Elastic Band Exercises Improved Sleep Quality and Depression of Nursing Home Older Adults in Wheelchairs

Kuei-Min Chen
Ph.D., RN., Professor
College of Nursing
Kaohsiung Medical University
Taiwan
Disclosure

Authors
- Kuei-Min Chen, Chun-Huw Li, Hsin-Ting Huang, & Yin-Yin Cheng

Learner Objectives
- To identify the protocol of a new complementary health practice method, the Wheelchair-bound Senior Elastic Band (WSEB), for nursing home older adults in wheelchairs.
- To recognize the psychological beneficial effects of the WSEB exercises on the nursing home older adults in wheelchairs.

Conflict of Interest
- No conflict of interest has been declared by the authors.

Funding
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Sleep disturbances and depression are costly and potentially disabling conditions affecting a considerable proportion of older adults.

Sleep disturbances are ascribed to the inactive lifestyles of repetitive daily routines, lack of physical exercise, excessive time spent in bed, or sleeping during the day (Foley, Ancoli-Israel, Britz, & Walsh, 2004).

Nursing home older adults in wheelchairs were even more disposed to these situations.

Physical activity or exercise is associated with a decreased state of depression and an enhanced psychological well-being (Vuillemin et al., 2005).
Elastic Band

- Simple & effective way of strength training.
- Simple to use & easy to carry.
- By changing the thickness and length of the elastic band, the level of resistance training can be flexibly increased or decreased.
- Can be designed and tailored for various populations with different levels of bodily functioning (Damush & Damush, 1999).
Evidence-Based Use of the Elastic Band

- Elastic band exercise has proven to be beneficial in both healthy and frail older adults (Dancewicz et al., 2003; Topp et al., 2002).
- Beneficial effects include:
  - Built up muscle strength and endurance
  - Increased flexibility and ROM
  - Enhanced gait and balance
  - Improved functional ability
- Pilot-testing of older adults in wheelchairs, participants slept better and felt more energetic after 4-week of elastic band exercises (Chen, Tseng, Chang, Huang, & Li, 2013).
To test the effects of a 6-month Wheelchair-bound Senior Elastic Band (WSEB) exercises on sleep quality and depression of nursing home older adults in wheelchairs.
Methods

- **Design:** Cluster randomized controlled trail
  - *Baseline, 3-month, and 6-month.*
- **Setting:**
  - 10 nursing homes, southern Taiwan
- **Sampling:**
  - Convenience sampling
  - *Cluster random assignment (E= 5 NH; C= 5 NH)*
- **Sample:**
  - 127 recruited (E = 64; C = 63)
  - 115 completed (E = 60; C = 55)
  - *Retention rate: 90.55%*
  - *Attendance < 50% (n=1) excluded (E=59; C=55)*
Sample Selection Criteria

- **Inclusion criteria**
  - aged $\geq 65$
  - using wheelchairs for mobility
  - live in facility $\geq 3$ months
  - Cognitively intact (SPMSQ $\geq 8$)
  - Heavily or moderate dependent in ADL (BI = 21-90)

- **Exclusion criteria**
  - Severe or acute cardiovascular, musculoskeletal, or pulmonary illnesses
  - Suffering from a SCI with no rehabilitation potential
Two levels: Basic & Advanced

Basic level was taught and practiced for the first 3 months followed by the advanced level for another 3 months.

Warm-up (12 minutes)

• 6 exercises to loosen up the body and cultivate the energy for a safe transition to the next phase.

Aerobic motion (10 minutes)

• 6 low-to-medium speed exercises to pump up the cardiovascular-respiratory system.

Harmonic stretching (18 minutes)

• 6 low-speed, gentle stretching exercises to build up muscle strength/endurance and increase ROM and flexibility.
Special characteristics

- Accommodate the *reduced muscle strength and body flexibility* experienced by many older adults and is *less strenuous*.

- The *thickness of the elastic belt* is chosen as *medium* to allow the level of resistance training to be flexibly increased or decreased.

