FACULTY OF MEDICINE AND HEALTH SCIENCES

THE FEASIBILITY OF REPOSITIONING PATIENTS WITH AN AUTOMATIC TURNING SYSTEM IN THE PREVENTION OF PRESSURE ULCERS

A CASE SERIES DESIGN

Word count: 6.690

Elien Zwaenepoel
Student number: 01106937

Promotor: Prof. dr. Dimitri Beeckman
Copromotor: MSc. Nico Knibbe
Mentor: MSc. Dorien De Meyer

Master thesis submitted to obtain the degree of Master of Science in Nursing and Midwifery

Academic year: 2016 – 2017

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UNIVERSITEIT GENT

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EENZIJDIGE VERKLARING

NDA-EV	

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Door:

Elien Zwaenepoel	
Student, ingeschreven aan UGent in de richting:	Master of science in de Verpleegkunde en Vroedkunde

Project:	Masterproef: The feasibility of repositioning patients with an automatic repositioning system

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Naam	Elien Zwaenepoel
Handtekening	*Voorafgegaan door handgeschreven vermelding "gelezen en goedgekeurd"* gelezen en goedgekeurd 
Datum:	15/05/'17

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Preface

Writing this master thesis is the final step to graduate and a chance to integrate all of the knowledge and skills I learned but this project could only be realized with the support and the efforts of a lot of other people as well. The research topic of my thesis wasn't the easiest option I could choose and there were some obstacles along the way. However, the learning process was worth the challenge. I would like to thank all of them who made it possible to finish up this project.

First of all, I would like to thank my promotor, prof. dr. Dimitri Beeckman, for giving me the opportunity to start this challenging research process and for supporting me during every phase of writing my first English paper. I also want to show my gratitude to my co-promotor Nico Knibbe and my mentor Dorien De Meyer. They provided me with constructive feedback and motivated me to improve and enhance my thesis.

Secondly, a special word of gratitude goes out to all of the employees of the nursing homes who contributed to the study: nursing managers, caregivers and technicians. They spend a lot of time helping me during the data collection process and I thoroughly appreciate all of the efforts they made to do this in the best way possible.

Furthermore, I want to thank the staff of Vendlet ApS. I acknowledge and appreciate the efforts they have made to provide me the equipment and supplies during the study and to give me the necessary technical assistance, information support service and advice. They even travelled all the way from Denmark or Germany to Belgium to support me when necessary.

Last but not least, a special thanks goes out to Wim, Brecht, Roeland, Soetkin, my parents and friends. Their support during the completion of this thesis really helped me and, maybe even more important, their help to give me the necessary distraction now and then gave me the courage to finish the work.

Abstract (English)

Background: Tailored repositioning of patients at risk of pressure ulcer development is an effective strategy in the prevention of pressure ulcers. However, the repositioning of immobile patients in bed is a physically straining and time consuming task for nursing personnel. The use of assistive devices can reduce the risk to develop musculoskeletal disorders (MSD's) and improve quality of care. Therefore, the evaluation of assistive repositioning devices on both patient and caregiver safety is necessary.

Objectives: This study determined the occurrence of skin problems associated with the use of the repositioning system. Furthermore, the assessment by residents and caregivers was explored, time investments were examined and the occurrence of MSD symptoms was determined.

Methods: A case series design was used to test the feasibility of the automatic repositioning system in the prevention of pressure ulcers. The study was conducted in two nursing homes. All caregivers and eligible residents of four participating wards were included. Data collection was performed by both the caregivers and the researcher using the provided data collection forms.

Results: 13 residents and 36 caregivers participated in the study. The occurrence of pressure ulcers was similar to the occurrence found in other studies. Most of the residents as well as the caregivers regarded the repositioning system as a positive innovation which can contribute to the comfort of patients and to the decrease of MSD symptoms. No time differences were observed but the system can be resource effective as some residents could be repositioned by a single caregiver instead of two caregivers.

Conclusion: The automatic repositioning system is feasible and beneficial for caregivers and patients to reposition immobile patients in bed if the necessary conditions are fulfilled.

Abstract (Nederlands)

Achtergrond: De herpositionering van patiënten met risico op decubitus is een effectieve preventiestrategie. Immobiele patiënten herpositioneren is echter een zeer belastende en tijdrovende taak voor zorgverleners. Het gebruik van hulpmiddelen kan het risico op ontwikkeling van een musculoskeletale aandoening (MSA) verminderen en de kwaliteit van zorg verhogen. Daarom is een evaluatie van het effect van het gebruik van deze hulpmiddelen op zowel de patiënt als de zorgverlener noodzakelijk.

Doel: Deze studie bestudeert het voorkomen van huidproblemen die verwant zijn met het gebruik van het herpositioneringsysteem. Daarnaast wordt de beoordeling door patiënt en zorgverlener, de tijd nodig voor bepaalde handelingen en het voorkomen van symptomen van MSA onderzocht.

Methode: Een reeks case studies wordt bestudeerd om de haalbaarheid van het gebruik van een automatisch herpositioneringssysteem te onderzoeken in de preventie van decubitus. De studie werd uitgevoerd in twee woonzorgcentra. Alle zorgverleners en geschikte patiënten van de vier deelnemende afdelingen werden betrokken bij het onderzoek. Zowel de zorgverleners als de onderzoeker voerden de data collectie uit, aan de hand van de voorziene instrumenten.

Resultaten: 13 bewoners en 36 zorgverleners werkten mee aan de studie. Het voorkomen van decubitus was vergelijkbaar met resultaten uit de literatuur. De meeste bewoners en zorgverleners beoordeelden het systeem positief en erkenden de bijdrage ervan aan zowel het comfort van de patiënt als aan het voorkomen van MSA symptomen. Er was geen tijdsverschil tussen transfers met het herpositioneringsysteem en manueel herpositioneren. Het systeem laat wel toe om sommige patiënten alleen in plaats van met meerdere zorgverleners te herpositioneren.

Conclusie: Het automatisch herpositioneringsysteem is voordelig voor zowel zorgverleners als patiënten indien het correct wordt toegepast.

THIS MASTER'S THESIS IS WRITTEN ACCORDING TO THE STRUCTURE OF A SCIENTIFIC ARTICLE. THE EXTENSIVE REPORT OF THE SYSTEMATIC LITERATURE REVIEW IS NOT PART OF THE ARTICLE. THE LITERATURE REVIEW HAS BEEN EVALUATED IN ANOTHER COURSE.

