OBJECTIVES: To determine optimal repositioning frequency of nursing home (NH) residents at risk for pressure ulcers (PrUs) when cared for on high-density foam mattresses.

DESIGN: Multisite, randomized, clinical trial, known as Turning for Ulcer ReductioN (TURN Study).

SETTINGS: NHs in the United States (n = 20) and Canada (n = 7) using high-density foam mattresses.

PARTICIPANTS: Consenting residents (N = 942) aged 65 and older without PrUs at moderate (scores 13–14) or high (scores 10–12) risk of PrUs according to the Braden Scale.

INTERVENTION: Participants were randomly allocated using risk stratification (moderate vs high) to a repositioning schedule (2, 3, or 4 hour) for 3 weeks. Blinded assessors assessed skin weekly.

MEASUREMENTS: PrU incidence (coccyx or sacrum, trochanter, heels).

RESULTS: Participants were mostly female (77.6%) and Caucasian (80.5%) and had a mean age of 85.1 ± 7.7. The most common diagnoses were cardiovascular (76.9%) and dementia (72.5%). Nineteen (2.0%) participants developed superficial PrUs. There was no significant difference (Wilcoxon test for ordered categories) in PrU incidence (P = .68) according to repositioning group (2 hour, 8/321, 2.5%; 3 hour, 2/326, 0.6%; 4 hour, 9/295, 3.1%), nor was there a statistically significant difference in the incidence of PrU between the high and moderate-risk groups (P = .79). Also, PrU incidence was not statistically significantly different between high-risk participants based on repositioning schedule (6/325, 1.8%, P = .90) or between moderate-risk participants based on repositioning schedule (13/617, 2.1%, P = .68).

CONCLUSION: There was no difference in PrU incidence over 3 weeks of observation between those turned at 2-, 3-, or 4-hour intervals in this population of residents using high-density foam mattresses at moderate and high risk of developing PrUs when they were repositioned consistently and skin was monitored. This finding has major implications for use of nursing staff and cost of NH care. J Am Geriatr Soc 61:1705–1713, 2013.

Key words: pressure ulcer prevention; nursing home; repositioning; Turning for Ulcer ReductioN Study

Pressure ulcers (PrUs) are a common problem in nursing home (NH) residents; the prevalence of PrUs in residents at high risk of developing PrUs at the outset of the study was 11.6% according to Nursing Home Compare;¹ other studies have reported a 14% to 24% PrU incidence on standard mattresses or foam overlays.²,³ Economic evaluation of the cost of prevention is emerging and variable, with support surfaces and repositioning identified as more costly elements of prevention.⁴–⁶ Pressure at the interface between bony prominences and support surfaces sufficient to occlude or reduce blood flow to tissues is thought to cause PrUs.⁷,⁸ Redistributing (through properties of support surfaces) and relieving (through repositioning) pressure to reduce length of exposure to pressure prevents PrUs. High-density foam mattresses distribute pressure more evenly and are replacing spring form mattresses.⁹,¹⁰ In practice, repositioning is done less frequently than the recommended every 2 hours,¹¹,¹² and questions remain about appropriate repositioning intervals.¹³,¹⁴

Three previous studies of support surfaces and repositioning schedules have been reported.²,³,¹⁵ Methodological challenges of these studies include that participants at all risk levels were studied despite the likelihood that low-risk subjects do not require repositioning and may have skewed the results; properties of support surfaces differ, with powered overlays and mattresses being more advanced in properties associated with pressure relief or reduction, yet only one study included turning (4 vs 6 hours) on

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high-density foam, and 4-hour turning may be sufficient for care of most moderate- and high-risk individuals; repositioning intervals are not comparable between support surfaces; random allocation has been done according to unit rather than participant; treatment fidelity was only partially reported; and outcome assessment was not masked. Determining appropriate frequency of repositioning is important to clarify guideline recommendations and prevent PrUs.

The objective of this multisite clinical trial, known as Turning for Ulcer Reduction (TURN Study), was to determine the efficacy of three repositioning schedules for PrU prevention in NH residents. It was hypothesized that, if time of exposure to pressure leads to PrUs, incidence of PrUs would increase as repositioning intervals increased.

METHODS

A multisite clinical trial was conducted to determine the efficacy of three repositioning schedules (2, 3, or 4 hour) on PrU prevention in NH residents cared for on high-density foam mattresses and observed for 3 weeks (April 2008 to June 2011).