- Accommodates the special characteristics of the wheelchair, and some exercises are executed using the *wheelchair’s handrails*.
WSEB Program Protocol

- **3 times per week**
- **40 minutes per practice session**
- **6 months**
- **Group practice** (12-15 per group)
- A **pre-recorded CD** made by the PI verbally guided the intervention process
- One certified instructor followed the CD, **demonstrated and led** the elastic band exercises
- The other certified instructor **guarded the safety** of the participants and took the attendance
- **Average attendance rate = 94.51%**
Outcome Measurements & Psychometric Properties

- **Sleep quality: Pittsburgh Sleep Quality Index (PSQI)**
  - 18-item; 7 subscales: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction.
  - Higher score = worse sleep quality.
  - PSQI > 5 = clinically significant sleep disturbances
  - Based on pre-test, $\alpha = .70$.

- **Depression state: Taiwanese Depression Questionnaire (TDQ)**
  - 18-item; Score range 0-54
  - TDQ > 19 = tendency toward depression
  - Based on pre-test, $\alpha = .92$. 
Results
Sample Characteristics
$t = -1.06 \ (p = 0.290)$

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**Age**

Mean: 
- Exp. (n = 59): 78.47
- Con. (n = 55): 79.87

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- **Exp. (n = 59)**
- **Con. (n = 55)**
Gender

Pearson $\chi^2 = 0.14$  $p = .713$
Marital Status

Exp. Group

- Married: 30.70%
- Single: 11.40%
- Widowed: 57.90%

Con. Group

- Married: 30.90%
- Single: 12.70%
- Widowed: 56.40%

Pearson $\chi^2 = 0.21 \ (p = .901)$
Educational Level

Pearson $\chi^2 = 3.63 \ (p = .163)$
SPMSQ

$t = -0.02 \ (p = .982)$
Barthel Index

Mean

Exp. (n = 59) 57.54
Con. (n = 55) 51.45

\[ t = 1.37 \ (p = .174) \]
Number of Chronic Illnesses

<table>
<thead>
<tr>
<th>Number of Chronic Illnesses</th>
<th>Mean</th>
<th>Exp. (n = 59)</th>
<th>Con. (n = 55)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td></td>
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<tr>
<td></td>
<td>2.14</td>
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</tr>
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<td></td>
<td>2.09</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ t = 0.23 \quad (p = .818) \]
Baseline Comparisons
## Baseline of the Two groups (N = 114)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Total M ± SD</th>
<th>Exp. M ± SD</th>
<th>Con. M ± SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjective sleep quality</td>
<td>1.15±0.81</td>
<td>1.07±0.67</td>
<td>1.24±0.94</td>
<td>-1.10</td>
<td>.276</td>
</tr>
<tr>
<td>Sleep latency</td>
<td>1.74±1.19</td>
<td>2.07±1.03</td>
<td>1.38±1.25</td>
<td>3.18</td>
<td>.002**</td>
</tr>
<tr>
<td>Sleep duration</td>
<td>0.96±1.16</td>
<td>1.02±1.17</td>
<td>0.91±1.16</td>
<td>0.50</td>
<td>.622</td>
</tr>
<tr>
<td>Habitual sleep efficiency</td>
<td>1.11±1.28</td>
<td>1.37±1.31</td>
<td>0.84±1.20</td>
<td>2.28</td>
<td>.025*</td>
</tr>
<tr>
<td>Sleep disturbances</td>
<td>0.59±0.61</td>
<td>0.71±0.65</td>
<td>0.45±0.54</td>
<td>2.31</td>
<td>.023*</td>
</tr>
<tr>
<td>Use of sleeping medications</td>
<td>1.20±1.45</td>
<td>1.42±1.49</td>
<td>0.96±1.39</td>
<td>1.71</td>
<td>.90</td>
</tr>
<tr>
<td>Daytime dysfunction</td>
<td>0.58±0.80</td>
<td>0.47±0.77</td>
<td>0.69±0.81</td>
<td>-1.46</td>
<td>.148</td>
</tr>
<tr>
<td>PSQI total score</td>
<td>7.33±4.34</td>
<td>8.14±3.84</td>
<td>6.47±4.71</td>
<td>2.06</td>
<td>.042*</td>
</tr>
<tr>
<td>TDQ</td>
<td>7.78±8.69</td>
<td>7.63±8.40</td>
<td>7.95±9.07</td>
<td>-0.20</td>
<td>.846</td>
</tr>
</tbody>
</table>
Interaction Effects between Time Points and Groups

Results of mix-design, two-way ANOVA indicated that there were significant interaction effects in the following variables:

• **Overall sleep quality** \((F = 5.84, p = .007)\)

• **Sleep duration** \((F = 7.79, p = .001)\)

