Preventing belt restraint use in newly admitted residents in nursing homes: A quasi-experimental study

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ABSTRACT

Background: Physical restraints are commonly used in psychogeriatric nursing home residents despite reports of negative consequences. Most research has focused on restraint reduction without addressing methods to prevent initiation of restraints in nursing homes. EXBELT has been found to decrease belt restraint use but should also be evaluated for its use in preventing restraints.

Objective: To investigate the effectiveness of the EXBELT intervention to prevent the use of belt restraints on psychogeriatric residents newly admitted to nursing homes.

Design: Quasi-experimental study design.

Setting: Twenty-six nursing home wards from thirteen Dutch nursing homes.

Participants: Newly admitted residents (n = 104) during a four month period.

Interventions: Fifteen wards (intervention group) implemented the EXBELT intervention, which consisted of four components: a policy change, education, consultation and the availability of alternative interventions.

Methods: Data on the use of belt restraints, other types of physical restraints, falls and fall-related injuries and psychoactive drug use were collected at T2 (4 months) and T3 (8 months) after baseline (T1) for those resident who were newly admitted after baseline and before T2 (4 months). Physical restraint use data were collected by a trained, blinded observer four times during a 24-h period.

Results: A total of 104 residents were newly admitted after baseline (T1) and before T2. Of those, 82 were present on T2 and T3. Informed consent was obtained from legal representatives of 49 out of the 82 residents. In the control group (n = 20), 15% and 20% used belts at T2 (4 months) and T3 (8 months), respectively. In the intervention group (n = 29), these proportions were 3% and 0%, respectively (OR = 0.08; 95% CI (0.01–0.76); p = 0.03). There was no increase in the intervention group in the use of other physical restraints, falls and fall-related injuries or psychoactive drug use.

Conclusion: The EXBELT intervention effectively seems to prevent the use of belt restraints in newly admitted residents in psychogeriatric nursing homes.

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What is already known about the topic?

- Physical restraints are often used in psychogeriatric nursing homes. Belt restraints is one of the most restrictive forms of physical restraint currently in use in nursing homes.
- Safety perceptions of nursing home staff result in physical restraint use in order to prevent falls, although many negative physical, psychological and social consequences of restraint use have been reported.
- The most frequently used multi-component intervention in studies aimed at reducing restraint use is that of education and consultation. The results of these studies are conflicting: some reported positive effects, while others found no effect.

What this paper adds

- This study focused on preventing belt restraint use in newly admitted residents as compared to reducing belt usage among already admitted residents.
- The EXBELT intervention includes a policy change, education, consultation and the availability of alternative interventions.
- EXBELT seems to be effective in preventing the use of belt restraints in newly admitted residents; no increase occurred in the intervention group in the use of other physical restraints, falls and fall-related injuries or psychomotor drug use.

1. Introduction

Of the estimated 235,000 people suffering from dementia in the Netherlands, about 40,000 reside in psychogeriatric nursing homes (Alzheimer’s and Association, 2010). Psychogeriatric nursing homes are institutions providing nursing care 24 h a day, assistance with activities of daily living and mobility, psychosocial and personal care, paramedical care, such as physiotherapy and occupational therapy, as well as room and board (Ribbe et al., 1997). They mainly serve very frail, older adults with psychogeriatric disorders, especially people with dementia, that affect autonomous personal care, mobility, continence, and cognitive functioning (Schols and Van der Schriek-van Weel, 2006). Physical restraints are often used in this population: estimates range from 15% to 66% (Capezuti et al., 2007; Hamers et al., 2004; Huizing et al., 2006). The large variance in prevalence estimates can be explained by the usage of different definitions of physical restraint use (e.g. in some studies bedrails were excluded as a physical restraint measure) and differences in data collection methods (resident observations versus questionnaires to nursing home staff about restraint use), next to differences in national restraint policies and characteristics of nursing homes and their residents.