Settings

Data were collected in NHs in the United States (n = 20) and Canada (n = 7). U.S. NHs were identified through quality improvement organizations, corporate nurse leaders of proprietary chains, the Advancing Excellence Campaign, and other contacts. The Toronto Health Economics and Technology Assessment collaborative identified NHs in Ontario, Canada. NH inclusion criteria were stable leadership and ability to commit facility resources for study participation. U.S. NHs had high-density foam mattresses, defined according to mass per unit volume (1.5–3 pounds/cubic foot) classified as Medicare Group 1 (in NH for ≤7 days) or long-stay residents (in NH for ≥90 days). These groups may be different because short-stay residents may have had recent illness or surgery or physiological or cognitive changes requiring rehabilitation or skilled nursing care. Physiological stress from illness or emotional stress related to relocation may result in high cortisol levels, which can predispose to PrUs, as Braden suggested. Long-stay residents may be more physiologically stable but more challenged by need for assistance with activities of daily living.

Residents were excluded from participation based on length of stay, being younger than 65, a Braden Scale mobility score of 4 (indicating independent mobility), and a Braden Scale score indicating very high (6–9), low (15–18), or no (19–23) risk of developing PrUs. Residents at no or low risk in pilot work do not lie in one position for 2 hours and as a result are not adherent to repositioning protocols. Residents at very high risk (scores ≥9) are often cared for on powered mattresses or alternating-pressure relief overlays.

Instrumental review board (IRB) committees at the University of Texas Health Science Center at Houston, the University of Toronto, and one clinical site approved the protocol. Each facility in the United States completed Federal Wide Assurance, indicating acceptance of University of Texas at Houston institutional review board review before onsite training.

Protocol

Recruitment included screening, obtaining consent, and determining random allocation. Repositioning required on-time turning (±30 minutes) while in bed, documenting the turning episode, reporting skin changes, care of incontinence briefs at each episode, meals, and bathing. Treatment fidelity required independent hourly documentation of position in bed. Adverse event reporting required completing reports promptly. Records review assessed completeness of forms at two levels: collection of demographic data and data transmittal to investigators.

Procedures

NH staff performed the protocol with ongoing quality and fidelity supervision from the research team. NH staff continued performing normal work requirements during the study, necessitating conscious planning to prevent staff overload, so project roles were described, and onsite training was completed for each project role before initiating the study to ensure protocol implementation. A mock trial was conducted after training to enhance protocol and documentation skills and to serve as a team-building activity. Telephone conference calls between the principal investigator, the research team, and the NH Team (site

Participants

Participants were aged 65 and older, were free of PrUs, were at moderate (13–14) or high (10–12) risk of developing PrUs according to the Braden Scale, had mobility limitations (≥3 on the Braden mobility subscale), and were using high-density foam mattresses. Participants were stratified according to risk level to determine whether moderate- and high-risk individuals have different repositioning requirements, a question that a study in which inclusion of low-risk individuals may have improved success of repositioning left unresolved.

Participants were newly admitted short-stay residents (in NH for ≤7 days) or long-stay residents (in NH for ≥90 days). These groups may be different because short-stay residents may have had recent illness or surgery or physiological or cognitive changes requiring rehabilitation or skilled nursing care. Physiological stress from illness or emotional stress related to relocation may result in high cortisol levels, which can predispose to PrUs, as Braden suggested. Long-stay residents may be more physiologically stable but more challenged by need for assistance with activities of daily living.

Residents were excluded from participation based on length of stay, being younger than 65, a Braden Scale mobility score of 4 (indicating independent mobility), and a Braden Scale score indicating very high (6–9), low (15–18), or no (19–23) risk of developing PrUs. Residents at no or low risk in pilot work do not lie in one position for 2 hours and as a result are not adherent to repositioning protocols. Residents at very high risk (scores ≥9) are often cared for on powered mattresses or alternating-pressure relief overlays.

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coordinator, recruiter, outcome assessor, and others) were held weekly until the project was progressing smoothly, then biweekly and later monthly throughout the study to promote quality and fidelity of treatment measures. Project and fidelity measures, recruitment concerns, adverse event reporting, effectiveness of blinding, and any other concerns were addressed. Communication included e-mail, postal service, telephone, text messages, and facsimile.