• **Habitual sleep efficiency** \((F = 8.57, p = .001)\)

• **Depression state** \((F = 13.21, p < .001)\)
Changes among 3 Time Points in Each Group
(One-Way ANOVA Repeated Measure)
Overall Sleep Quality

Exp. (n = 59): $F = 1.85$ ($p = .171$)

Con. (n = 55): $F = 5.02$ ($p = .015^*$)
**Sleep Duration**

Exp. (n = 59): $F = 7.12$ (p = .002**)  
Con. (n = 55): $F = 1.80$ (p = .175)
Habitual Sleep Efficiency

Exp. (n = 59): F = 4.27 (p = .025*)
Con. (n = 55): F = 4.63 (p = .019*)
**Depression State**

Exp. (n = 59): $F = 4.38$ ($p = .022^*$)

Con. (n = 55): $F = 11.27$ ($p < .001^{**}$)
Group Comparisons at Different Time Points (ANCOVA)
### 3-month Time Point

<table>
<thead>
<tr>
<th>Variables</th>
<th>Adjusted $M$</th>
<th>$E$</th>
<th>$C$</th>
<th>$SS$</th>
<th>$df$</th>
<th>$MS$</th>
<th>$F$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Sleep Quality</td>
<td></td>
<td>6.82</td>
<td>7.84</td>
<td>28.46</td>
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<td>28.46</td>
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<tr>
<td>Sleep Duration</td>
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<td>0.64</td>
<td>1.11</td>
<td>6.37</td>
<td>1</td>
<td>6.37</td>
<td>11.09</td>
<td>.001**</td>
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<tr>
<td>Habitual Sleep Efficiency</td>
<td></td>
<td>0.83</td>
<td>1.36</td>
<td>7.70</td>
<td>1</td>
<td>7.70</td>
<td>7.46</td>
<td>.007**</td>
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<tr>
<td>Depression State</td>
<td></td>
<td>5.02</td>
<td>10.58</td>
<td>882.09</td>
<td>1</td>
<td>882.09</td>
<td>28.10</td>
<td>&lt;.001***</td>
</tr>
</tbody>
</table>
## Adjusted $M$

<table>
<thead>
<tr>
<th>Variables</th>
<th>$E$</th>
<th>$C$</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>$F$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Sleep Quality</td>
<td>7.04</td>
<td>8.32</td>
<td>45.27</td>
<td>1</td>
<td>45.27</td>
<td>4.83</td>
<td>.030*</td>
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<tr>
<td>Sleep Duration</td>
<td>0.65</td>
<td>1.15</td>
<td>7.10</td>
<td>1</td>
<td>7.10</td>
<td>10.07</td>
<td>.002**</td>
</tr>
<tr>
<td>Habitual Sleep Efficiency</td>
<td>0.98</td>
<td>1.37</td>
<td>4.10</td>
<td>1</td>
<td>4.10</td>
<td>3.66</td>
<td>.058</td>
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<tr>
<td>Depression State</td>
<td>5.53</td>
<td>11.43</td>
<td>990.41</td>
<td>1</td>
<td>990.41</td>
<td>18.85</td>
<td>&lt;.001***</td>
</tr>
</tbody>
</table>
Conclusions

- After 6 months WSEB, participants had longer sleep duration, better habitual sleep efficiency, and less depression than their baseline.
- Experimental group had longer sleep duration, better habitual sleep efficiency, and less depression than the control group at 3-month and maintained throughout the 6-month study.
- Although the participants were rather old in age, less educated, heavily dependent on others for their ADL, and had multiple morbidities, they were still capable of learning, following, and doing the WSEB exercises.
Study Limitations

- **Convenience sampling** → some elders who met the sample selection criteria but represented critical differences from the sample studied were not recruited due to their location of residence being outside of targeted institutions → **limit generalizability**

- A **cluster randomization** for the group assignment might **undermine the individual differences**; clustering effect might **cause the baseline differences between two groups**, reduce its **statistical power**, and diminish the reliability of the results.
Clinical Implications

- The WSEB program be incorporated as a group exercise activity in long-term care facilities to improve the sleep quality and depression of elderly residents in wheelchairs.

- Nursing home directors could recruit volunteers to learn the program and lead the elderly residents in wheelchairs to practice the WSEB exercises regularly in the facilities.
Comments & Questions