1 Introduction and research aims

The National Pressure Ulcer Advisory Panel (NPUAP), European Pressure Ulcer Advisory Panel (EPUAP) and Pan Pacific Pressure Injury Alliance define pressure ulcers as "… a localized injury to the skin and/or underlying soft tissue, usually over a bony prominence, resulting from sustained pressure (including pressure associated with shear)" (National Pressure Ulcer Advisory Panel, EPUAP, Pan Pacific Pressure Injury Alliance 2014). In institutional long term and geriatric care, pressure ulcer incidence and prevalence are up to 20% (Kottner et al. 2011, Kottner et al. 2010, De Brauwer et al. 2012). As a result, the annual cost of pressure ulcer treatment in nursing homes in Flanders is estimated to be €4.86 million (Demarre et al. 2015). Besides the treatment cost, pressure ulcers are an extra burden to patients; geriatric patients who develop pressure ulcers are more at risk for hospitalisation and have an increased mortality risk (Medical Advisory Secretariat 2009).

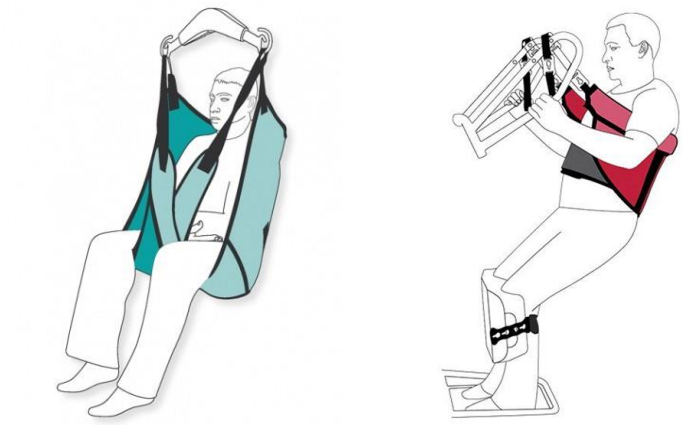
Risk for pressure ulcer development is associated with aging, intensity of sensory perception and a declined general health status but also with impaired mobility and decreased activity (Gillespie et al. 2014). Therefore, regular and tailored repositioning of patients at risk is part of good patient care and an effective strategy in the prevention of pressure ulcers (Latimer et al. 2015, Serraes and Beeckman 2016). When adequate preventive measures are applied (including regular repositioning alongside other preventive strategies to reduce pressure), pressure ulcers can often be prevented, nursing costs can be decreased and quality of life can be improved (Medical Advisory Secretariat (2009, Neilson et al. 2014).

Immobile patients often have low physical and/or cognitive resources which results in difficulties to change their posture in bed by themselves. The repositioning of immobile or bedridden patients constitutes a physically straining and a time consuming task for the nursing staff but it is a core responsibility of

nursing personnel in the prevention of pressure ulcers. This is especially the case in long term care as elderly with a decreased general health status are a vulnerable population to develop pressure ulcers (Gillespie et al. 2014, Hallmark et al. 2015). Repositioning patients in bed is one of the highest risk activities performed by caregivers (Weiner et al. 2017). Among nurses, musculoskeletal disorders (MSD) are the main cause of work-related health problems. The annual incidence of back pain among nurses is 40-50%. 20-24% of the nurses with MSD symptoms had to stay home from work for more than 31 days (Hallmark et al. 2015).

The risk of MSD's among caregivers can be reduced by using assistive devices for patient transfers in bed such as patient lifters (figure 1) and sliding sheets. The use of assistive devices can also improve the quality of care (Edlich et al. 2004). A study in American nursing homes examined the association between the availability of patient lifters on the workplace and workplace injuries and identified a reduce of 41% in the odds of an injury when the nurses had the possibility to use a patient lifter (D'Arcy et al. 2012).

Figure 1. Passive lifter and Standing lifter



In research however, there are some indications of negative effects on patients health associated with transferring patients by using assistive devices. These adverse events include skin-related problems such as abrasions and fall-related events such as fractures (Elnitsky et al. 2014, Peterson et al. 2015). Although the

use of medical assistive devices for repositioning is common in the elderly population and the positive effects on MSD's are demonstrated, the adverse events on patients is only explored in a few studies (Elnitsky et al. 2014).

To guarantee skin safety of elderly adults, iatrogenic skin injuries (such as pressure ulcers, incontinence associated dermatitis (IAD) and skin tears) need to be prevented (Campbell et al. 2016). Aging is associated with changes in the physical and chemical barrier function of the skin because cell replacement is declined, wound healing is compromised, immune responses are delayed, thermoregulation is affected and sweat and sebum production are declined (Kottner et al. 2013). This makes the skin more vulnerable to external factors. Consequently, the ability of the skin to resist friction is reduced. In a geriatric population, cutaneous aging is relevant as these age-related changes often result in skin problems such as xerosis, skin tears and pressure ulcers (Humbert et al. 2016, Elnitsky et al. 2014). In this study, an automatic repositioning system to change the posture of patients in bed is evaluated. It is presented by the developers to be safe for the caregiver as well as for the skin of the patients. Evaluation of assistive repositioning devices on both patient and caregiver safety is rare.

The purpose of this study is to determine the operational feasibility of the automatic repositioning system to change the position of elderly, immobile patients in bed in the prevention of skin problems. The following research questions will be addressed:

1. What is the occurrence of skin problems related to the use of the automatic repositioning system?
2. How do residents and caregivers assess the automatic repositioning system?
3. Is there a time difference between repositioning manually and automatically?
4. What is the occurrence of MSD symptoms with caregivers related to the use of the automatic repositioning system?

2 Methods

2.1 Study design

A case series study was performed to determine the feasibility of the automatic repositioning system Vendlet V5s® in the prevention of pressure ulcers. Every participating resident was exposed to the intervention during a period of four weeks between December 2016 and march 2017.

