Usability of Patient-Centered Health IT: Mixed-Methods Usability Study of ePill

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ePill: Electronic Patient Information Leaflet
Usability of Patient-Centered Health IT: Mixed-Methods Usability Study of ePill | University of Cologne | Ali Sunyaev

Gebrauchsanweisung Cotrim forte-riathioph®
Tabletten
Wirkstoffe: Sulfamethoxazol 800 mg und Trimethoprim 160 mg (Cotrimoxazol 960 mg)

Zusammensetzung
Arylamidhaltiger Bestandteil: 1 Tablet enthält 960 mg Cotrimoxazol (entp. 800 mg Sulfamethoxazol und 160 mg Trimethoprim).


Vegetarische Konstellationen

Das Produkt Cotrim forte-riathioph® ist ein Vitaminpräparat und es enthält keine pharmazeutischen Substanzen.

Anwendungsgebiete
Bei akuten Infektionen durch Keime, die gegen Cotrim forte-riathioph® empfindlich sind.

Anwendungshinweise
Der Patient soll die Tabletten möglichst unverändert einnehmen.

Dosisempfehlungen
Bei Erwachsenen und Kindern ab 12 Jahren: 1 Tablette morgens und abends, auch bei Kindern ab 2 Jahren.

Sonderanwendungen

Bei schweren Infektionen oder bei bestehenden Keimresistenzen kann die Dosis erhöht werden.

Aussagen
Wie kann man sich von Cotrim forte-riathioph® nicht verabschieden?

Die Patienten werden aufgefordert, die Tabletten morgens und abends einnehmen.

Was müssen Sie im Straßenverkehr bei der Anwendung von Cotrim forte-riathioph® beachten?

Die Tabletten sind für die Pflege der Patienten in der täglichen Lebens situationsverbundenheit.

Wichtiges: Die Tabletten sind für die Pflege der Patienten in der täglichen Lebens situationsverbundenheit.

Quellenangabe
Nink & Schroeder, 2005

(Source: Nink & Schroeder, 2005)
Motivation

- Providing patients with information leads to positive effects\(^1,^2\)
  - Increase patients’ knowledge, patient empowerment, …
- Most patients are inclined to read patient information leaflets\(^3\)

<table>
<thead>
<tr>
<th>Issues of Written Information on Pharmaceuticals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Readability</strong></td>
</tr>
<tr>
<td>Font size is too small(^4,^5)</td>
</tr>
<tr>
<td>Further formatting aspects are not appropriately chosen(^5)</td>
</tr>
<tr>
<td><strong>Comprehensibility</strong></td>
</tr>
<tr>
<td>Many difficult/technical terms are used (Required reading level is too high)(^3,^5)</td>
</tr>
<tr>
<td>Headings and bullet points could be used more effectively for text structuring(^4)</td>
</tr>
<tr>
<td><strong>Content</strong></td>
</tr>
<tr>
<td>Provision of irrelevant information(^3,^5)</td>
</tr>
<tr>
<td>Excessive amount of information(^3,^5)</td>
</tr>
</tbody>
</table>

1: Johanson et al. (2010)  
2: Sheard et al. (2006)  
3: Rajasundaram et al. (2006)  
4: Luk et al. (2010)  
5: Winterstein et al. (2010)
ePill: Research design
Electronic Patient Information Leaflet

• Design science research paradigm\(^1,2,3\)
  - Theory-driven design (IS success model\(^8\), signaling theory\(^9\))
  - Incremental development approach
  - Multiple design cycles of artifact creation/refinement
  - Qualitative/quantitative evaluation

• Mixed methods evaluation\(^4,5\)
  - Assess artifact quality with semi-structured interviews\(^6\)
    (elicitation of requirements and evaluation through observation)
  - Artifact refinements with a qualitative usability study\(^7\)
    (fixed tasks to test functionality and discussion in focus groups)
  - Demonstrate artifact utility and efficacy with quantitative evaluation

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1: Gregor and Hevner 2013
2: Hevner et al. 2004
3: Purao 2002
4: Ågerfalk 2013
5: Venkatesh et al. 2013
6: Davis et al. 2006
7: Basch 1987
8: DeLone and McLean 2003
9: Spence 1973
Web Application – Three Basic Tasks

1. **Search for pharmaceuticals:** Enable users to specify some parameters and search corresponding pharmaceuticals in the underlying database.

2. **Display information on pharmaceuticals:** Enable users to view at least the information provided by printed leaflets.