Procedures are described that related to each role, rationale, contribution to the protocol, and content and length of onsite training. The site coordinator, often the Director or Associate Director of Nursing, was responsible for oversight of the project, including assigning staff to roles, ensuring adherence to the protocol, overseeing a mock trial, and serving as NH champion. The site coordinator attended at least one certified nursing assistant (CNA) and supervisor session and all or significant portions of each remaining role training.

The recruiter, who was not responsible for direct care, followed protocol for screening (alphabetical order on each unit) and obtained consent from those who met the criteria. Consent was obtained after explanation of the study from residents judged to be competent based on answers to protocol-related questions or from a legal representative.

Protocol Allocation
Two sets of numbered envelopes were used, one each for residents at high and moderate risk of developing PrUs. Protocol allocation was conducted by selecting a sealed envelope from numerically ordered risk stratification envelopes. Each envelope contained another envelope with the concealed repositioning frequency. The recruiter prepared a bedside folder containing a fixed indicator dial for the 2-, 3-, or 4-hour repositioning frequency. Because sites varied in size, repositioning frequency was randomized in blocks of 6 (two participants per repositioning schedule) to ensure equal distribution of repositioning at each site, unlike previous studies randomly selecting units.2,3 Up to three participants were studied at one time on each unit; as one participant completed, another began, until all eligible residents were studied (different from other studies occurring for a specific number of days per unit, with subjects studied concurrently).2,3 New residents were studied as they presented, and long-term residents were studied as consent was obtained, but after the newly admitted residents, until all eligible participants had been studied. Training included publicity, screening procedures, consent, random assignment, and human subjects considerations, requiring approximately 5 hours with a project trainer.

Protocol Implementation
Participants were repositioned while in bed. Facility-wide PrU prevention measures, such as use of chair cushions, heel protector boots, heel elevation, barrier creams, and incontinence briefs were continued throughout the study. Participants sat in chairs, stood at intervals, ate meals, bathed, and went to therapy as usual. Regulatory requirements and facility application of best practices guided care within each NH.

Repositioning by CNAs was expected within ± 30 minutes of scheduled time, with documentation recorded at each episode. The protocol included repositioning in bed and brief checks according to schedule. Documentation at each repositioning episode required 1 minute (as assessed by staff) and included time of repositioning, new position (right, left, back, chair), heel position (up, yes or no), skin condition (normal, red, bruised, open), brief condition (wet, dry, soiled), and skin care (washed, barrier cream, brief change). Special observation for individuals with dark skin was taught. Shift handoff was taught to ensure on-time repositioning. Changes in skin over bony prominences were reported to supervisors. Training was completed in 1-hour required inservice education classes offered around the clock, focusing on repositioning, remembering to reposition on time, documentation, assessor blinding, and practice.

Supervisors (licensed nurses) coached nursing assistants, observed and recorded resident position (right, back, left, chair) hourly, reported adverse events, and checked study forms for completeness on each shift. Training of nurse supervisors included CNA sessions regarding repositioning and documentation and assessor blinding plus 30 minutes for adverse event reporting and skin care if red areas were reported.

Licensed nurses assessed Braden Scale risk scores and skin over bony prominences. Training was conducted in 3-hour sessions using videos,21,22 scenarios, and paired independent observations of photographs and residents according to training recommendations for Braden Scale and wound assessment (including dark-skinned individuals) used in previous studies and tested by others.23 Blind procedures were explained (CNA documentation in closed folder, assessments conducted on unassigned units).

The NH assessment coordinator, who received one-on-one training, recorded demographic and participant condition data on study forms. Data were transmitted on a schedule to project offices. The assessment coordinator and data transmittal specialist were trained individually in 2-hour sessions. After the 2- to 3-day training for all roles, a mock trial was conducted before participants were enrolled.

Treatment Fidelity
Treatment fidelity was measured in three ways; CNA documentation on the repositioning checklist was evaluated monthly for percentage of on-time repositioning in bed (repositioning within ± 30 minutes of assigned time/total expected repositioning episodes), mean length of time in one position was calculated based on CNA documentation, and percentage agreement between participant position and length of time in position was calculated from CNA repositioning checklists and supervisor-reported hourly position status. Teleconferences focused on maintaining 80% on-time repositioning and 80% agreement in position changes. Confirmation of recruitment, allocation, masking, assessment, and adverse events was done.