2.2 Setting

A convenience sample of nursing homes was invited to participate. The study was conducted in a nursing home, because a significant part of its' residents meet the criteria of the target population of the Vendlet system (section 2.4 Intervention). Six facilities in West-Flanders (Belgium) were invited to participate in the study via email, including a brief summary of the experiment. If the population of the facilities corresponded to the preconceived inclusion criteria (section 2.3 Target population and participants), further information concerning the study was provided during a face-to-face meeting. Four facilities refused to cooperate because the project didn't fit their planning or because there were not enough eligible residents. Two nursing homes agreed formally to participate in the study. Four wards were included; one ward in nursing home A and three wards in nursing home B. In both facilities, there are caregivers who exclusively work in night shifts and caregivers who work during the day in different shifts. The ratio of nurses to nursing assistants is 2:7 in facility A and 4:9 in facility B.

2.3 Target population and participants

All residents of the four participating wards were screened for eligibility. Residents were selected as eligible participants if they met the following criteria:

- having an impaired mobility based on two items of the Braden-scale: activity (maximum score of 2) (Kottner et al. 2008) and mobility (maximum score of 2) (Powers et al. 2004);
- receiving routine repositioning as part of daily care.

Being unable to give oral informed consent was an exclusion criteria.

The head nurse of each ward assessed the eligibility of the participants. Each four week period, a random sample of eligible participants was taken by the researcher to determine which residents could potentially be included. The size of the sample was determined by the availability of beds with the installed repositioning system (Vendlet V5s®). Random selection of the elderly occurred by using the software package SPSS statistics (23).

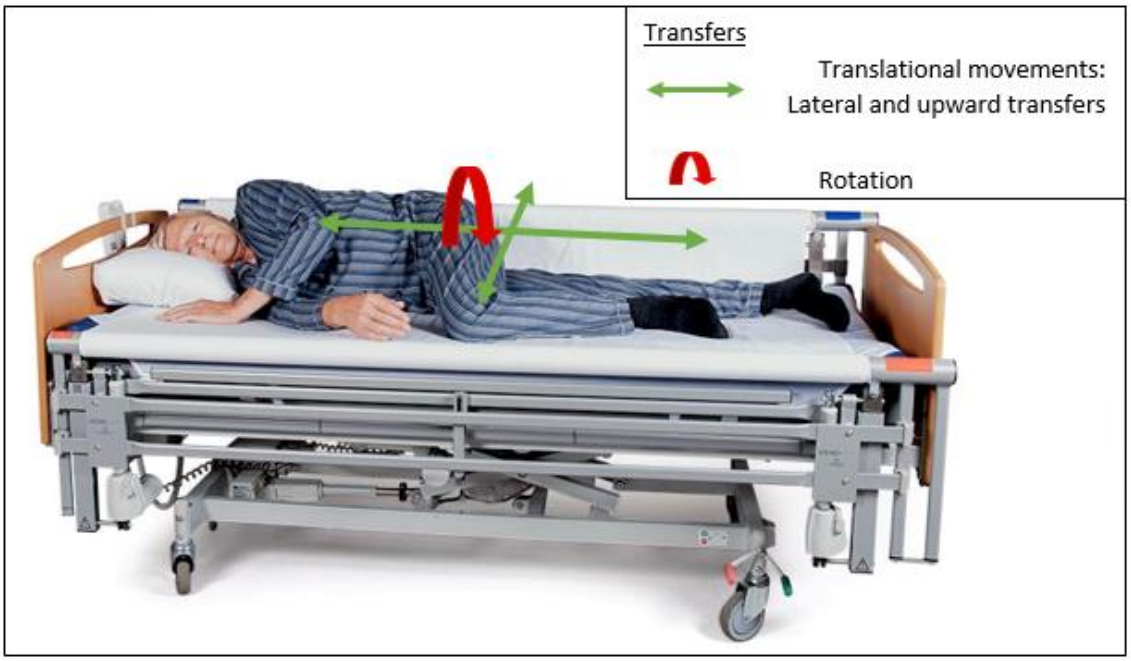
All caregivers were included in the study. Blinding of caregivers and participating residents was not possible because of the obvious visible differences between a normal bed and the beds with the Vendlet V5s® system.

2.4 Intervention

In this study, an electro-mechanic patient turning system Vendlet V5s®, developed by the Danish company Vendlet ApS, was tested. The repositioning system was used by the caregivers on a daily basis for four months. The Vendlet V5s® is a medical device attached to the bedframe and developed to assist health care workers with the repositioning of patients in bed. Six beds with an installed Vendlet V5s® were available for the study. A period of four weeks was provided for each participating resident.

The system consisted of two lateral bars on each side of the bed and a sheet that can be wound up on these bars. The system enabled caregivers to reposition patients with a remote control. During the study, the repositioning was performed according to the standards determined by the company Vendlet ApS (Vendlet ApS 2016). Repositioning was defined as a rotation, a lateral transfer, an upward transfer or a combination of these three transfers (Figure 2). By operating the remote control with one hand and supporting the patient with the other, the position of the patient could be changed.

Figure 2. Transfers (Vendlet ApS, http//:www.vendlet.com, 2017)



The Vendlet V5s® is designed for patients who are dependent of others to receive daily care and have a weight which ranges between 40 kg and 200 kg. According to the manufacturer, the system is suitable for individuals with an impaired mobility, using a patient lifter or a standing aid to be transferred in and out of the bed. Furthermore, the manufacturer claims the Vendlet V5s® is appropriate for patients at risk for pressure ulcer development. The system aims to have a positive effect on patients' comfort and skin condition as well as on the workload of caregivers (Vendlet ApS, http//:www.vendlet.com, 2017).

The installation of the Vendlet V5s® requires compatibility with the bed. Since the beds in the participating nursing homes didn't meet the necessary requirements, six beds including the installed Vendlet V5s® systems were made available by Vendlet ApS for a period of four months. The most common compatibility issues were insufficient length of the bed(frame) or a bed lacking a square steel frame. Therefore, the intervention included the use of both the Vendlet V5s and a different bed. The mattresses used during the study were the same mattresses as the ones the residents used before.

2.5 Data collection

2.5.1 Outcomes

The purpose of this study was to gather information about the use of the Vendlet V5s® repositioning system. Study outcomes were data on skin condition, patient comfort, user friendliness of the Vendlet V5s®, musculoskeletal disorders (MSD) and time taken by caregivers to reposition the residents.

