INTRODUCTION

• Causes of falls in older adults are multi-factorial and typically result from the interaction of intrinsic and environmental risk factors. The most important intrinsic risk factors for falls include muscle weakness and gait and balance disorders.1
• Computerized dynamic posturography (CDP) is the gold standard for balance assessment and is used to guide rehabilitation.
• However, CDP systems are costly and not portable; thus, many older adults do not have access to such equipment.

PURPOSE

To examine feasibility of using the low-cost gaming system, Nintendo Wii Fit®, to assess balance in older adults.

METHODS

Design

• Quasi-experimental pilot study

Participants

• Community-dwelling, older adults (> 60 years) were recruited
• Inclusion criteria: able to ambulate household distance without assistive device, stand independently for 20 mins
• Exclusion criteria: cognitive deficit (Montreal Cognitive Assessment < 21/30), unstable medical condition, progressive neurological disease, severe pain with weight bearing, vision impairment, prior Wii Fit use

Protocol

• Atlanta VAMC/Emory University IRB approved the protocol and all participants gave informed consent
• Convenience sampling methods included flyers and presentations at local senior centers and Atlanta VAMC
• Participants were evaluated during a 3-hour session
• Participants were assessed for leg strength, gait speed, dynamic gait index, and timed up and go
• CDP (SMART Equites® Balance System, NeuroCom International, Inc, Portland, OR) testing included the Sensory Organization Test (SOT) and Limits of Stability (LOS) test
• Participants used the Wii Fit® system (Nintendo, Kyoto, Japan)
• The system includes: computer interface, monitor, and Wii balance board, a small force platform that the player stands on during play (Figure 1)
• Two balance games- Ski Slalom and Table Tilt- were identified a priori by expert review as potentially relevant to real-life balance situations (Figure 2)
• Three trials of each game were completed

RESULTS (cont’d)

• Scores for all games were normally distributed with the exception of trial 3 of SS Time.
• 29 of 200 correlations between Wii game performance and standard measures were statistically significant.
• Correlations were strongest for SS Time and LOS
• Reaction time, SS penalties and LOS end-point excursion (Table2), and SS penalties and gait speed (r = -0.60, p = 0.005).
• Wii fit age correlated with LOS Directional control and leg strength (r = -0.49, p = 0.032).
• Gait speed of Wii Fit ranks (Unbalanced vs Amateur) for Tilt Table were significantly different (p = 0.02)

DISCUSSION

• Certain Wii Fit® balance games, the Ski Slalom in particular, may capture similar domains of information as a “gold standard” assessment tool.
• The Wii Fit® system may have utility in the evaluation of balance problems in older adults.
• Use of a simple, inexpensive gaming system may provide an alternative method for testing and training balance in community-dwelling older adults when other resources are not available.

FUNDING SOURCE

This study was funded by a visit grant from Atlanta VA Rehab R & D Center of Excellence. Drs. Lin and Cleveinger were supported by funding from the VA Special Fellowship in Advanced Geriatrics (GRECC). The views expressed here are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs or the United States government.

REFERENCES


Table 2. Correlations between Wii Fit measures and CDP

| Variable          | Wii Fit age | SS time | SS penalties | TT points | TT time | LOS RT | LOS MV | LOS GPE | LOS GPE | LOS DCE | SS time | SS penalties | TT points | TT time | LOS RT | LOS MV | LOS GPE | LOS GPE | LOS DCE | SS time | SS penalties | TT points | TT time | LOS RT | LOS MV | LOS GPE | LOS GPE | LOS DCE |
|-------------------|-------------|---------|--------------|-----------|---------|--------|--------|--------|--------|--------|---------|-------------|-----------|---------|--------|--------|--------|--------|--------|---------|-------------|-----------|---------|--------|--------|--------|--------|--------|--------|
|                   |             |         |              |           |         |        |        |        |        |        |         |             |           |         |        |        |        |        |        |         |             |           |         |        |        |        |        |        |        |

Table 1. Participant characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y), mean ± SD (range)</td>
<td>74.6 ± 10.2 years (62 - 90 years)</td>
<td></td>
</tr>
<tr>
<td>Female sex, n (%)</td>
<td>18 (85%)</td>
<td></td>
</tr>
<tr>
<td>Montreal cognitive assessment (10/30), mean ± SD (range)</td>
<td>26.8 ± 3.0 (22 - 30)</td>
<td></td>
</tr>
<tr>
<td>History of fall (%)</td>
<td>None 95%, One 23%, Two or more 23%</td>
<td></td>
</tr>
<tr>
<td>10f chair stand (n), mean ± SD (range)</td>
<td>12.0 ± 2.9 (7 - 19)</td>
<td></td>
</tr>
<tr>
<td>Gait speed (m/s), mean ± SD (range)</td>
<td>1.12 ± 0.30 m/s (0.76 - 1.83 m/s)</td>
<td></td>
</tr>
<tr>
<td>Dynamic gait index (24), mean ± SD (range)</td>
<td>19.7 ± 3.6 (9 - 24)</td>
<td></td>
</tr>
<tr>
<td>Timed up and go (s), mean ± SD (range)</td>
<td>8.8 ± 2.4 (6.7 - 13.8 s)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Correlations between Wii Fit measures and CDP

<table>
<thead>
<tr>
<th>Variable</th>
<th>Wii Fit age</th>
<th>SS time</th>
<th>SS penalties</th>
<th>TT points</th>
<th>TT time</th>
<th>LOS RT</th>
<th>LOS MV</th>
<th>LOS GPE</th>
<th>LOS GPE</th>
<th>LOS DCE</th>
<th>SS time</th>
<th>SS penalties</th>
<th>TT points</th>
<th>TT time</th>
<th>LOS RT</th>
<th>LOS MV</th>
<th>LOS GPE</th>
<th>LOS GPE</th>
<th>LOS DCE</th>
<th>SS time</th>
<th>SS penalties</th>
<th>TT points</th>
<th>TT time</th>
<th>LOS RT</th>
<th>LOS MV</th>
<th>LOS GPE</th>
<th>LOS GPE</th>
<th>LOS DCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Wii Fit® system including balance board to measure center of pressure

Figure 2. Example from Ski Slalom game

Table 2. Correlations between Wii Fit measures and CDP

<table>
<thead>
<tr>
<th>Variable</th>
<th>Wii Fit age</th>
<th>SS time</th>
<th>SS penalties</th>
<th>TT points</th>
<th>TT time</th>
<th>LOS RT</th>
<th>LOS MV</th>
<th>LOS GPE</th>
<th>LOS GPE</th>
<th>LOS DCE</th>
<th>SS time</th>
<th>SS penalties</th>
<th>TT points</th>
<th>TT time</th>
<th>LOS RT</th>
<th>LOS MV</th>
<th>LOS GPE</th>
<th>LOS GPE</th>
<th>LOS DCE</th>
<th>SS time</th>
<th>SS penalties</th>
<th>TT points</th>
<th>TT time</th>
<th>LOS RT</th>
<th>LOS MV</th>
<th>LOS GPE</th>
<th>LOS GPE</th>
<th>LOS DCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Wii Fit® system including balance board to measure center of pressure

Figure 2. Example from Ski Slalom game