminderung der Harnsäureausscheidung, Auslösung eines Gichtanfalls

Wenn Sie Nebenwirkungen bei sich beobachten, die Sie beeinträchtigen, teilen Sie diese bitte Ihrem Arzt oder Apotheker mit.

Wie können Sie die Therapie zusätzlich unterstützen?

An der Entstehung von Ablagerungen an Blutgefäßen und Blutgerinnseln sind verschiedene Risikofaktoren beteiligt. Diese können zu Durchblutungsstörungen führen und sogar einen Herzinfarkt oder Schlaganfall auslösen. Risikofaktoren sind u.a. **Übergewicht, Rauchen und hoher Blutdruck.** Achten Sie daher auf eine halbe Stunde körperliche Bewegung pro Tag und eine gesunde Ernährung. Essen Sie möglichst wenig cholesterinreiche Lebensmittel tierischen Ursprungs wie Butter, Sahne, Wurst und Eier. Geben Sie das Rauchen auf und vermeiden Sie Stresssituationen. Lassen Sie regelmäßig Ihren Blutdruck beim Arzt kontrollieren. So können Sie die medikamentöse Therapie optimal unterstützen

Figure 1. Example scenario presented to study participants (German original)

also estimated but did not result in superior fit. In an extended model, the influence of sociodemographic characteristics of respondents on choices was investigated. Since sociodemographic attributes do not vary but are constant across choices for any individual these variables are entered as interactions with the attribute variables.²⁵ These interactions reflect differences in attribute preferences across subpopulations. The regression model was used to predict hypothetical choices for combinations of attribute levels.

Reliability of choices was assessed by comparing participants' original choices with the results of the duplicate choice. Agreement of choices was assessed using Cohen's Kappa *K*. In logistic regression analysis, participants' characteristics as well as the position of the original choice in the sequence of choices were used to identify predictors for reliable choices. We also examined whether participants had dominant preferences for any attribute, i.e., always choose as to maximize or minimize one attribute irrespective of

the levels of all other attributes. Hypothetical choice paths for dominant preferences towards single attributes were created. For each attribute, a choice sequence was recorded that an individual with dominant preferences for this attribute would have chosen. For example, a respondent with a dominant preference for colored leaflets would chose the colored leaflet in set 1 (e.g., alternative 1), the colored leaflet in set 2 (e.g., alternative 1), the colored leaflet in set 3 (e.g., alternative 2), etc. Actual choice sequences were then compared to these hypothetical paths and the number of respondents with dominant preferences was calculated.

SAMPLE

As we aimed to elicit preferences of those most affected by frequent drug usage, we aimed to sample subjects aged 50 years and older. Research assistants recruited elderly citizens in public spaces in several cities in North Rhine-Westphalia and asked for participation. Subjects willing to participate were asked about their age and those aged at least 50 were invited to take the interview. Participants were offered a soft drink and a voucher. A sample size of 1,000 was approached.²⁶ The study was approved by the ethics committee of the university of Witten/Herdecke.

RESULTS

During a period of 11 weeks, 1,000 interviews with participants aged 50 and over were conducted. Drug intake was prevalent among responders with nearly three quarters reported regular use of medicines on a daily basis. Use of antihypertensive drugs was reported with highest frequency. 40% reported intake of 4 or more different tablets per day. Table 2 reports participants' characteristics.

The descriptive analysis of choices between scenarios made by participants indicates that overall, perceived differences within sets seem not to have triggered clear preference patterns across the entire population. For all choice sets, participants' choices were nearly equally split across the two choices within a set. Among the eight sets, the largest difference observed was 20%, with 40% opting for one scenario, and 60% opting for the foldover. However, the analysis of patterns of dominant preferences reveals that a considerable number of participants had dominant preferences for either attribute, i.e., did always optimize one level of one specific attribute, irrespective of all other attributes (Table 3). The attributes for which the highest frequencies of dominant preferences were