At baseline, the following basic characteristics of the patients were collected by the researcher (Appendix 1): year of birth, gender, comorbidities, relevant treatments, length, weight, Braden-score, mobility level, skin condition, incontinence status, type of mattress and Katz-score.

A time span of four weeks assured the possibility to evaluate the skin condition of the patients. Assessment of the skin condition was performed on a daily basis by the caregivers of the nursing homes. Twice a week (eight times for each resident), the caregivers evaluated the skin condition and documented their assessment on a survey sheet. When abnormalities of the skin condition were observed during the daily assessment (changes in comparison with the day before), registrations were performed simultaneously.

The time spent on repositioning was recorded for three types of transfers: rotations, lateral transfers and upward transfers were used as a standard according to the possibilities of the Vendlet system. Time measurements (minutes: seconds) were collected by the researcher through direct observation of repositioning of the patients. A chronometer was used: the measurement started when the caregiver took the remote control and ended when the transfer was completed and the posture of the patient was executed as the caregiver intended to do. Next, the caregivers were asked to write down the estimated time needed to perform the repositioning with and without using the Vendlet V5s®.

2.5.2 Instruments

Skin condition

The survey sheet to document the skin condition consisted of a list of skin observations. The occurrence of a pressure ulcer was defined according to the classification system of the European and the US National Pressure Ulcer Advisory Panels (EPUAP and NPUAP 2014). In this system, there are seven possible outcomes to assess the level of severity of possible pressure ulcers: no pressure ulcer, four categories of pressure ulcers, an unstageble pressure ulcer or a deep tissue pressure ulcer. The four categories are ranged from category I (non-blanchable erythema of intact skin) to category IV (full-thickness skin and tissue loss). Furthermore, the presence of skin tears, pain, increased temperature of the skin and presence of blanchable erythema were documented as well. Finally, data related to repositioning was recorded: frequency, position and reasons for repositioning (Appendix 2).

Assessment of caregivers and residents and MSD symptoms

Two questionnaires were used to evaluate the Vendlet V5s® by both the patients and the caregivers. The questionnaires were in Dutch and based on two questionnaires currently used in a study to evaluate another type of repositioning device (De Meyer et al. 2017). The questionnaire for assessing patient comfort consisted of 7 items. Five of them were related to respectively general comfort, intensity of the noise generated by the system, appraisal of the noise, lying comfort and effort of the patient during repositioning using a 10-point Likert scale. The two other items concerned patients' complaints and preferences. These items were formulated as multiple choice questions (Appendix 3).

The questionnaire for the assessment of the caregivers relating to the Vendlet V5s® consisted of 12 items. Six items used a 10-point Likert scale, one was a multiple choice question, four items were yes-no questions and the twelfth item was the Nordic questionnaire. The first 6 items dealt with general evaluation, the added value, positive patient feedback, negative patient feedback, the feedback of colleagues, a comparison of the Vendlet V5s® to manual repositioning and

relief of physical overload. The other 6 questions dealt with muskuloskeletal disorders (Appendix 4).

2.6 Procedure

Before actual data collection was started, the researcher organized and performed a training program for the caregivers to ensure proper usage of the Vendlet V5s® system. The training sessions were scheduled to maximize the attendance of staff members of the participating wards. On each ward, one caregiver was responsible to train new colleagues or staff members who could not participate in one of the formal training sessions. The head nurse of the ward or the facilities project leader followed up on the training. One session preceded the start of the experiment and was organized on every ward in cooperation with a skilled staff member of the company Vendlet ApS. It was held 4 weeks before the start of the data collection (start-up phase) to give the caregivers sufficient time to get used to working with the Vendlet V5s system. The second session took place at the start of the study. 24 caregivers participated in 1 or more training sessions. Subsequently, for each ward the responsible person was asked to gather all remarks and to explain problems experienced by the caregivers during working with the Vendlet V5s® system. The researcher communicated and resolved identified problems with Vendlet ApS and the promotor of this study.

Besides the two hands-on training sessions, instruction videos (considering information about the use, the assembly and the practical operations of the system) in Dutch were available one month before the start of the study. A detailed technical manual of the Vendlet V5s® was available in every nursing office of the participating wards. To facilitate the use of the Vendlet V5s® system in the start-up phase, every installed bed was equipped with a quick guide.

The second training session included an introduction to the study aims and the progress of the study. Next, the data collection form was explained to assure uniformity and correctness of the completion of the skin observation form.

Furthermore, the caregivers could keep using the standard repositioning protocol of the facility.

During the study, the skin of each resident was observed daily and recorded twice a week. Particular efforts were made to make the information clear and accessible for as well nurses as other caregivers. During the first period of data collection, the caregivers were accompanied by the researcher to complete the skin observation form. This allowed caregivers to become familiar with the data collection procedure. The information about the data collection form was available in a well-ordered document available in the nursing office and also in the cover letter of the informed consent document. Data were collected between December 2016 and March 2017.

Skin assessment was performed by the caregivers, supervised by a qualified nurse. The inter-rater reliability of the skin observations between the caregivers and the researcher is calculated by the researcher based on weekly observations from the second 4 weeks of data collection onward (because in the first four week period, the caregivers were regularly assisted by the researcher to complete the survey sheet). These observations of the skin condition by the researcher occurred blinded for the caregivers while time measurements were performed.

2.7 Analysis

On admission, baseline characteristics were collected to determine the target population of the repositioning system. Descriptive statistics, medians and frequencies, were used to present categorical data. The inter-rater reliability (intraclass correlation coefficient) was computed to quantify the degree of agreement between skin assessment performed by the caregivers and the researcher. Fisher's exact test were performed to determine differences among groups. Data was analysed by using the statistical program SPSS (version 23).

2.8 Ethical considerations

The study was conducted in compliance with the ethical rules for human experimentation stated in the Declaration of Helsinki. The study was approved by the Ethics Committee of Ghent University hospital (B670201630119) in 2016. Written informed consent was obtained from all participants (personnel, residents of the nursing homes or in some cases their representative) by the researcher.

3 Results

3.1 Residents' perspective

Twenty-two residents met the inclusion criteria, eight in the first nursing home and twelve in the second. Six residents did not give consent to participate. There was a drop out of three residents, one because of technical problems and two because of dissatisfaction with the system from the start. The final sample size was thirteen residents, three in the first nursing home and ten in the second. Figure 3 is a flowchart of the inclusion process of the residents.