3. **Supplementary services:** Offer supplementary services like refining the displayed information, linking to similar pharmaceutical information, or aggregating pharmaceutical information.
Flexible User Interface

- Different users prefer different GUI designs
  - e.g. simplicity vs. fast access to everything
  
  ⇒ Let users configure GUI according to their preferences
  
  ⇒ Preset selection on home page
  
  ⇒ Menu to switch visibility of all GUI components

Similarly, users can configure the categories of information displayed on pharmaceuticals.
Usability Study: Motivation and Design

- Neglecting usability principles will lead to applications that fail to generate true value for users\(^1\)
- Usability testing can deliver important information to detect potential for optimization

### Tasks and Task Questionnaires

<table>
<thead>
<tr>
<th>Tasks and Task Questionnaires</th>
<th>Focus Groups(^3,4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short storyline</td>
<td>Eight participants per session</td>
</tr>
<tr>
<td>Three tasks consisting of several subtasks</td>
<td>Questioning Route: Structured strategy</td>
</tr>
<tr>
<td>Questionnaire after every task</td>
<td></td>
</tr>
<tr>
<td>After all tasks: System Usability Scale (SUS) questionnaire(^2)</td>
<td></td>
</tr>
</tbody>
</table>

\(^1\): Goldberg et al. (2011)  
\(^2\): Brooke (1996)  
\(^3\): Krueger (1998)  
\(^4\): Krueger and Casey (2000)
Usability Study: Results

- SUS score: **64.91**
- No significant connection between task type and task questionnaire responses
- Significant correlations between demographic items and questionnaire responses

Quotes from Focus Groups

<table>
<thead>
<tr>
<th>Layout</th>
<th>“I was not able to find all functions. They should be more eye-catching.”</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>“I like the possibility to decide which information is displayed.”</td>
</tr>
<tr>
<td>Displaying general medical information</td>
<td>“The information is not well edited.”</td>
</tr>
<tr>
<td></td>
<td>“I would like to have a short summary of every medicament’s main effect in a few words.”</td>
</tr>
<tr>
<td>Different Views of ePill</td>
<td>“The term “expert view” is very confusing. For me, only a doctor is an expert in this context.”</td>
</tr>
</tbody>
</table>
Usability Study: Conclusion

**ePill’s Usability**
- Basic concept was positively conceived
- SUS score of 65: rating lying between ‘OK‘ and ‘GOOD‘
- Problems regarding the different views
- Implications for ePill’s future development were derived

**Study Design**
- **SUS**: Useful to derive an approximate, overall classification
- **Tasks and task Questionnaires**: Enabled a more detailed analysis of usability
- **Focus Groups**: Allowed participants to exchange opinions and to create ideas for improvement

1: Bangor et al. (2008)
Outlook: Evaluation Process

Random Assignment

Intervention Group I
Baseline Establishment
Tool Utilisation
Information Provision
MPR Assessment

Intervention Group II
Baseline Establishment
Tool I Utilisation
+Supplementary Services
MPR Assessment

Intervention Group III
Baseline Establishment
Tool II Utilisation
+Personalized Services
MPR Assessment

Control Group
Baseline Establishment
MPR Assessment

Questionnaire A

Questionnaire B

Analysis

Source: Dehling and Sunyaev (2013)
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Backup Slide: Motivation

Different Distribution Systems and Quality from Country to Country\(^1,\(^2\)

<table>
<thead>
<tr>
<th>Description</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voluntary or mandatory distribution of patient information leaflets</td>
<td></td>
</tr>
<tr>
<td>Distribution of leaflets with every or only the first supply of a pharmaceutical</td>
<td></td>
</tr>
<tr>
<td>Information offered as package insert, leaflet, or printout at source of supply</td>
<td></td>
</tr>
<tr>
<td>Leaflets can be produces by manufacturers or 3(^{rd}) parties</td>
<td></td>
</tr>
<tr>
<td>US: Often only short instructions on container; no standardisation(^2)</td>
<td></td>
</tr>
<tr>
<td>EU: Mandatory distribution with every supply of a pharmaceutical; general structure and basic content enshrined in law(^3)</td>
<td></td>
</tr>
</tbody>
</table>

\(\Rightarrow\) Written information on pharmaceuticals has potential for improvement

\(\Rightarrow\) Address deficits regarding readability, comprehensibility, and content with a web application

- Focus on Germany, where similar problems have been reported\(^4\)

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1: Luk et al. (2010)
2: Winterstein et al. (2010)
3: Council of the European Communities (1992)
4: Fuchs et al. (2007)
Backup Slide: Usability Study - Motivation

- Neglecting usability principles will lead to applications that fail to generate true value for users¹
- Designing interfaces on the basis of usability principles inspires user confidence and results in usable and useful interfaces²
- Usability testing can deliver important information to detect potential for optimization

⇒ We conducted a usability study to identify usability problems and examine whether users are able to use core features of ePill
⇒ We present a mixed-methods research design for usability studies based on the example of ePill

¹: Goldberg et al. (2011) ²: Tsopra et al. (2014)
References


References – Backup Slides


