Development Trajectory of a Fall Detection Device Involving Community-Dwelling Older People

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Disclosure slide

- **Authors**: Thilo, FJS, Schols, JMGA, Halfens, RJG, & Hahn, S
- **Learning objectives**:
  - The learner will be able to:
    - describe the theoretical framework of user involvement from Shah et al. (2009) in the development of health-related technologies.
    - outline challenges and added values of user involvement in the development of health-related technologies, using the example of a fall detection device.
- **Conflict of interest statement**:
  - The authors declare that they have no competing interests.
- **Employer**:
  - Bern University of Applied Sciences, Switzerland
- **Sponsorship**:
  - Bern University of Applied Sciences
Why bother?

Community-dwelling older people

- Healthy aging (WHO, 2012)
- Incidence of falls (Peel, 2011)
- Negative fall consequences (Simpson, 2014; Fleming, 2008)
- Fall detection technologies not commonly used (Nyman, 2014)
- User involvement: «need-driven» approach (Thilo et al. 2016)

Technology-driven

Needs-driven

(Bridgelal Ram et al., 2007)
Study aims

» ...to explore and consider the needs, requirements, feasibility and usability aspects in daily life
» ...of a wearable fall detection sensor, including its smartphone application
» ...from the perspective of community-dwelling older people
» ...by involving them interactively in the development and testing
The AIDE-MOI device

<table>
<thead>
<tr>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mock-up of the fall</td>
<td>Four patch patterns</td>
<td>Mock-up smartphone application</td>
<td>Alert message (SMS)</td>
</tr>
<tr>
<td>detection sensors</td>
<td></td>
<td>screens (screenshots)</td>
<td></td>
</tr>
<tr>
<td>Rigid model</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>Bendable model</td>
<td></td>
<td>First screen</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Second screen</td>
<td></td>
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<td></td>
<td></td>
<td>Third screen</td>
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</table>

(Foto Thilo)

(Thilo et al., 2017)
Theoretical framework ‘medical device technology development process’ (Shah et al., 2009)
Methodological approach according to the theoretical framework ‘medical device technology development process’ from Shah et al. (2009)

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Phase 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idea generation &amp; concept development</td>
<td>Device (re)-design &amp; prototype development</td>
<td>Prototype testing involving in-house &amp; trials in the real field</td>
<td>Device deployment in the market &amp; user feedback</td>
</tr>
<tr>
<td><strong>January – July 14</strong></td>
<td><strong>July 14 – April 15</strong></td>
<td><strong>May – October 15</strong></td>
<td><strong>In preparation</strong></td>
</tr>
</tbody>
</table>

- **In-house testing**
  - **N = 22**
  - 3 semi-structured focus group interviews
  - Qualitative data analysis (Sandelowski, 2000)
  - Based on findings -> prototype development (Thilo et al., in review)
  - Piloting prototype in research team
  - Lab -> improvement prototype

- **Real field trial**
  - **N = 15 -> 4 groups / 9 days**
  - Coaching (2h) Day 1
  - Visit at home (1h) Day 2
  - Day 3-8
  - 24h Hotline
  - User manual
  - Diary
  - Usability scale (PSSUQ, Lewis, 2002)
  - 3 Semi-structured focus group interviews (2h) Day 9

(Thilo et al., 2016b)
Table 1: Participant characteristics (N=15)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Participants (N=15)</th>
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<tbody>
<tr>
<td>Age (years), mean (SD)</td>
<td>81 (5.6)</td>
</tr>
<tr>
<td>Age (years): (min-max)</td>
<td>75 - 92</td>
</tr>
<tr>
<td>n (%)</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>11 (73)</td>
</tr>
<tr>
<td>Male</td>
<td>4 (27)</td>
</tr>
<tr>
<td>Living alone</td>
<td>9 (60)</td>
</tr>
<tr>
<td>Assistance in daily living</td>
<td>6 (40)</td>
</tr>
<tr>
<td>History of fall(s)</td>
<td>4 (27)</td>
</tr>
<tr>
<td>Fear of falling</td>
<td>8 (53)</td>
</tr>
<tr>
<td>Use of walking aid</td>
<td>2 (13)</td>
</tr>
<tr>
<td>Instability during walking</td>
<td>6 (40)</td>
</tr>
<tr>
<td>Smartphone use prior to study participation</td>
<td>4 (27)</td>
</tr>
</tbody>
</table>

Abbreviations: SD, standard deviation; min, minimum; max, maximum
What are important results?

- **Sensor - feasibility and usability**
  - Positive aspects
  - Aspects requiring improvement

- **Smartphone - feasibility and usability**
  - Aspects requiring improvement

- **App - feasibility and usability**
  - Positive aspects
  - Aspects requiring improvement

(Thilo et al., submitted)
Experience-based: What are the challenges and added values of user involvement?

<table>
<thead>
<tr>
<th>Added values</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>» Focus: The requirements of human &lt;-&gt; technology</td>
<td>» Recruitment</td>
</tr>
<tr>
<td>» Development needs-driven: what is needed and not only feasible</td>
<td>» «Real» consideration of the perspective of users</td>
</tr>
<tr>
<td>» Involvement of the same person several times</td>
<td>» Level of involvement: consultation, contribution, collaboration, control</td>
</tr>
<tr>
<td>» Early recognition of problems in real-life utilization</td>
<td>» Interprofessional collaboration: common language, openness, curiosity,</td>
</tr>
<tr>
<td>» Unexpected results</td>
<td>time, regular contact</td>
</tr>
<tr>
<td></td>
<td>» Financial resources</td>
</tr>
</tbody>
</table>
What are the conclusions?

» Older people contribute in a «needs-driven» way
» Study encourages further development of the fall detection and alerting device
» Enables researchers to go beyond factors related to the technology itself
» Identifies barriers and facilitators in daily use
» The use and integration of a fall detection and alerting device in daily life is a complex process
» Technical aspects seems to be inseparably linked to human factors
References

- Thilo, F.J.S., et al., Involvement of older people in the development of fall detection systems: a scoping review. BMC Geriatrics, 2016a. 16(42).
- Thilo, F.J.S., et al., Involvement of the end user: exploration of older people’s needs and preferences for a wearable fall detection device – a qualitative descriptive study Patient Preference and Adherence 2017. 11: p. 11-22.
Thank you for your attention!

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Questions & comments are welcome

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