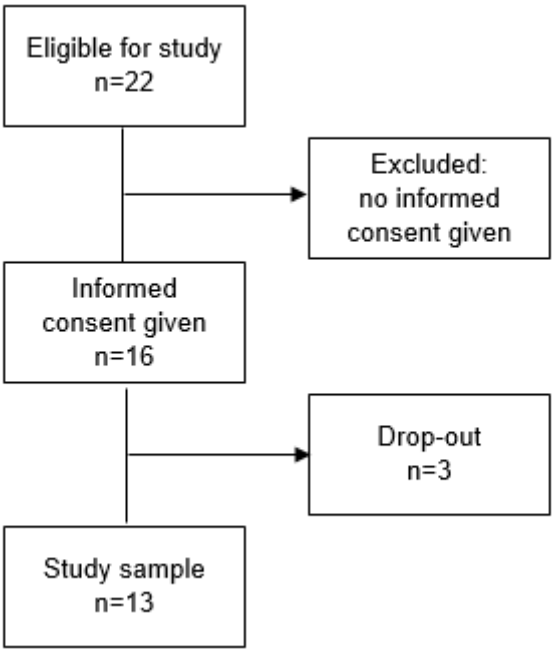


Figure 3. Flowchart of the inclusion process of residents.

3.1.1 Baseline characteristics of participating residents

The participants in the study were predominantly female: nine women participated and four men. The median age was 86 years (range 74-99 years). The median risk assessment score on the Braden scale was 14 (range 12-19). Two residents had a score of one at the activity subscale and eleven residents scored two. Six residents had a score of one at the mobility subscale and seven scored two. The median weight of the residents was 70,7 kg. The residents had a median body mass index of 28,7. The median score on the Katz scale was 22.

The residents had a mobility level C, D or E. Five people had a mobility level C, six people had level D and the remaining two people had level E. The sample consisted of long-stay residents of which two persons were newly admitted to the nursing home. Ten residents had urinary incontinence and six of them were incontinent for faeces as well. Five residents were using a viscoelastic mattress and eight residents were using a dynamic air mattress (Alpha XL, Arjohuntleigh).

3.1.2 Skin condition

At baseline, four residents had a pressure ulcer. Resident A had two pressure ulcers: a category one pressure ulcer was situated on the left heel and a category two pressure ulcer on the sacrum. Resident B had two category one pressure ulcers situated on the sacrum and the left heel. Resident C and resident D both had a category four pressure ulcer situated on the sacrum. Resident D had a category one pressure ulcer situated on the heel as well. The other residents didn’t have pressure ulcers before the start of the study.

There were no residents who had skin tears at baseline. Resident E and F had moisture-associated skin damage situated on the gluteal sulcus and the sacrum respectively. The remaining 10 residents had no other wounds. Resident G and H had blanchable erythema situated on the heel. Resident I had back pain and resident J had pain located on the heel. Resident K, L and M had none of previously mentioned complaints.

During the experiment, two residents (resp. B and I) developed a pressure ulcer: a category I pressure ulcer and a category II pressure ulcer. Four pressure ulcers healed during the experiment. Six residents (resp. G, H, J, K, L and M) didn't had pressure ulcers during the four week period. The interrater-reliability between the skin observations of the researcher and the caregivers on-site was 0.79 (95% CI, 0.63-0.89).

3.1.3 Case studies

Table 1 shows a summary of basic characteristics, the skin condition and important observations of the 13 participants.

Table 1 Case series

Resident	*A*	*B*	*C*	*D*	*E*	*F*
Gender	Male	Female	Female	Female	Female	Female
Age	86	85	83	91	86	97
Comorbidities	Parkinson's disease	Parkinson's disease	Osteoporosis	Parkinson's disease	Multiple sclerosis	CVA with paresis of the left leg
Braden score	13	14	12	13	12	13
Mobility	2	2	2	1	2	2
Activity	2	1	1	1	1	1
Mobility level	Mobility level C (B) → mobility level E (D16-24)	Mobility level D (B) → mobility level E (D2-7) → mobility level D (D8-28)	Mobility level D (B + D1-28)	Mobility level E (B + D1-28), bedridden for a few years	Mobility level D (B + D1-28)	Mobility level D (B + D1-28)
Weight (kg)	77.7	47	43	73.1	57.7	70.7
BMI	27.9	21.2	17.9	38	24.8	34.1
Type of Incontinence	Urinary + faecal	-	Urinary + faecal	Urinary + faecal	Urinary + faecal	Urinary
Type of mattress	Foam (B) →Dynamic air mattress (D20)	Dynamic air mattress	Dynamic air mattress	Dynamic air mattress	Dynamic air mattress	Dynamic air mattress
Katz score	24	20	27	28	22	21
Skin Condition	Cat. 2 PU situated on the sacrum and a cat. I PU on the left heel (B) → cat. I PU at the sacrum (D9) → cat. II PU at the sacrum, BE: varying on the heel, ST: -	2 cat. I PU's situated on the sacrum and the left heel → no PU's (D3) → cat. I PU on the heel (D26), BE: 6/8 registrations, ST: -	Cat. IV PU situated on the sacrum (B + D1-28), BE: shoulder (D18), lower leg (D25), 4 NS, ST: -	Chronic cat. IV PU situated on the sacrum (B + D1-28) cat. I PU on the heel (D24), BE: back and heels (D3), hip (10) ST: -	No PU or injuries (B) → IAD (D18-28), BE: NS (D9 and D22), on the sacrum (D16), on the heel (D19 and D26), ST: -	No PU or injuries (B) → IAD (D2-9), BE: on the heels (D22), right calf (D22-28) and on the sacrum (D1-16), ST: -
Pain	From day 20 on: pain situated on the sacrum	Pain was registered during the last two registrations	3/8 registrations: NS	3/8 registrations: 1x wrist, 2x NS	-	Buttock (D2-9), calf (D24-28)
Observations	Day 16-20 hospital admission, not cooperative during care	Illness (D2-7)	Incapable to reposition herself	Urinary catheter, incapable to reposition herself	Incapable to reposition herself	Nervous and anxious person