Table 2. Sample characteristics (n=1,000)

| Characteristic | n (%) |
|--|------------|
| Age, years (mean (SD)) | 66.1 (9.1) |
| 50-59 | 26.6 |
| 60-69 | 35.6 |
| 70-79 | 29.6 |
| 80 and above | 8.2 |
| Female gender | 54.6 |
| German not as first language | 3.7 |
| School education | |
| Lower education level (primary education) | 42.3 |
| Intermediate education level (secondary education) | 24.6 |
| Higher education level (tertiary education) | 33.1 |
| Regular use of drugs | |
| Never | 13.7 |
| Seldom | 9.2 |
| Occasionally | 3.3 |
| Weekly | 1.7 |
| Daily | 72.1 |
| Medication utilized for treatment of * | |
| Hypertension | 49.8 |
| Hypercholesterolemia | 20.3 |
| Cardio-Prevention | 16.6 |
| Diabetes | 10.5 |
| Pain | 15.2 |
| Any of the above | 66.5 |
| Number of different tablets taken regularly on a daily basis | |
| None | 25.5 |
| 1-2 tablets | 34.4 |
| 3-4 tablets | 24.3 |
| 5-7 tablets | 11.6 |
| 8 or more tablets | 4.1 |

*Multiple responses allowed.

observed were "presentation of side-effects" and "what-to-do information". The type of optimization strategy followed (minimization or maximization) was nearly equally split. Overall, 235 subjects (23.5%) followed an optimization strategy for one specific attribute, i.e., did not trade attributes against each other.

Table 3. Number (%) of responders exhibiting dominant preferences (n=1,000)

| | Optimization strategy* | | |
|--------------|------------------------|------------|----------|
| | Minimizing | Maximizing | Either |
| Color | 4 (0.4) | 33 (3.3) | 37 (3.7) |
| Symbol | 17 (1.7) | 15 (1.5) | 32 (3.2) |
| Summary | 3 (0.3) | 7 (0.7) | 10 (1.0) |
| Side-effects | 30 (3.0) | 29 (2.9) | 59 (5.9) |
| What to do | 32 (3.2) | 31 (3.1) | 63 (6.3) |
| Tips | 1 (0.1) | 33 (3.3) | 34 (3.4) |

*The numbers refer to identified subjects that made a choice *sequence* as if they based their choice only on the level of one single attribute, i.e., did not trade attributes against each other. For example, 1.5% always chose the alternative with symbols in the 8 choice sets while 1.7% systematically opted for the alternatives without symbols, irrespective of the levels of all other attributes. See methods section for detailed information.

Of the 1,000 duplicate choices, 84% were exact replicates of the original choice, i.e., responders chose the same alternative when presented the same choice set a second time. Interrater agreement was moderate ($K=0.67$, CI 0.6 - 0.7). Logistic regression analysis revealed that some choice sets were significantly more likely to be affected by non-reliable choices, that is, choices were harder to reproduce by participants. For example, the odds ratio for providing a replicate choice was 0.50 ($p=0.044$) if set 2 was duplicated compared to choices in which set 1 was reproduced, irrespective of its position in the sequence of choices. The position of the original choice relative to its duplicate, i.e., whether the duplicate set replicated choices earlier or later in the sequence, nearly reached statistical significance (OR=1.1, $p=0.060$). The closer original and duplicate choices were located relative to each other, the more likely were choices to be reliable. Among personal characteristics, only education was a significant predictor for a reproduced choice (OR for intermediate/higher compared to lower educational level: 1.64, $p=0.007$).

Table 4 reports results of the base regression model and the model with interactions.

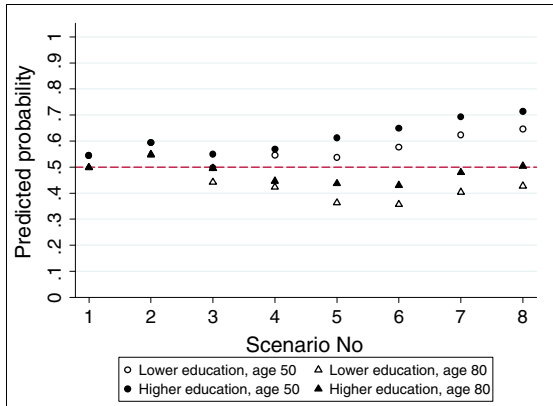
The overall model is significant at the 0.01 level according to model chi-square and the non-significant Hosmer-Lemeshow statistic. In the base model, all attributes except the extent of side-effects presented, significantly affected participants choices. Participants slightly preferred colored over black-white leaflets, no visual presentation of quantification of side-effects ("smilies"), the provision of a brief summary and general health tips, but no information on what to do in case of side-effects. Overall, the relation between attributes and choices was rather weak and model fit was

limited. Dropping data from respondents that exhibited dominant preferences did not change results. There were significant interactions between age and presentation of what-to-do information, summary, and side-effects, and between education, what-to-do recommendations, and extent of information about side-effects. When interactions were included, the importance of the what-to-do information attribute increased considerably and the main effect of the side-effects attribute reached significance.