Outcome
Licensed nurses blinded to repositioning schedule assessed the outcome, PrUs on sites susceptible to pressure when
lying in bed (coccyx or sacrum, trochanter, heel),\textsuperscript{24} weekly. Stage 1 PrUs identified on 2 consecutive days excluded false positives caused by reactive hyperemia. The study continued for 3 weeks because 90% of PrUs developed in the first 3 weeks in a previous study.\textsuperscript{3,15}

Data Analysis
To estimate power and sample size, it was hypothesized that 3- or 4-hour repositioning would be significantly and incrementally different from 2-hour repositioning if the combination of high-density foam mattresses, repositioning, and documentation was not effective and if PrU incidence increased from 4% or less to 8% or greater. Sample size needed to detect this change at a one-tailed alpha of 0.05 and power of 0.80 was 900 participants in a per-protocol analysis.

Descriptive statistics were used: frequencies for categorical measures and means and standard deviations for continuous measures. Bivariate analyses were used to test relationships between each risk group and within risk group according to allocation to 2-, 3-, or 4-hour repositioning. Contingency tables were created for discrete variables, and Wilcoxon tests were performed for ordered categories and Fisher exact tests for two-by-two tables. Two-sample t-tests or analysis of variance was used for continuous variables. A two-sided \( P \) value \(<0.05\) was considered statistically significant. Analyses were performed using SAS version 9.2 (SAS Institute, Inc., Cary, NC).

RESULTS
Participants
Of 6,240 residents screened, 1,400 met eligibility requirements, and 967 (69%) agreed to participate (Figure 1). Participants were allocated to 2- (\( n = 335 \)), 3- (\( n = 333 \)), or 4- (\( n = 299 \)) hour repositioning; 25 participants who were allocated but did not receive the intervention because of death, hospitalization, choice, or other reasons before beginning the study were not included in the final per-protocol analysis, resulting in 942 participants (\( n = 321/335, 326/333, 295/299 \), respectively), more than in previous studies.\textsuperscript{3,15}

Participants were predominantly female (77.6%) and Caucasian (80.5%) and had mean age of 85.1 \( \pm \) 7.7. The most commonly occurring diagnoses were cardiovascular (76.9%) and dementia (72.5%) (Table 1). There was no significant difference in age between each risk group and within risk group except for BMI, which was lower in the 2-hour group (\( P = 0.05 \)) and wet times per day, which was more frequent in the 2- than the 3- or 4-hour groups (\( P < 0.001 \)). High-risk participants did not differ according to repositioning group except for wet times per day, which occurred more frequently in the 2-hour group than in the 3- or 4-hour groups (\( P < 0.001 \) (Table 1). The overall mean percentage of meals eaten during the study was 75.1 \( \pm \) 21.6%; high-risk participants ate significantly less than moderate-risk participants (\( P = 0.004 \)).

Interrater Reliability and Fidelity
Interrater reliability for Braden Scale scoring was assessed between trainers and nurse assessors during training (\( r = 0.93 \)) and between facility nurses quarterly (\( r = 0.90 \)). Percentage of on-time repositioning was 82.1% for the total study population; 2-hour repositioning had the highest percentage of on-time repositioning (88.6%; 3-hour, 79.6%; 4-hour, 71.6%). Mean time in one position was 2.06 hours for 2-hour repositioning (median 2), 2.9 for 3-hour (median 3), and 3.7 for 4-hour (median 4). Percentage agreement between CNA and supervisor position recordings was 88.9% for the total study population. Agreement was 88.9% for 2- and 3-hour repositioning and 88.7% for 4-hour.

Outcome
PrUs developed on the coccyx or sacrum (\( n = 18 \)), trochanter (\( n = 1 \)), and heels (\( n = 2 \)) for 21 PrUs on 19 (2.0%) participants. PrUs were limited to superficial Stage 1 (\( n = 2 \)) and Stage 2 (\( n = 19 \)) ulcers. No Stage 3 or 4 or unstageable ulcers developed. Overall, there was no significant difference in PrU incidence (\( P = 0.68 \)) between groups (2-hour, 8/321 (2.5%) ulcers/group; 3-hour, 2/326 (0.6%) ulcers/group; 4-hour, 9/295 (3.1%) ulcers/group; Table 2). The incidence of PrUs was not significantly different between high- (6/325, 1.8%) and moderate- (13/617, 2.1%) risk participants (\( P = 0.79 \)), nor was there a significant difference in incidence of ulcers between high-risk subjects allocated to 2-, 3-, or 4-hour repositioning (\( P = 0.90 \)) or between moderate-risk subjects allocated to different repositioning groups (\( P = 0.68 \)). There were no significant differences between short- (<7 days) and long- (>90 days) stay admissions in allocation groups.