Resident	**G**	**H**	**I**	**J**	**K**	**L**	**M**
Gender	Male	Female	Male	Male	Female	Female	Female
Age	74	93	84	81	99	92	78
Comorbidities	Parkinson's disease, depression	Paresis of the right leg	Diabetes, degenerative changes in the cervical spine	Paresis of the left arm and leg	Hernia	Rheumatoid arthritis	Hemiparesis, osteoporosis
Braden score	14	17	13	19	17	15	16
Mobility	2	2	1	2	2	2	2
Activity	1	2	1	2	2	2	2
Mobility level	Mobility level D (B + D1-28)	Mobility level D (B + D1-28)	Mobility level E (B + D1-4) → Mobility level D (D4-28)	Mobility level C (B + D1-28)	Mobility level C (B + D1-28)	Mobility level C (B + D1-28)	Mobility level D (B + D1-28)
Weight (kg)	87.3	58	85	79.7	45.2	83	67.6
BMI	28.7	23.9	29.3	29.3	21.3	37.8	31
Type of Incontinence	Urinary + faecal	Urinary	Urinary + faecal	-	-	Urinary	Urinary + faecal
Type of mattress	Dynamic air mattress	Foam	Dynamic air mattress	Foam	Foam	Dynamic air mattress	Foam
Katz score	28	22	26	11	15	22	28
Skin Condition	No PU or injuries (B) → IAD (D5-7), BE: heel (B), registered on D1 and D8, ST: -	No PU or injuries (B + D1-28), BE: heel (B), NS (D8 and D15), ST: -	No PU (B), IAD (B + D 1-28) → cat. I PU situated on the sacrum (D1) → cat. II PU (D4-28) BE: /, ST: -	No PU or injuries (B + D1-28), BE: -, ST: -	No PU or injuries (B + D1- 28), BE: -, ST: -	No PU or injuries (B + D1-28), BE: -, ST: -	No PU or injuries (B + D1-28), BE: - , ST: -
Pain	D5 and D12: NS	Back pain (D5), NS (D12 and D16)	Severe back pain (B + D1-28)	-	-	Back pain (D5)	Pain while mobilising her right arm/leg
Observations	Little responsive, not cooperative during morning care	Participation for two weeks: her bed could not be transferred to her new room	Increasingly comfortable during morning care concerning back pain and stress levels	Cooperative during morning care	Cooperative during morning care	Not cooperative during morning care, quickly agitated	Very tiring to reposition herself in bed

Abbreviations: PU=pressure ulcer, B=baseline, D1-28=day 1-28, BE=blanchable erythema, ST= skin tears, NS= not specified, IAD=Incontinence Associated Dermatitis

3.1.4 Appraisal of the Vendlet V5s® system by the residents

Nine patients (resp. A, B, E, F, G, I, J, K, L) completed the questionnaire. All of the questionnaires were completed by the researcher during an interview with the resident. The four patients who didn't complete the questionnaire had the following reasons: three patients could not differentiate between the bed, mattress and the Vendlet system and one patient was hospitalized after the experiment which made it impossible to complete the questionnaire within ten days after the experiment.

Resident A, B, G and I reported they prefer to be repositioned with the help of the Vendlet V5s®. Resident J and K preferred to be repositioned manually. The three other residents (F, E and L) reported that their preference depended on which caregiver performed the repositioning. Table 2 presents the results of the questionnaire for each resident who completed the questionnaire.

Table 2. Assessment of the Vendlet V5s® by the residents

Residents	**A**	**B**	**E**	**F**	**G**	**I**	**J**	**K**	**L**
How do you evaluate the general comfort provided by the automatic repositioning system? (1 = not comfortable at all, 10 = very comfortable)	8	9	10	5	6	9	5	8	8
How comfortable does your new position feels after being repositioned with the Vendlet system? (1 = not comfortable at all, 10 = very comfortable)	8	8	10	6	10	8	7	7	8
Is the system making noise during utilisation? (1 = a lot of noise, 10 = no noise at all)	5	10	9	10	10	8	10	10	10
Is the noise annoying? (1 = not annoying at all, 10 = very annoying)	2	1	1	1	1	1	1	1	1
How fatiguing is the repositioning? (1 = not fatiguing at all, 10 = very fatiguing)	2	2	1	8	1	1	1	1	1

3.2 Caregivers' perspective

The informed consent forms were signed by 48 caregivers of the 4 participating wards. 36 caregivers completed the questionnaire which indicates a response rate of 75%. The respondents were 9 caregivers of nursing home A and 27 caregivers of nursing home B. The sample consisted of 16 nurses and 19 nursing assistants. 61% (n=22) of the caregivers indicated they worked several times with the Vendlet V5s® system and 28% (n= 10) used the system frequently. A minority of 11% (n= 4) used the system once or did not answered the question.

3.2.1 Appraisal of the Vendlet system by caregivers

The mean score for the overall appraisal of the Vendlet system by caregivers was 6.5/10 (range 3-10). A statistically significant difference was found between the overall appraisal of the Vendlet V5s® among caregivers of nursing home A (5/10) and nursing home B (7.04/10) (p=0.012).

More than 70% (26/36) of the caregivers indicated that the Vendlet V5s® contributed to the repositioning of patients with an impaired mobility. 31% of them perceived it as a contribution to the repositioning (score of ≥8). 25% announced that the system rather not contributed to the repositioning of patients with an impaired mobility (score of ≤5).

The caregivers tend to score the amount of feedback received by patients very divergent (Table 3). The mean extent of the amount of positive and negative feedback of patients reported to the caregivers was respectively 4.56 for positive feedback and 5.8 for negative feedback.

Table 3 The extent of positive and negative feedback of residents received by caregivers (n=36), 1=no feedback at all, 10=a lot of feedback

SCORE	1	2	3	4	5	6	7	8	9	10
RECEIVED POSITIVE FEEDBACK	3	4	5	3	10	4	4	3	0	0
RECEIVED NEGATIVE FEEDBACK	1	4	2	3	6	3	5	8	1	2

A slight majority of the respondents (19) indicated that the appraisal of colleagues was rather positive.

All of the respondents indicated there is a difference between manual repositioning and repositioning with the use of the Vendlet V5s® system. 8% (3) of the caregivers announced there is only a small difference. 75% (19) announced the repositioning of patients is easier with the Vendlet V5s® system compared to manual repositioning. 17% (6) of the caregivers experienced the repositioning with the Vendlet V5s® system as more difficult than manual repositioning.