Older participants had a stronger preference towards less information. Higher educated participants valued inclusion of information about all side-effects and what-to-do information higher compared to individuals with lower educational attainment. Participants' choices for a number of hypothetical leaflets were predicted taking the significant interactions between attributes and age and education into account. Figure 2 shows that while education has a considerable impact on choice probability this rarely results in different choices predicted for participants of the same age but different levels of education, scenario 3 being an exception. Scenario 3, which differs from the reference in only that more side-effects were reported, was favored by younger, higher educated participants and less likely to be chosen by older subjects with lower education, while older participants with higher education and younger respondents with lower education were indifferent. Contrary, scenarios 4–8 clearly show the age-divide in preferences, irrespective of educational level. With additional information elements provided, choice probability relative to the reference scenario rises for younger participants and declines for older interviewees. Only in higher educated, older

Table 4. Results of Random effects logit regression models

| Variable | Basic model | | | Interaction model | | |
|--------------------------|-------------|-----------|--------|-------------------|-----------|--------|
| | Odds ratio | CI | p | Odds ratio | CI | p |
| Color | 1.10 | 1.02,1.15 | <0.001 | 1.10 | 1.05,1.15 | <0.001 |
| Symbol | 0.93 | 0.89,0.97 | 0.002 | 0.93 | 0.89,0.97 | 0.002 |
| Summary | 1.06 | 1.02,1.11 | 0.008 | 1.59 | 1.14,2.21 | 0.005 |
| Side-effects | 0.97 | 0.93,1.02 | 0.208 | 1.39 | 0.98,1.98 | 0.063 |
| What to do | 0.95 | 0.91,0.99 | 0.034 | 2.68 | 1.88,3.80 | <0.001 |
| Tips | 1.21 | 1.16,1.27 | <0.001 | 1.22 | 1.17,1.28 | <0.001 |
| Age x What-to-do | | | | 0.98 | 0.97,0.99 | <0.001 |
| Age x Summary | | | | 0.99 | 0.99,1.00 | 0.014 |
| Age x Side-effects | | | | 0.99 | 0.99,1.00 | 0.004 |
| Education x What-to-do | | | | 1.10 | 1.00,1.20 | 0.045 |
| Education x Side-effects | | | | 1.24 | 1.13,1.36 | <0.001 |
| No of individuals | 8,000 | | | 7,976 | | |
| No of observations | 1,000 | | | 997 | | |
| Log-likelihood function | -5,486 | | | -5,428 | | |
| Model chi2 | 0.000 | | | 0.000 | | |
| Hosmer-Lemeshow test | 0.60 | | | 0.16 | | |
| McFadden pseudo R2 | 0.01 | | | 0.02 | | |



Legend*:

| | Color | Symbols | Summary | Side-Effects | What-to-do | Tips |
|------------|-------|---------|---------|--------------|------------|------|
| Reference | No | No | No | No | No | No |
| Scenario 1 | No | No | Yes | No | No | No |
| Scenario 2 | No | No | Yes | No | No | Yes |
| Scenario 3 | No | No | No | Yes | No | No |
| Scenario 4 | No | No | No | No | Yes | No |
| Scenario 5 | No | No | No | Yes | Yes | No |
| Scenario 6 | No | No | Yes | Yes | Yes | No |
| Scenario 7 | No | No | Yes | Yes | Yes | Yes |
| Scenario 8 | Yes | No | Yes | Yes | Yes | Yes |

The red dashed line indicates the 0.5 probability at which the choice between a labeled scenario and the reference scenario switch. Data points above the dashed line indicate that these scenarios would be chosen over the reference scenario.

* See Table 1 for information on attributes

Figure 2. Predicted probabilities of choosing scenario over reference scenario

individuals, this preference for less information can be compensated by presenting information in color, and inclusion of general health tips.

DISCUSSION

We investigated patients' preferences for presentation of information about drugs using a discrete choice design. Differences between the base model for the entire population and the interaction model indicate that preferences towards drug information are strongly affected by age and level of education. While older and less educated individuals preferred less over more information, younger and higher educated participants were interested in more information about side effects and additional advice on what to do in case of side-effects. Ende *et al.* assessed patients' desire for information and their wish for decision making presenting different vignettes.²⁷ In concordance with our findings, younger age and higher level of education were the only factors with a significant influence on information seeking behavior. Interestingly, other sociodemographic and morbidity-associated factors did not predict patients' behavior and desire. The fact that 84% of original choices were replicated indicates the robustness of our approach. However, choice reliability was affected by education. Whether this is due to task complexity or less stable preferences remains unclear. The fraction of responders that exhibited dominant preferences, i.e.,

did not trade attributes but based their choice on one single attribute (23%), is comparable to that observed in other studies.^{28,29} These individuals may have exposed very strong preferences or simply used decision heuristics in response to task complexity.