Poor mobility, high dependency and impaired cognitive status are the strongest predictors of restraint usage (Burton et al., 1992; Capezuti, 2004; Gallinagh et al., 2002; Hamers et al., 2004; Sullivan-Marx et al., 1999). Several studies demonstrated that in almost all cases, physical restraints are used as safety measures (Capezuti, 2004; Hamers et al., 2004; Werner, 2002), mainly to prevent falls (more than 90%) (Capezuti, 2004; Hamers et al., 2004; Werner and Mendelsson, 2001). Other uses include the prevention of wandering, the control of restless and aggressive behaviour and maintenance of a resident’s position while seated in a chair (Capezuti, 2004; Castle et al., 1997; Gallinagh et al., 2002; Hantikainen, 1998; Ryden et al., 1999). In nursing homes physical restraints in most cases are used for more than three months and as a routine measure (Hamers et al., 2004). It seems that it is difficult to remove physical restraints once they are deployed. Many negative physical, psychological and social consequences of restraint use have been reported, such as problems with balance and coordination, incontinence, demoralisation, depression, aggression and impaired social functioning. The use of restraints may even increase the risk of serious injury and death (Evans et al., 2003; Healey et al., 2008; Miles and Irvine, 1992; Mohler et al., 2011). In the light of the accumulating evidence regarding the adverse consequences of physical restraint use, their use should be recognized as inappropriate (Hamers et al., 2004; Hamers and Gulpers, 2009; Meyer et al., 2009; Sullivan-Marx, 2001). In addition, physical restraints usage affects human rights which should enable us live full lives with maximum dignity and respect (Hughes, 2008).

Knowing that the use of physical restraints has been shown to be ineffective and sometimes even hazardous, attention must be focused on interventions that can effectively reduce current usage as well as prevent initiation of restraints in newly admitted residents. Up until now, however, attention has mainly focused on the reduction of physical restraint use. Only one study (Huizing et al., 2009b) reported on the prevention of physical restraint use in newly admitted residents. In this study, an educational programme combined with consultation provided by a nursing specialist did not prevent the use of physical restraints in newly admitted residents to psychogeriatric nursing home wards (Huizing et al., 2009b). Most studies that aim to reduce restraint use also have mostly used education and consultation interventions. In studies that aimed to reduce restraint use, in general the most frequently used interventions were also education and consultation. The results of these studies are conflicting: some reported positive effects (Evans et al., 1997; Testad et al., 2005), while others found no effect (Evans et al., 1997; Huizing et al., 2006; Testad et al., 2010). Recent studies confirmed that education alone is not enough to ensure a reduction in the use of restraints (Huizing et al., 2009a; Pellfolk et al., 2010; Testad et al., 2010). The availability of alternative interventions seems to be an important additional prerequisite for eliminating restraint use (Becker et al., 2003; Capezuti et al., 1999; Freeman, 2004; Hoffman et al., 2003). In some countries such as Denmark, Scotland and the US belt restraint use is only permitted under strict conditions (Hamers and Huizing, 2005). These measures seem to have contributed to a reduction in restraint use in these countries (Bower et al., 2003; Castle, 1998, 2002; Dunn, 2001). However, the challenge of finding the ideal combination of interventions to avert the use of physical restraints from clinical practice still remains (Hamers and Huizing, 2005).
Based on the outcomes and implications from previous studies we developed a comprehensive strategy called the EXBELT intervention to reduce and prevent initiation of the use of belt restraints. The strategy includes a policy change, education, consultation and the availability of alternative interventions. The implementation of the EXBELT intervention resulted in a 50% reduction in belt use (odds ratio = 0.48, 95% confidence interval = 0.28–0.81; p = .005) (Gulpers et al., 2011). The aim of the present study was to examine the effect of EXBELT intervention on the prevention of belt restraint use in newly admitted residents of psychogeriatric nursing home wards.

2. Methods

2.1. Design and sample

The present study is part of the quasi-experimental study which focused on the reduction of belt restraint usage in residents with dementia who reside in psychogeriatric nursing homes (Gulpers et al., 2010, 2011). In this study we employed a quasi-experimental longitudinal study with 8 month follow-up to examine the effect of a multi-component intervention programme on reduction and prevention of belt restraints in two different samples: (1) residents living in as nursing homes and (2) newly residents admitted.