DISCUSSION
The demographic characteristics of participants in the TURN Study were similar to those of three previous studies of repositioning conducted in Belgium and Ireland, with mostly white (80%) and female (77–87%) participants with a mean age ranging from 85 to 87.\textsuperscript{2,3,15}

Incidence of PrUs in the TURN Study was low (2.0%) in moderate- and high-risk participants allocated to three repositioning intervals, unlike in previous studies. Only superficial (Stage 2) and no Stage 3 or 4 ulcers developed. There were no significant differences in PrU development between the high- and moderate-risk groups or within the
high- and moderate-risk groups allocated to 2-, 3-, or 4-hour repositioning. The 2.0% incidence was consistent in moderate- and high-risk participants in the TURN Study and is comparable with the 2007 prevalence of PrUs in low-risk, long-stay residents (2%) in U.S. NHs.1

PrU incidence in the TURN Study was lower than expected, possibly because of the combination of high-density foam mattresses, repositioning, and documentation. Many assume that the incidence of ulcers will increase with less-frequent turning, as some studies have found.2,15 When high-density foam mattresses effectively redistribute pressure, less-frequent repositioning may be possible without increasing PrU incidence.

Considering only 2-, 3-, 4-, or 6-hour repositioning intervals in previous randomized studies of repositioning (Table 3), the low incidence of PrUs in the TURN Study is similar to the 3% (2 ulcers/66 participants) incidence reported previously2 for a 4-hour repositioning group on viscoelastic mattresses (the only group equivalent to the current study) and similar to that of another study15 that reported a 3% (3 ulcers/99 participants) incidence for those on powered mattresses repositioned every 3 hours. Incidence of PrU Stages 2 to 4 reported previously ranged from 14.3% to 24.1% without high-density foam mattresses.2,3,15

No Stage 3 or 4 PrUs were reported in the TURN Study or in the 4-hour repositioning groups of a previous study using high-density foam mattresses,2 but Stage 3 or 4 ulcers developed in other groups in other studies,2,15 suggesting that longer (≥4 hours) repositioning intervals, powered beds, spring mattresses, and overlays did not protect against PrUs. Finding few superficial and no deeper ulcers is consistent with the 4-hour repositioning result in a previous study.2

Participants at high risk were significantly different from those at moderate risk with regard to percentage eaten and brief changes, expected predictors of PrUs, yet there was no difference in PrU incidence between moderate- and high-risk participants. Data suggest that the combination of support surface, repositioning, and documentation were successful in preventing ulcers in the moderate- and high-risk groups.

Consideration should be given to the possibility that the documentation, a consistent part of the protocol, added a measure of safety by reminding CNAs to elevate heels, observe and report skin changes, and document and report continence care. Documentation may have been an effective reminder of preventive care and observations, as reported in previous studies of CNA documentation.26,27

Limitations of the study are related to the many challenges studying NH residents using NH staff. Explicit detailed protocols, onsite training, specific documentation, fidelity measures, and systematic communication with the research team were designed to reduce the limitations.

Figure 1. Turning for Ulcer Reduction Study flow diagram.

2-Hour Turn Group
Allocated to intervention (n=335)
Received allocated intervention (n=321)
Did not receive allocated intervention: (n=14)
Death (n=2)
Hospitalized (n=1)
Other (n=3)
Participant choice (n=8)

3-Hour Turn Group
Allocated to intervention (n=333)
Received allocated intervention (n=326)
Did not receive allocated intervention: (n=7)
Hospitalized (n=1)
Participant choice (n=6)

4-Hour Turn Group
Allocated to intervention (n=299)
Received allocated intervention (n=295)
Did not receive allocated intervention (n=4)
Hospitalization (n=2)
Participant choice (n=1)
Other (n=1)