3.2.2 Musculoskeletal disorders

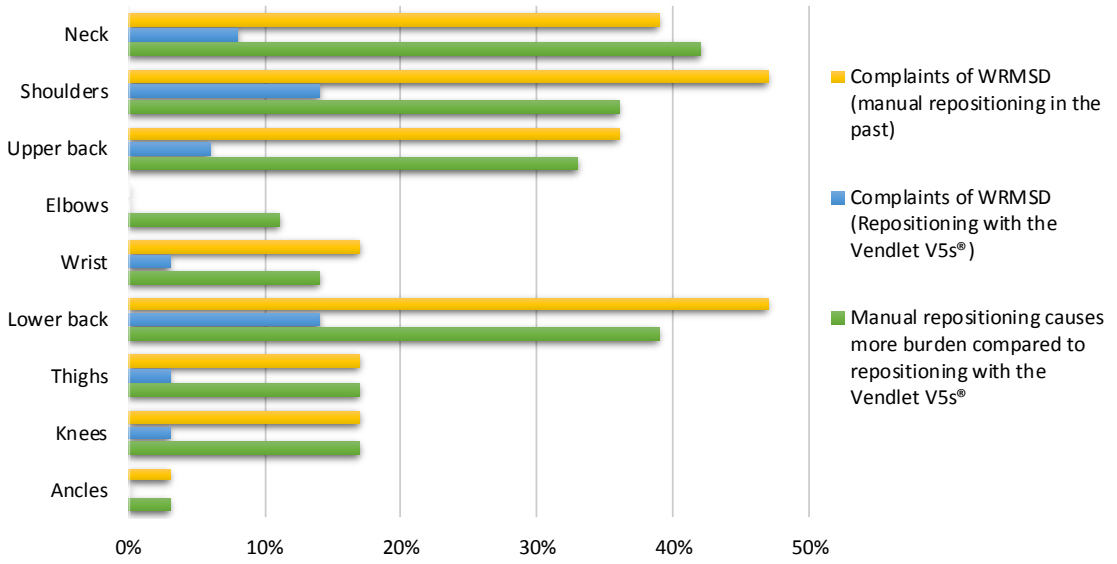
The prevalence of back pain and neck/shoulder complaints among caregivers was respectively 61% (22) and 50% (n=)18 over the past year. During the past three months, 50% (n=18) of the caregivers had back pain. The prevalence of neck and shoulder complaints during the past three months was 50% (n=18) as well.

Most of the caregivers (63,9%) indicated they once had WRMSDs symptoms in one or more body regions while repositioning patients. 19.4% (n=7) of the caregivers had WRMSDs symptoms in one or more body regions while repositioning patients with the Vendlet V5s®. 52,8% (n=19) of the respondents

indicated manual repositioning of patients causes more complaints in one or more body regions than repositioning with the Vendlet V5s®.

The presence of musculoskeletal complaints during manual repositioning in the past occurred predominantly in the region of the lower back (47%)(n=17), the shoulders (47%)(n=17), the neck (39%)(n=14) and the upper back (36%)(n=13). The modal body regions reported by the respondents where they experienced pain during repositioning, with the Vendlet V5s®, were the same but there were fewer complaints: respectively five (14%) reports of pain in the lower back, five (14%) in the shoulders, three (8%) in the neck and two (6%) in the upper back. Even if the caregivers were asked to indicate the difference between manual repositioning and repositioning with the use of the Vendlet V5s® concerning musculoskeletal complaints, they reported the same four body regions to be more burdened by manual repositioning compared to repositioning with the Vendlet V5s® (Figure 4).

Figure 4. Work related musculoskeletal disorders



3.2.3 Time budget

During the study, 52 repositioning manoeuvres were observed during morning care and recorded by the researcher. These time measurements were divided into three kind of movements:

- 37 rotational movements
- 15 sideward transfers
- 0 upward transfers.

No measurements were performed during upward transfers because caregivers didn't use the Vendlet V5s® system to carry out this kind of transfer. The rotational movements were separated in 21 rotational movements from supine position to lateral position and 16 rotational movements from lateral position to supine position. The median time to complete a rotational movement from supine position to lateral position was 25 seconds. The median time to complete a rotational movement from lateral to supine position was 13 seconds. The median time to complete a sideward transfer was seven seconds. In table 4, the estimated time needed to reposition a patient according to caregivers is shown.

Table 4. The estimated time to reposition a patient

Transfers	Median time needed in seconds
Estimated time (without the Vendlet V5s®)	
Rotation: supine – lateral	90 s
Rotation: lateral – supine	60 s
Sideward transfer	64,5 s
Estimated time (with the Vendlet V5s®)	
Rotation: supine - lateral	180 s
Rotation: lateral – supine	45 s
Sideward transfer	45 s

4 Discussion

Over the years, numerous medical assistive devices have been developed to facilitate providing care for impaired elderly. This study evaluated the feasibility of repositioning patients with the automatic repositioning system Vendlet V5s® in the prevention of pressure ulcers. One of the objectives of this study was to determine the occurrence of skin problems associated with the use of the Vendlet V5s®. Furthermore, the assessment of the repositioning system by residents and caregivers was explored, time investments of executing transfers with the Vendlet V5s® were examined and the occurrence of MSD symptoms among caregivers was determined.

4.1 Summary of main findings

The use of the Vendlet V5s® could not be associated with the occurrence of skin problems. According to the risk assessment using the Braden scale, 10 out of 13 residents were at risk of developing pressure ulcers. Four residents had pressure ulcers at baseline. Due to their impaired mobility and limited ability to reposition themselves, the study sample consisted of people who were vulnerable to develop pressure ulcers. In this study, there was an incidence of two category I pressure ulcers (15%, n=2). This is comparable with the incidence in long term care facilities found in other research studies (Demarre et al. 2013). When regular repositioning in bed is performed as a single standard preventive measure of pressure ulcers, not all areas of high bed-skin interface can be relieved sufficiently. As a result, the incidence of pressure ulcers often can't be reduced (Peterson et al. 2013). Furthermore, the same mattress is used during the study as before to exclude bias of influences on pressure ulcer development related to adaptation of this preventative measure. Accordingly, no causal relationship was found between the use of the Vendlet V5s® system as a single measure and the occurrence of pressure ulcers.