The present study focuses primarily on the prevention of belt restraints in newly admitted residents. A total of 104 residents were newly admitted after baseline (T1) and before the T2 measurement (4 months after baseline). Only residents who were newly admitted after baseline (T1) and before the T2 measurement and were present at both the T2 and T3 (8 months after baseline) measurement were included. In order to participate, the prevalence of belt restraint use on the psychogeriatric nursing home ward had to be at least 10%. Belt use was defined as the use of any type of belt restraint applied to the waist at least once a day. Wards were excluded for participation if they were restricted to residents with Korsakoff’s, if wards were undergoing administrative reorganization and/or construction renovations, and if they were participating in other projects and/or studies aimed at restraint use. A total of 26 psychogeriatric wards from 13 nursing homes throughout various regions in the Netherlands were recruited for the study. A total of 6 nursing homes (15 wards) were allocated to the EXBELT intervention group and 7 nursing homes (11 wards) were allocated to the control group (which received care as usual). In order to avoid contamination bias from nursing homes that were situated in close proximity, these were assigned to the same group by the research team. In addition, nursing homes in close proximity were also assigned to the same group in order to keep the study feasible and avoid excessive travel time for the nurse specialists who delivered the educational and consult part of the intervention. Randomization was not feasible by the introduction of the intervention in different parts of the Netherlands with limited nursing staff available (n = 2) and travel distances of more than 200 km. We tried to minimize the travel distances as much as possible. This also accounts for the nursing home staff who participated in the educational program. The study design is described in more detail elsewhere (Gulpers et al., 2010).

2.2. Intervention

The EXBELT intervention was delivered to the 15 wards in the intervention group during the four months following baseline data collection (T1). The EXBELT intervention comprises four key components; institutional policy change, education, consultation and the availability of alternative interventions (Gulpers et al., 2010):

- The institutional policy change discourages the use of belt restraints: written and oral communication with all members of the nursing home staff and with the relatives of residents about a reduction in the current use of belts and the prohibition of belt restraint use on newly admitted residents.
- An educational programme was delivered to members of the nursing home staff (physician, nurses, paramedical staff, psychologist, and ward manager) by a nursing specialist. The content of the training programme was: fall prevention, (negative) aspects of physical restraints, attitudes, decision making and the use of resident-centred alternatives. This programme consisted of three 3-h sessions over a period of 3 weeks. An additional 90-min educational session summarising the content was provided to staff members of the intervention wards who could not attend the educational programme.
- Consultation: two nursing specialists provided on-site consultations with individual nurses on the intervention wards regarding the challenges of reducing and preventing restraint use. A nursing home director was also available for individual consultations with nursing home managers and clinical staff.
- Alternative interventions: alternative interventions were discussed with the multidisciplinary team and with the representatives of the residents. Managers purchased resident-centred alternative interventions such as hip protectors, infrared alarm systems, balance training, exercise, special pillows and adjustable low-height beds.

2.3. Measures

In our study, physical restraints were defined as any limitation on an individual’s freedom of movement by using measures or equipment such as belts (materials attached to the waist) tied to a chair or bed, full-enclosure bedrails and (wheel) chairs with a locked tray table (Hantikainen, 1998). The use of belt restraints (primary outcome) and other physical restraints (secondary outcomes) was measured per resident using an observation tool developed by Huizing et al. (2006). The interrater reliability was found to be perfect (kappa = 1.0) (Huizing et al., 2006). Restraints were simultaneously recorded as present or absent by trained observers who were blinded to the group assignment.

The days and times of observations were not announced to the wards to prevent any temporary removal of belts (Evans et al., 1997; Gulpers et al., 2010). Observations were
made four times during a 24-h period (morning, afternoon, evening and night). Falls and fall-related injuries (e.g., haematomas, bruises, lacerations, joint dislocations and fractures) over the previous 3 months were recorded using an incident reporting system that Dutch nursing homes are required to maintain (Arcares, 2002). Data on psychoactive drug use (antipsychotics, antidepressants, tranquillisers and hypnotic medication) were collected from the residents’ medical records.

