Usability evaluation of a guideline implementation system for cardiac rehabilitation: Think aloud study

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Guideline implementation systems

Knowledge on best practices

Clinical practice guidelines

Data entry

Clinical decision support (CDS) systems

Human factors issues

Clinical decision making

Quality of care
Setting

• Disease management
  – Cardiac rehabilitation (CR) needs assessment procedure

• Extensive data collection during 30 to 60 min patient interview
  – Performed by specialized rehab nurse

• Multidisiplinary CR guidelines include paper-based clinical algorithm
Question 2: Is there a disruption/potential problem with the psychological functioning of the patient?

2a. Is there a disruption or potential problem with the emotional functioning of the patient?

Result MacNew Quality-of-life questionnaire: dimension emotional functioning

Disruption or potential problem with emotional functioning of the patient
- Severe: ≤ 2nd decile
- Moderate: ≥ 3rd and ≤ 6th decile
- None: ≥ 7th decile

Severe

Goals:
(4) Regain emotional balance
(5) Learn to cope with cardiac disease in a functional manner

Intervention
Individual screening by a psychologist and/or a social worker. He or she determines further interventions.

Moderate

Goals:
(4) Regain emotional balance
(5) Learn to cope with cardiac disease in a functional manner

Intervention
Education followed by lifestyle change counseling and/or relaxation therapy

None

No intervention related to emotional functioning

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Introduction

Overview sections

Section: NAP

Sub-sub-sections: Items within the domain Social condition

Sub-section: Data entry domains

Next button: Fixes predefined data entry order
Study aim

• To evaluate the system’s
  – Model of predefined data entry order
  – Task efficacy (completeness)
  – Task efficiency (mouse clicks)

Design

• Think aloud usability protocol
• 7 professional end-users from 5 clinics
• 2 scenarios: fictitious and real patiënt
• 7 tasks (with 41 subtasks) based on the guidelines
Results – deviation from predefined next system step (example trajectory fictitious patiënt)
Results – deviation from predefined next system step (example trajectory real patiënt)
## Results – task completion and mouse clicks

<table>
<thead>
<tr>
<th></th>
<th>Task 1</th>
<th>Task 2</th>
<th>Task 3</th>
<th>Task 4</th>
<th>Task 5</th>
<th>Task 6</th>
<th>Task 7</th>
<th>AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td># subtasks per task / # mouse clicks minimally required</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>4</td>
<td>41</td>
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<td></td>
<td>49</td>
<td>85</td>
<td>59</td>
<td>23</td>
<td>29</td>
<td>40</td>
<td>54</td>
<td>339</td>
</tr>
</tbody>
</table>

### Fictitious patient case

<table>
<thead>
<tr>
<th></th>
<th>Task completion</th>
<th>Average subtask completion</th>
<th>Average mouse clicks needed for completed subtasks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6/7</td>
<td>96%</td>
<td>151%</td>
</tr>
<tr>
<td></td>
<td>0/7</td>
<td>83%</td>
<td>114%</td>
</tr>
<tr>
<td></td>
<td>6/7</td>
<td>98%</td>
<td>109%</td>
</tr>
<tr>
<td></td>
<td>4/7</td>
<td>89%</td>
<td>164%</td>
</tr>
<tr>
<td></td>
<td>2/7</td>
<td>73%</td>
<td>240%</td>
</tr>
<tr>
<td></td>
<td>1/7</td>
<td>70%</td>
<td>131%</td>
</tr>
<tr>
<td></td>
<td>1/7</td>
<td>75%</td>
<td>182%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>82%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>156%</td>
</tr>
</tbody>
</table>

### Real patient case

<table>
<thead>
<tr>
<th></th>
<th>Task completion</th>
<th>Average subtask completion</th>
<th>Average mouse clicks needed for completed subtasks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4/7</td>
<td>75%</td>
<td>145%</td>
</tr>
<tr>
<td></td>
<td>0/7</td>
<td>62%</td>
<td>108%</td>
</tr>
<tr>
<td></td>
<td>2/7</td>
<td>61%</td>
<td>139%</td>
</tr>
<tr>
<td></td>
<td>2/7</td>
<td>71%</td>
<td>131%</td>
</tr>
<tr>
<td></td>
<td>0/7</td>
<td>51%</td>
<td>194%</td>
</tr>
<tr>
<td></td>
<td>0/7</td>
<td>59%</td>
<td>117%</td>
</tr>
<tr>
<td></td>
<td>1/7</td>
<td>75%</td>
<td>115%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>63%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>136%</td>
</tr>
</tbody>
</table>
Discussion — summary

• Users deviated from predefined data entry order
• Users could not complete all tasks as defined in the guidelines
• Users needed to many navigation actions

Advice to system developers

• The system should be better adapted towards end-users’ mental model (= towards their expectancies)
  – E.g.: more flexible and transparent data entry
Discussion — lessons for system development

• Implementation of a paper-based guideline in software is a challenge
  – Local, compliant adaptations should be supported (e.g. different data entry order)
  – Develop in short cycles, with early involvement of end-users

• Ultimately this leads to more efficient and effective system use

Quality of care
Thank you for your attention!
Extra results – deviation from predefined data entry order

• Overall: 41% deviation
  – Fictitious patient: 38%
  – Real patiënt: 45%

• Task completion
  – On average: each 40 deviations were associated with 1 task less being complete

• Mouse clicks
  – On average: each deviation was associated with 6 mouse clicks