Lost to follow-up (n=35)
Hospitalized (n=8)
Died (n=6)
Discharged (n=2)
Withdrew (n=14)
Other (n=5)

Lost to follow-up (n=28)
Hospitalized (n=13)
Died (n=2)
Discharged (n=8)
Withdrew (n=5)

Lost to follow-up (n=26)
Hospitalized (n=8)
Died (n=1)
Discharged (n=2)
Withdrew (n=10)
Other (n=5)

Analyzed (n=321)
Did not receive allocated intervention: (n=14)

Analyzed (n=326)
Did not receive allocated intervention: (n=7)

Analyzed (n=295)
Did not receive allocated intervention: (n=4)
Table 1. Demographic and Risk Status Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Moderate-Risk Participants</th>
<th>High-Risk Participants</th>
<th>Overall, n = 942</th>
<th>P-Value (Random Group Comparison)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total, n = 617</td>
<td>2 Hours, n = 210</td>
<td>3 Hours, n = 209</td>
<td>4 Hours, n = 198</td>
</tr>
<tr>
<td></td>
<td>942</td>
<td>615</td>
<td>208</td>
<td>197</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td>(85.2 ± 7.6)</td>
<td>(85.6 ± 7.8)</td>
<td>(84.3 ± 7.7)</td>
</tr>
<tr>
<td><strong>BMI, kg/m²</strong></td>
<td></td>
<td>615</td>
<td>208</td>
<td>197</td>
</tr>
<tr>
<td>n (mean ± SD)</td>
<td></td>
<td>(25.7 ± 5.9)</td>
<td>(24.8 ± 5.4)</td>
<td>(26.2 ± 6.3)</td>
</tr>
<tr>
<td><strong>Braden score total score, n (mean ± SD)</strong></td>
<td>13.6 ± 0.5</td>
<td>13.6 ± 0.5</td>
<td>13.6 ± 0.6</td>
<td>13.6 ± 0.5</td>
</tr>
<tr>
<td><strong>Sensory perception, n (mean ± SD)</strong></td>
<td>2.88 ± 0.58</td>
<td>2.93 ± 0.61</td>
<td>2.83 ± 0.56</td>
<td>2.87 ± 0.55</td>
</tr>
<tr>
<td><strong>Moisture, n (mean ± SD)</strong></td>
<td>2.16 ± 0.63</td>
<td>2.17 ± 0.62</td>
<td>2.12 ± 0.64</td>
<td>2.20 ± 0.64</td>
</tr>
<tr>
<td><strong>Activity, n (mean ± SD)</strong></td>
<td>2.07 ± 0.33</td>
<td>2.07 ± 0.29</td>
<td>2.07 ± 0.37</td>
<td>2.06 ± 0.32</td>
</tr>
<tr>
<td><strong>Mobility, n (mean ± SD)</strong></td>
<td>2.21 ± 0.46</td>
<td>2.21 ± 0.47</td>
<td>2.23 ± 0.46</td>
<td>2.20 ± 0.44</td>
</tr>
<tr>
<td><strong>Nutrition, n (mean ± SD)</strong></td>
<td>2.75 ± 0.61</td>
<td>2.71 ± 0.62</td>
<td>2.81 ± 0.56</td>
<td>2.73 ± 0.64</td>
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<tr>
<td><strong>Friction, n (mean ± SD)</strong></td>
<td>1.50 ± 0.50</td>
<td>1.49 ± 0.51</td>
<td>1.51 ± 0.50</td>
<td>1.51 ± 0.50</td>
</tr>
<tr>
<td><strong>Mean percentage eaten over study, n (mean ± SD)</strong></td>
<td>76.5 ± 20.9</td>
<td>75.8 ± 20.9</td>
<td>77.0 ± 20.5</td>
<td>76.7 ± 21.5</td>
</tr>
<tr>
<td><strong>Wet times/d, n (mean ± SD)</strong></td>
<td>4.04 ± 1.58</td>
<td>4.55 ± 1.72</td>
<td>4.05 ± 1.42</td>
<td>3.49 ± 1.41</td>
</tr>
<tr>
<td><strong>Female, n (%)</strong></td>
<td>464 (75.2)</td>
<td>156 (74.3)</td>
<td>155 (74.2)</td>
<td>153 (77.3)</td>
</tr>
<tr>
<td><strong>Race, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>506 (82.0)</td>
<td>178 (84.7)</td>
<td>175 (83.7)</td>
<td>153 (77.3)</td>
</tr>
<tr>
<td>Black</td>
<td>37 (6.0)</td>
<td>12 (5.7)</td>
<td>7 (3.3)</td>
<td>18 (9.1)</td>
</tr>
<tr>
<td>Asian</td>
<td>59 (9.6)</td>
<td>16 (7.6)</td>
<td>20 (9.6)</td>
<td>23 (11.6)</td>
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<tr>
<td>Hispanic</td>
<td>14 (2.3)</td>
<td>4 (1.9)</td>
<td>6 (2.9)</td>
<td>4 (2.0)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (0.16)</td>
<td>0 (0.0)</td>
<td>1 (0.5)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td><strong>Diagnosis category, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dementia</td>
<td>421 (69.0)</td>
<td>140 (67.3)</td>
<td>142 (68.9)</td>
<td>139 (79.0)</td>
</tr>
<tr>
<td>Cerebrovascular</td>
<td>216 (35.4)</td>
<td>73 (35.1)</td>
<td>80 (38.8)</td>
<td>63 (32.1)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>173 (28.4)</td>
<td>61 (29.3)</td>
<td>63 (35.8)</td>
<td>49 (25.0)</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>491 (80.5)</td>
<td>161 (77.4)</td>
<td>171 (83.0)</td>
<td>159 (81.1)</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>333 (54.6)</td>
<td>118 (56.7)</td>
<td>102 (49.5)</td>
<td>113 (57.6)</td>
</tr>
</tbody>
</table>