2.4. Ethical considerations

Aggregated, restraint use prevalence was collected without resident-identifiers. Since none of the newly admitted participants were cognitively able to provide informed consent, written informed consent was obtained to collect additional demographic data, data on falls, fall-related injuries, and psychoactive drug use, from the legal representatives of the residents. The study design and protocol were approved by both the Medical Ethics Committee of the University Hospital Maastricht and Maastricht University, as well as by the local Ethical Committees of participating nursing home associations.

2.5. Data collection and analysis

Data for this study were collected 4 months (T2) and 8 months (T3) following baseline. The residents for whom we obtained complete data at both T2 and T3 were used and analysed according to the intention-to-treat principle. We used Fisher’s exact test for the categorical variables. Statistical Package for the Social Sciences (SPSS) software version 17.0 was used to perform these analyses. In addition, generalised estimating equation (GEE) techniques were employed to estimate the effect on the main outcome variable (belt restraint use). The GEE analysis accounts for clustering within homes and wards as well as serial correlation (across time points) within residents. We adjusted for baseline characteristics and dependence in the measurements (age, psychoactive drug use and falls) A difference between groups was deemed not due to chance if \( p \leq 0.05 \).

3. Results

For restraint use prevalence we included all residents newly admitted after baseline (T1) that were also present at both post-intervention data collection periods (T2 and T3; \( n = 82 \)) control group \( n = 39 \) and intervention group \( n = 43 \). We collected only observational data regarding physical restraint use from this group.

For 49 residents out of 82, we obtained informed consent from their legal representatives. For these 49 residents, additional information (demographic characteristics, falls, fall-related injuries and psychoactive drug) was available for both post-intervention measurements (T2 and T3) (see Fig. 1). No differences were found between the control \( ( n = 20 ) \) and intervention group \( ( n = 29 ) \) in terms of...
demographic characteristics, sex, recent falls and fall-related injuries or psychoactive drug use at (T2), except age; residents in the intervention group were older ($p = 0.03$) (Table 1).

### 3.1. Belt restraint use

Among the 82 newly admitted residents an increase in the use of belt restraints was observed in those residing in the control ward ($n = 39$) from 8% at T2 to 13% at T3, whereas belt use in the intervention group ($n = 43$) was 2% at both T2 and T3 (13% versus 2%, $p = 0.10$ at T3) (Table 2).

The subgroup of 49 newly admitted residents with informed consent received belt restraints more often in the control group than in the intervention group (at T2 15% versus 3%, $p = 0.29$) although it was not until T3 that this difference became statistically significant (20% versus 0%, $p = 0.02$) (Fig. 2). The GEE model, adjusting for baseline characteristics, confirmed this finding (OR = 0.08; 95% CI (0.01–0.76), $p = 0.03$).

### 3.2. Physical restraint use

As can be seen in Tables 2 and 3, increases in the use of all restraining measures were found in the control group compared to a decrease in the use of these measures in the

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**Table 1**

Background characteristics and outcome measures upon admission ($n = 49$).

<table>
<thead>
<tr>
<th>Measured variables</th>
<th>Control group ($n = 20$)</th>
<th>Intervention group ($n = 29$)</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Background characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>14 (70)</td>
<td>18 (62)</td>
<td>0.76</td>
</tr>
<tr>
<td>Age, mean ± SD</td>
<td>82 ± 6.6</td>
<td>85.9 ± 5.1</td>
<td>0.03</td>
</tr>
<tr>
<td><strong>Outcome measures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belt restraints, n (%)</td>
<td>3 (15)</td>
<td>1 (3.4)</td>
<td>0.29</td>
</tr>
<tr>
<td>Falls, n (%)</td>
<td>8 (40)</td>
<td>11 (37.9)</td>
<td>1.00</td>
</tr>
<tr>
<td>Fall related injuries, n (%)</td>
<td>2 (10)</td>
<td>7 (24)</td>
<td>0.28</td>
</tr>
<tr>
<td>Psychoactive drug use, n (%)</td>
<td>14 (70)</td>
<td>22 (76)</td>
<td>0.75</td>
</tr>
</tbody>
</table>

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**Table 2**

Differences between the intervention and control groups in the use of physical restraints ($n = 82$, complete data).

