How to prevent recurrent falls? using new technologies

Efficacy of Home-Based Technology (HBTec) for Falls Preventing in Frail Older Adults

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FRANCE
CONFLICT OF INTEREST DISCLOSURE

I have no potential conflict of interest to report
Falls = Higher risk in causing dependence

- Incidence: 1/3 Seniors > 65 ans and ½ Seniors > 80 ans
- Resulting in more than $19 billion in health care costs annually in US

Mortality:

- 10 leading causes of death in older adults in US
- 9000 deaths/y in France

(Keene, BMJ 1993), (Gorina, Aging Trends, 2005)
### Morbidity of Falls

<table>
<thead>
<tr>
<th>Morbidity</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injurious falls</td>
<td>50</td>
</tr>
<tr>
<td>Fractures</td>
<td>5</td>
</tr>
<tr>
<td>Psychological trauma</td>
<td>40</td>
</tr>
<tr>
<td>Hospital visits (Hospitalisation &amp; ED visits)</td>
<td>20</td>
</tr>
<tr>
<td>Institutionnalization</td>
<td>40</td>
</tr>
<tr>
<td>Dependence accelerating</td>
<td>50</td>
</tr>
</tbody>
</table>

(Keene, BMJ 1993), (Gorina, Aging Trends, 2005)
Context of Research Question
Prevention Strategies

- Cochrane review
  - Multifactorial interventions reduce the rate of falls in varying degree

- **BUT NO VALID INTERVENTION STUDY**
  - Home-Based Technology & Home Automation
ESOPPE-FRAIL
Research Aims

- **Primary objective**
  - Evaluate HBTec effect on Inside Falls in frail older adults
    - Cumulative incidence of inside fallers over 12 months from the baseline

- **Secondary objective**
  - Evaluate HBTec effect on Inside Falls related admission to Emergency Room in frail older adults
METHODS
Design, Participants

- **Design**
  - Prospective study
    - Intervention Group
    - Control Group

- **Participants Recruitment**
  - Community-Dwelling older adults
  - Intervention group originally known
  - Control group matched by age, sex and dependence level
METHODS
HB Tec Pattern Innovation

SAFETY PATTERN

Gas detector, Bracelet, Intercom Technology

Well-Being at Home

Lighted Path

TeleAssistance Service Platform

Emergency Calls

Friendly Calls

Well-being at Home

Individual Safety

Caregivers safety

Psychological Assurance

Social Link Maintenance

(Tchalla et al., Gerontechnology 2012)
METHODS
Eligibility criteria & Sample size

- **Inclusion criteria**
  - Age ≥ 65
  - Live in study setting at least 1 year
  - Iso-Ressources Group (IRG) 3/4/5/6
  - Consent form agreement

- **Exclusion criteria**
  - Severe Dementia (MMS< 10)

- **Sample size: No = 202**
  - Hypothesis: Reduction 15% Inside Fallers (β = 20%, α=5%)
Eligibles No= 208

Excluded No=12

Allocation No=196

HBTec Intervention Group No=98

Lost to Follow-up No=4

Analyzed No=94
Cumulative Incidence =30.9%

Control Group No =98

Lost to Follow-up No=2

Analyzed No=96
Cumulative Incidence =50.0%

(Tchalla et al., Arch Geriatr Gerontol 2012)
ESOPPE-FRAIL
Frailty Assessment

At least 3 criteria on 5: « Frail »
- Weight Loss: 5% on the year or > 4 kg
- Gait Speed
- Muscle Strength: « grip test »
- Physical Activities: PASE
- Fatigue: CES-D Score

1 to 2 criteria: « Pre-Frail »
No criteria: « Robust »

(Tchalla et al., Arch Geriatr Gerontol 2012)
## Descriptive analysis

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Global population N=190 (%)</th>
<th>HBTec Group n= 94 (%)</th>
<th>No HBTec Group n=96 (%)</th>
<th>( P ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Mean ±SD, y</td>
<td>83,4 ± 6,2</td>
<td>84,9 ± 6,5</td>
<td>82,0 ± 5,7</td>
<td>0,0013</td>
</tr>
<tr>
<td>Women</td>
<td>147 (77,4)</td>
<td>72 (76,6)</td>
<td>75 (78,1)</td>
<td>0,8011</td>
</tr>
<tr>
<td>Widow(er)</td>
<td>112 (58,9)</td>
<td>62 (66,0)</td>
<td>50 (52,1)</td>
<td>0,0526</td>
</tr>
<tr>
<td>Caregiver</td>
<td>164 (86,3)</td>
<td>86 (91,5)</td>
<td>78 (81,3)</td>
<td>0,0400</td>
</tr>
<tr>
<td>Education (&lt; High school)</td>
<td>139 (73,2)</td>
<td>73 (77,7)</td>
<td>66 (68,8)</td>
<td>0,2275</td>
</tr>
<tr>
<td>Individual Habitation</td>
<td>146 (76,8)</td>
<td>67 (71,3)</td>
<td>79 (82,3)</td>
<td>0,0719</td>
</tr>
<tr>
<td>Rural living Area</td>
<td>81 (42,6)</td>
<td>40 (42,6)</td>
<td>41 (42,7)</td>
<td>0,9828</td>
</tr>
</tbody>
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*(Tchalla et al., Arch Geriatr Gerontol 2012)*
## Descriptive analysis