(Continued)
Data must be interpreted with these limitations in mind. The study may offer protocols, procedures, and tools to promote translational and quality improvement studies.

Implementation of these findings should consider the protocols of TURN and replacing older, spring type mattresses with high-density foam mattresses; these are prerequisites for repositioning at 3- or 4-hours rather than traditional 2-hour. Participants in the TURN Study were at moderate and high risk on the Braden Scale, suggesting that the findings of this study might be limited to residents at these risk levels. It is likely that vigilant assessment and documentation of factors related to PrU prevention cued staff and helped to reduce the incidence of ulcers. Overall care in studies of repositioning was identified as “facility application of best practices.” As guidelines are developed in which repositioning recommendations are made, documentation may ensure that early signs of PrUs are noted.

There was no difference in PrU incidence over 3 weeks of observations between those turned at 2-, 3-, or 4-hour intervals in this population of NH residents at moderate and high risk of developing PrUs using high-density foam mattresses when repositioning was done consistently and skin was monitored. These findings have potential to influence translational and quality improvement studies and implications for use of nursing staff and cost of NH care.

**ACKNOWLEDGMENT**

**Conflict of Interest:** This work was funded by National Institutes of Health, National Institute of Nursing Research, and National Institute on Aging Research Grant NCT00665535 and by the Ontario Ministry of Health and Long Term Care and the Toronto Health Economic Technology Assessment collaborative.

Bergstrom is co-owner of Prevention Plus, a website dedicated to dissemination, education, and training related to the Braden Scale for Predicting Pressure Sore Risk and pressure ulcer prevention and receives royalties.

**Author Contributions:** Bergstrom N and Horn SD: had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Bergstrom N, Horn SD, Rapp MP: study concept and design. Bergstrom N, Rapp MP, Stern A: acquisition of data. Bergstrom N, Horn SD, Barrett R, Watkiss M: analysis and interpretation of data. Bergstrom N, Horn SD: drafting of the manuscript. Bergstrom N, Horn SD: supervision.

**Sponsor’s Role:** The funding sources had no role in the design or conduct of the study; collection, management, analysis, or interpretation of the data; or preparation, review, or approval of the manuscript.

**Posters:** Rapp MP, Villarreal R, Peffer A, Bergstrom N, Horn SD, Smout R, Pressure Ulcer Prevention and Person-Centered Care. 41st Annual Wound, Ostomy, Continence Nurses Society Conference, St. Louis, Missouri, June 2009.