<table>
<thead>
<tr>
<th>Outcome measures</th>
<th>First post-test after 4 months (T2)</th>
<th>Second post-test after 8 months (T3)</th>
<th>p-Value</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control ($n = 39$)</td>
<td>Intervention ($n = 43$)</td>
<td>Control ($n = 39$)</td>
<td>Intervention ($n = 43$)</td>
</tr>
<tr>
<td><strong>Primary</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belt restraints, n (%)</td>
<td>3 (8)</td>
<td>1 (2)</td>
<td>0.34</td>
<td>5 (13)</td>
</tr>
<tr>
<td><strong>Secondary</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Wheel)chair with a locked table, n (%)</td>
<td>2 (5)</td>
<td>1 (2)</td>
<td>0.60</td>
<td>3 (8)</td>
</tr>
<tr>
<td>Fully enclosed bedrails, n (%)</td>
<td>10 (26)</td>
<td>11 (26)</td>
<td>1.00</td>
<td>12 (31)</td>
</tr>
<tr>
<td>Deep and/or overturned (wheel) chair, n (%)</td>
<td>1 (3)</td>
<td>3 (7)</td>
<td>0.62</td>
<td>2 (5)</td>
</tr>
<tr>
<td>Sleep suits, n (%)</td>
<td>2 (5)</td>
<td>2 (5)</td>
<td>1.00</td>
<td>4 (10)</td>
</tr>
<tr>
<td>At least one physical restraint device, n (%)</td>
<td>12 (31)</td>
<td>13 (30)</td>
<td>1.00</td>
<td>14 (36)</td>
</tr>
</tbody>
</table>

* Effects were assessed by means of Fisher's exact tests.

---

**Table 3**

Differences between the intervention and control groups in the use of physical restraints, falls and psychoactive drug use in newly admitted residents ($n = 49$, complete data and informed consent).

<table>
<thead>
<tr>
<th>Outcome measures</th>
<th>First post-test after 4 months (T2)</th>
<th>Second post-test after 8 months (T3)</th>
<th>p-Value</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control ($n = 20$)</td>
<td>Intervention ($n = 29$)</td>
<td>Control ($n = 20$)</td>
<td>Intervention ($n = 29$)</td>
</tr>
<tr>
<td><strong>Primary</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belt restraints, n (%)</td>
<td>3 (15)</td>
<td>1 (3)</td>
<td>0.29</td>
<td>4 (20)</td>
</tr>
<tr>
<td><strong>Secondary</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Wheel)chair with a locked table, n (%)</td>
<td>1 (5)</td>
<td>0 (0)</td>
<td>0.41</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Fully enclosed bedrails, n (%)</td>
<td>3 (15)</td>
<td>7 (24)</td>
<td>0.50</td>
<td>5 (25)</td>
</tr>
<tr>
<td>Deep and/or overturned (wheel) chair, n (%)</td>
<td>0 (0)</td>
<td>2 (7)</td>
<td>0.51</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Sleep suits, n (%)</td>
<td>2 (10)</td>
<td>2 (7)</td>
<td>1.00</td>
<td>3 (15)</td>
</tr>
<tr>
<td>At least one physical restraint measure, n (%)</td>
<td>5 (25)</td>
<td>8 (28)</td>
<td>1.00</td>
<td>6 (30)</td>
</tr>
<tr>
<td>Falls, n (%)</td>
<td>5 (25)</td>
<td>11 (38)</td>
<td>1.00</td>
<td>4 (20)</td>
</tr>
<tr>
<td>Fall-related injuries, n (%)</td>
<td>2 (10)</td>
<td>7 (24)</td>
<td>0.28</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Fall-related fractures, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychoactive drug use, n (%)</td>
<td>14 (70)</td>
<td>22 (76)</td>
<td>0.75</td>
<td>13 (65)</td>
</tr>
</tbody>
</table>

* Effects were assessed by means of Fisher's exact tests.

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intervention group. However, these differences proved not to be statistically significant.