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<th>P value</th>
</tr>
</thead>
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<tr>
<td>ADL 5-6 (Independence &amp; mild dependence)</td>
<td>147 (77,4)</td>
<td>72 (76,6)</td>
<td>75 (78,1)</td>
<td>0,8011</td>
</tr>
<tr>
<td>Polypharmacy</td>
<td>112 (58,9)</td>
<td>62 (66,0)</td>
<td>50 (52,1)</td>
<td>0,0526</td>
</tr>
<tr>
<td>Multimorbidity</td>
<td>164 (86,3)</td>
<td>86 (91,5)</td>
<td>78 (81,3)</td>
<td>0,0400</td>
</tr>
<tr>
<td>Diagnosed Dementia</td>
<td>139 (73,2)</td>
<td>73 (77,7)</td>
<td>66 (68,8)</td>
<td>0,2275</td>
</tr>
<tr>
<td>Cognitive Impairment</td>
<td>146 (76,8)</td>
<td>67 (71,3)</td>
<td>79 (82,3)</td>
<td>0,0719</td>
</tr>
<tr>
<td>Depression</td>
<td>146 (76,8)</td>
<td>67 (71,3)</td>
<td>79 (82,3)</td>
<td>0,0719</td>
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<td>Hypertension a</td>
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(Tchalla et al., Arch Geriatr Gerontol 2012)
## Inside Fallers, Final Multinominal Regression Model

**Characteristics (No=190)**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>OR</th>
<th>95.5% CI</th>
<th>P value</th>
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</thead>
<tbody>
<tr>
<td>Home- Based Technology (HBTec)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No HBTec</td>
<td>Reference</td>
<td>Reference</td>
<td>0.0012</td>
</tr>
<tr>
<td>HBTec</td>
<td>0.33</td>
<td>[0.17 – 0.65]</td>
<td></td>
</tr>
<tr>
<td>Age, y</td>
<td>2.82</td>
<td>[1.57 – 5.01]</td>
<td>0.0005</td>
</tr>
<tr>
<td>Type of habitation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collective</td>
<td>Reference</td>
<td>Reference</td>
<td>0.0329</td>
</tr>
<tr>
<td>Individual</td>
<td>2.36</td>
<td>[1.07 – 5.21]</td>
<td></td>
</tr>
</tbody>
</table>

AUC Score = 0.74
Test Hosmer Lemeshow: $\chi^2 = 0.48$

NNT = 5

(Tchalla et al., Arch Geriatr Gerontol 2012 & Tchalla et al., Gerontechnology 2012)
## ESOPPE-FRAIL
### Inside Falls related Hospital visits, Final Model

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<th>P value</th>
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<tr>
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<tr>
<td>No HBTec</td>
<td>Reference</td>
<td>Reference</td>
<td>0.0091</td>
</tr>
<tr>
<td>HBTec</td>
<td>0.30</td>
<td>[0.12 – 0.74]</td>
<td></td>
</tr>
<tr>
<td><strong>Age, y</strong></td>
<td>2.82</td>
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<td>Collective</td>
<td>1</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Individual</td>
<td>2.36</td>
<td>[1.07 – 5.21]</td>
<td></td>
</tr>
<tr>
<td><strong>Multimorbidity (&gt;2 co-morbidities)</strong></td>
<td>2.78</td>
<td>[1.02 – 7.55]</td>
<td>0.0456</td>
</tr>
</tbody>
</table>

*(Tchalla et al., Arch Geriatr Gerontol 2012 & Tchalla et al., Gerontechnology 2012)*

(15)
DISCUSSION
Summary of Findings

- Efficacy of HBTec on Inside Falls
- Good Acceptability of HBTec: 97.3% (The Free AiROT) in Frail Older Adults
- Risk Factors:
  - Aging
  - Individual Habitation
- Relative Risk Difference: 38%
- Number of Older Adults Needed to equipped or Threat for avoiding 1 Inside Faller (NNT):
  - NNT = 5 Frail Older Adults
HBTec possible actions on:

- **Receptors:**
  - Lighted Path improve vision
  - Stimulate contact & Movement

- **CNS:**
  - Self-confidence (behaviour)
  - Maintenance of Functional Reserves

- **Effectors:**
  - Inside Physical activities
    (Muscle mass & Muscle strength)
**DISCUSSION (4)**

**Limits**

- **Intervention group older than Control group**
  - Possible Underestimation of HBTec effect

- **Falls Assessment**
  - Self-Report bias, possible bias
    - Possible underestimation of non serious falls
    - Underestimation or Overestimation of HBTec effect because of the known allocation group
TAKE HOME MESSAGES

1) Qualitative Finding:
   - Good Acceptability of HBTec tools (> 95%)

2) Quantitative Finding:
   - Efficacy of HBTec on Inside Cluster Fallers

3) Cost-Effectiveness Study Needed
   - Ongoing in FRANCE: DOMOLIM Clinical Trial with No 1200 Older Adults (NCT: 01697553) in LIMOGES
Thanks!

- Tchalla A., MD, PhD
- Dantoine T., MD, PhD
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