Bergstrom N, Rapp MP, Villarreal R, Horn SD, Smout R, Stern A, Rubiani G. Turning and Documentation...
Table 2. Incidence of Pressure Ulcers Overall According to Risk Group Stratification and Allocation to Repositioning Interval

<table>
<thead>
<tr>
<th>Group</th>
<th>Participants with Ulcers/All Participants, n/N (%)</th>
<th>P-Value, Wilcoxon (for Ordered Categories)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All participants</td>
<td>19/942 (2.0)</td>
<td></td>
</tr>
<tr>
<td>Moderate risk</td>
<td>13/617 (2.1)</td>
<td></td>
</tr>
<tr>
<td>High risk</td>
<td>6/325 (1.8)</td>
<td></td>
</tr>
<tr>
<td>Moderate vs high risk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Comparison of Pressure Ulcer Risk, Support Surface, and Pressure Ulcer Grade 2 to 4 Incidence According to Repositioning Interval in Four Randomized Controlled Trials

<table>
<thead>
<tr>
<th>Study</th>
<th>Braden Scale Score</th>
<th>Support Surface</th>
<th>2 Hour</th>
<th>3 Hour</th>
<th>4 Hour</th>
<th>6 Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defloor et al.²</td>
<td>Mean 13.0 ± 2</td>
<td>Standard mattress</td>
<td>9/63 (14%)</td>
<td>14/58 (24%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Viscoelastic mattress</td>
<td>2/66 (3%)</td>
<td>Stage 2</td>
<td>10/63 (15.9%)</td>
<td>Stage 2</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Stage 4 (3.2%)</td>
</tr>
<tr>
<td>Vanderwee et al.³</td>
<td>Mean 15.0 ± 3</td>
<td>Viscoelastic foam overlay (7 cm), on top of a standard mattress</td>
<td>17/122*</td>
<td>Stage 2 (13.9%)</td>
<td>22/113³</td>
<td>Stage 2 (19.5%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Stage 3 or 4 (2.5%)</td>
</tr>
<tr>
<td>Moore et al.¹⁵</td>
<td>Braden Activity and Mobility Subscales</td>
<td>99% had powered pressure redistribution overlay</td>
<td>2/99 (2%)</td>
<td>Stage 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turning for Ulcer ReductioN</td>
<td>Moderate risk (13–14)</td>
<td>Viscoelastic high-density foam mattress</td>
<td>Moderate: 6/210 (2.9%)</td>
<td>High: 2/111 (1.8%)</td>
<td>Moderate: 0/209 (0%)</td>
<td>High: 2/117 (1.7%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Stage 2</td>
<td></td>
<td>Stage 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

*Experimental group (2 hours side lying, 4 hours supine, 2 hours side lying) (resulting in 50% of time on 4-hour turning).
¹Control group (4-hour repositioning).

Correction made after online publication September 19, 2013: “4 Hour” and “6 Hour” columns in Table 3 have been updated.

Fidelity in a Randomized Controlled Trial for Pressure Ulcer Prevention, 62nd Annual Scientific Meeting of the Gerontological Society of America, Atlanta, Georgia, November 2009.


Bergstrom N, Horn SD, and colleagues. Symposium: The TURN Study: A Phase 3 clinical trial to determine the incidence of pressure ulcers among moderate and high risk (Braden Scale) nursing facility residents cared for on high density foam mattresses and turned at 2-, 3-, or 4-hour intervals. State of the Science Conference, Council for the Advancement of Nursing Science, Symposium of the State of the Science Conference on Nursing Research, District of Columbia, September 2012. Symposium papers included:

1 Bergstrom N, Horn SD, Rapp MP, Stern A, Barrett R, Watkiss M. Study Design, Settings, and Demographic Characteristics of TURN Study Participants.
2 Bergstrom N, Horn, SD, Rapp MP, Stern A. The TURN Facility Identification, Characteristics, and Orientation to Enable the Conduct of a Randomized Trial in Nursing Facilities.
3 Bergstrom N, Horn SD, Rapp, MP, Stern A, Watkiss M, Barrett R. The TURN Study: Ensuring Treatment and Outcome Fidelity.
4 Bergstrom N, Horn SD, Rapp, MP, Stern A, Barrett R, Watkis, M. The TURN Study: Is There a Difference in Pressure Ulcer Incidence with 2, 3, or 4 Hour Turning of Nursing Facility Residents?

Bergstrom, Nancy. (Keynote, invited). TURNNing: From data to policy to practice. Presented at the Ontario
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