3.3. Falls and psychoactive drug use

Falls, fall-related injuries and the use of psychoactive drugs did not change among those in the intervention group over time. The number of fallers decreased in the control group between T2 and T3 (from 40% to 20%). Despite this reduction in the number of falls, the percentage of fall-related injuries (10% at T2 and T3) did not change in the control group. No significant differences in falls, fall-related injuries or psychoactive drug use were observed between the two post-intervention points (T2 and T3; Table 3).

4. Discussion

Our study indicates that the EXBELT intervention prevented belt restraint use in newly admitted psychogeriatric nursing home residents. We also found a trend that the EXBELT intervention can prevent the use of other physical restraints. Not using belt restraints did not lead to any adverse effects such as an increase in psychoactive drug use, falls or fall-related injuries. These results are in line with the effects of the EXBELT intervention in the larger study among already admitted residents (Gulpers et al., 2011). That study also showed that a statistically significant decrease in the use of belts and other physical restraints in nursing homes is attainable without causing an increase in psychoactive drug use, falls or fall-related injuries (Gulpers et al., 2011).

The integrated EXBELT approach substantially contributed to the prevention of restraint use. Although education in combination with consultation showed conflicting outcomes in previous studies, these are necessary components of the more comprehensive EXBELT intervention. Education is one of the indispensable elements of any implementation strategy, but additional approaches are often necessary (Grol et al., 2005). However, we believe that the strength of the EXBELT approach is in the combination of its components (institutional policy change, education, consultation and the availability of resident-centred alternative interventions); they all seem necessary aspects for preventing belt restraint. Education informs staff of why and how to minimize restraint use, the consultant reinforces these concepts by demonstrating how to apply alternatives in resident situations. Therefore, it is important that alternative devices, instead of physical restraints, are available and easily accessible to staff. The policy change supports and clarifies what is expected of staff. It also provides a clear message to residents’ relatives regarding the facilities’ regard to restraint use.

Following baseline, implementation of the multi-component intervention began with education. The change of policy, consultation and availability of alternative interventions were implemented before the second data collection period (T3). At the first post-test (T2) the intervention was starting to work, differences in restraint use were found between the intervention and control groups, but this trend was more robust at the second post-test (T3) once the intervention had been fully implemented. This indicates again that the combination of all elements of the EXBELT intervention is required to prevent initiation of restraints in newly admitted residents.

Our study had some limitations. Although we collected observation data on restraint use at both time points (T2 and T3) for 82 newly admitted residents; legal representatives gave approval for participation for only 60% (n = 49) of these residents. This limited our ability to evaluate the demographic characteristics, falls, fall-related injuries and psychoactive drugs data for 40% of the newly admitted residents. Furthermore, we have no data on demographic characteristics and physical restraint use of all newly admitted residents who were only present at one measurement (T2 or T3). Therefore we were unable to assess the impact of sample selection bias which may have implications for the generalizability of the findings. The number of newly admitted residents was not large. The requirement of informed consent further reduced the size of the sample and the power of the study. Consequently, we have to be careful in interpreting our results. However, we still think that our results show a convincing preventive EXBELT trend. Thirdly, a quasi-experimental design was used. In order to avoid contamination bias and excessive travel time, randomization by ward or home was not feasible. For that reason assignment to either the intervention or control groups was done by the research team. Nevertheless, both resident populations were broadly similar. Fourthly, newly admitted residents did not use belt restraints before admission to the nursing home; further information was not available about other types of restraint use before admission. Using physical restraints before admission may impact the use of restraints after admission. Finally, it has often been reported that short-term benefits disappear over time. Between baseline (T1) and the first post-test (T2) (a period of 4 months), the average length of stay of newly admitted residents was 2 months. There was a period of 4 months between T2 and T3. The results at T3 that represent residents with an average stay of 6 months after admission provide a positive indication of the potential long-term effects of the EXBELT intervention to prevent belt restraint and other types of physical restraint use in the newly admitted residents.

5. Conclusion

The prevention of belt restraint and other types of physical restraint use in newly admitted residents in nursing homes seems to be attainable without causing an increase in psychoactive drug use, falls and fall-related injuries. In view of the small sample size and modest follow-up period, it would be desirable to conduct additional studies using larger samples to explore long-term effects of EXBELT on the use of physical restraints on newly admitted residents.

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Trial registration: NTR2140.

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