The information about what to do in case of side effects was not generally favored. This may point to "decision making" which has clearly to be differentiated from "information seeking" and is possibly not wanted by many patients.²⁷ This is underlined by the fact, that this additional information was preferred only by participants with higher education. Presentation of adverse events (AE) has been discussed frequently.¹² It is unequivocally accepted that percentages as well as verbal expressions such as "this adverse event occurs rarely" are misunderstood in their true incidence, depending on the severity of the AE, own experiences, and framing. It has therefore been suggested, to supplement numerical information with figures and charts, where icon displays and bar charts have been proven to be comprehensible and accepted.^{30,31} In a randomized trial in patients aged 65 and above self-reported adherence to drug prescriptions increased when PILs with graphically displayed information of side effects were provided. However, there was no preference for icons or bar graphs.³² We thus choose an icon display with happy and sad faces expressing the number of patients with and without side effects. Apparently, this was not favored by the majority of responders. This may be explained by the fact, that the pictogram was not ideal and augmentation of the area with the unhappy smilies would have been necessary.³³ Perhaps our written explanation did already provide a comprehensible denominator and the pictogram did not offer additional benefit. Moreover, to understand graphs a higher educational level might be necessary, which is also underlined by our results.³⁰ With respect to the overall presentation of the scenarios, we used font size 11, serif type, short sentences and paragraphs for all scenarios and avoided expert terms. Thus, our scenarios already mirrored many recommendations regarding PILs.³⁴⁻³⁶ This may explain why design features such as colors and additional icons played only a minor role for participants' choices. The majority of participants preferred a colored over a black-white scenario. The literature is inconclusive regarding patients' preferences towards colored PILs. Bernardini *et al.* found that most of the patients, primarily the lower educated, did not like a colored PIL, while other studies report patients' desire for color.^{37,38} Experts recommend the conservative use of only dark colors.^{35,39} Participants also preferred important information in form of a short summary, similarly to Lee *et al.*⁴⁰

Some aspects limit the generalisability of our findings. First, we used prepared leaflets rather than theoretical descriptions of scenarios to measure preferences. Low dose acetylsalicylic acid served as example drug to operationalize information. While this has the advantage that patients rated realistic situations rather than ambiguous constructs, interactions between type of drug and preferences towards attributes may exist and it is unclear whether our results also apply to other drugs. Second, a considerable fraction of participants in our sample seemed to exhibit dominant preferences, counteracting the theoretical premises of DCE. Furthermore, due to the methodology, we were able to investigate only a limited number of attributes and levels.

Finally, subjects aged 80 and above account only for a small fraction in our sample probably due to our recruiting strategy. This may limit the generalisability of our results since these patients are those with most frequent and multiple drug use.

Despite these limitations, our study has important implications for future improvement of PILs. Even among the already restricted age group above 50 years, significant differences between age groups were observed emphasizing the need for age-specific adaptation of the extent of drug information. Much more research is needed to reach the oldest old, who are probably not the readers of websites. Our results emphasize the importance of education and proof, that more general information is required especially by higher educated people. Our findings can be useful for manufacturers adapting their websites for consumers⁴¹ as well as for independent (such as NICE in UK, IQWiG in Germany) drug information sources.^{42,43}

CONFLICT OF INTEREST

The authors declare no conflict of interest.

KEY POINTS

- Participants preferred colored over black-white leaflets, no visual presentation of quantification of side-effects, the provision of a brief summary, and general health tips, but no information on what to do in case of side-effects.
- There is a strong age and education divide in preferences with older and less educated participants favoring less information.
- Participants' preferences were duplicated in a repeated choice task and thus seem reliable.

ACKNOWLEDGEMENTS

We gratefully thank the individuals who participated in this study and the research assistants that conducted the field work. The support by "gestaltend – Designbüro Frank Scheele" in design of the PILs is highly appreciated. The authors thank Prof. Monika A. Rieger for her intellectual contributions to the design of the study.

Funding: Financial support for this study was provided by a research grant from The German Federal Ministry for Education and Research (grant #01GX0751). The funding source had no influence on study design; in the collection, analysis, and interpretation of the data; in the writing of the manuscript; and in the decision to submit the manuscript for publication. The views expressed and any errors or omissions are the sole responsibility of the authors.

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