Despite some remarks, the majority of the residents as well as the caregivers regarded the Vendlet V5s® system as a positive innovation and indicated the potential. However, there is a prominent difference concerning general

appreciation of the system between nursing home A and B which indicates that also external factors such as education, management and training have a major influence on the appraisal of a new system.

Time measurements were very different from the estimated time reported by caregivers. Besides, it's clear that caregivers overestimated the time needed to perform transfers in bed. Therefore, no comparison can be made between transfers aided by the Vendlet V5s® system compared to manual transfers. However, fewer caregivers were required to perform several transfers. Therefore, the use of the Vendlet system can improve the efficient use of caregiver's resources.

As MSD's are multi-factorial and non-acute injuries, several factors can contribute to the onset, deterioration or the perception of the presence of these injuries besides transfers with the Vendlet V5s®. However, caregivers in this study perceived less MSD's symptoms during transferring patients in bed with the Vendlet V5s® compared to manual repositioning which suggests a favourable effect. A longitudinal study should be performed to verify this effect.

This further discussion of the results provides potential explanations for the findings of the study. The explanations will be compared to alternative studies on the topic concerning implications for practice, education and the prospect for further research.

4.2 Implications for practice

It is paramount to assess whether the Vendlet V5s® is suitable for the resident who requires repositioning. Regular repositioning is part of pressure ulcer prevention but the repositioning procedure itself has options to improve as well (Peterson et al. 2013). The easiness to perform gentle and gradual transfers with the Vendlet V5s®, in contrast with manual repositioning, might improve skin- and patient friendliness. For example, resident I did not groan anymore during morning care, which he did before during manual turning in bed. The groaning

was a sign he was in acute pain due to his severe, chronic back pain. This indicates a decrease of pain levels during morning care due to the use of the Vendlet V5s® compared to manual repositioning. Since morning care is the moment in which most of the transfers in bed occur and these nursing procedures can cause pain for patients, the Vendlet V5s® can contribute to non-pharmacological pain management (Fragala and Fragala 2014, Peterson et al. 2013).

Three participants dropped out of the study at an early stage. These participants did not drop out because of the transfers in the bed itself. However, they experienced difficulties during transfers into and out of the bed. The problems resulted from the rigid lateral bar of the Vendlet V5s® system. The bar prevented smaller patients from reaching the floor when sitting on the side of the bed. Furthermore, the sit-to-stand transfer could be painful due to excessive pressure on the lateral bar. Therefore, this study indicates the Vendlet V5s® system is not an appropriate tool for residents with a mobility class A, B or C. However, problems can still occur with lower mobility classes as well. Resident F has a mobility level D but still gave a low comfort rating for the repositioning system. The discomfort was caused during the transfer to her wheelchair. Although the resident had a mobility level D, the transfer was aided by an active lift. Therefore, Resident F had to sit at the side of the bed during transfer. Due to the lateral bar, she could not keep her balance anymore. Therefore this study recommends limiting the application of the Vendlet V5s® system to patients with a mobility level of D or E and patients who are moved using a passive lifter.

When caregivers compared the use of the Vendlet V5s® to manual repositioning, fewer WRMSD's complaints were reported. Overexertion by moving and turning patients exposes caregivers to major risks concerning the development of occupational injuries, especially back injuries (Fragala and Fragala 2014, Hallmark et al. 2015, Weiner et al. 2017). Since the turning and sideward transferring of patients in bed is nearly effortless with the Vendlet V5s®, the use of the repositioning system might explain the report of fewer WRMSD's

complaints. Furthermore, the caregivers experienced less physical burden in the body regions most at risk of overload (lower back, shoulder, neck and upper back). This suggests the musculoskeletal system is overloaded less by using the Vendlet V5s® and contributes to the prevention of WRMSD's.

Although the Vendlet V5s® is capable to perform upward transfers, caregivers did not use this option. Upward transfer using the system requires the most complex action (upwards zig-zagging). Since the caregivers had limited experience with the system, the complexity inhibited performing the upward transfers. Therefore, lifting patients up in bed remained a high-risk activity to develop WRMSD's. However, the Vendlet V5s® uses a permanent sliding sheet underneath the draw sheet. The presence of a sliding sheet on a mattress reduces the force needed to reposition patients (Fragala and Fragala 2014, Hallmark et al. 2015, Weiner et al. 2017). As a result, the manual repositioning of patients was also enhanced due to the presence of the Vendlet V5s® system.

The difference between the estimated time to reposition a patient in bed with the Vendlet V5s® compared to manual repositioning is not significant. In some cases (resident I), repositioning a patient using the Vendlet V5s® requires only one caregiver while manual repositioning requires two. On the questionnaire, several caregivers noted the necessity of two caregivers to reposition a patient manually as an annex to their estimation. The Vendlet V5s® system can thus aid in the overall time budget of the ward.

Although the systems were in use for a total of 4 months, only 28% (n=10) of caregivers used the system frequently. The other caregivers only used the system on some occasions. Furthermore, caregivers did not perform the more complex motions with the Vendlet V5s®. For caregivers to master the system, training must be organized continuously during the first months of implementation. Therefore, the researcher provided extra training while attending morning care. If the use of the system is continued, extra training could help caregivers to perform the more complex motions as well.

4.3 Education

Caregivers need to be trained to clearly differentiate between available resources and related preventative measures in order to accomplish appropriate allocation of assistive devices. The gap (5/10 vs. 7.04/10) concerning the overall appraisal by caregivers of nursing home A compared to nursing home B might be attributed to organizational differences between the facilities. The study of Demarré et al. (2012) showed that nurses have a more positive attitude towards pressure ulcer prevention compared to nursing assistants. As a result, nurses show higher compliance with preventive measures than nursing assistants. The ratio of nurses to nursing assistants is 2:7 in facility A and 4:9 in facility B. This might explain why caregivers in nursing home A are less prone to use the Vendlet V5s® and therefore assess the system worse than caregivers of nursing home B.

Although the knowledge of most of the nursing assistants regarding pressure ulcers or skin problems was rather limited, the training, information sessions and supervision of qualified nurses seemed to be sufficient. This resulted in a good inter-rater reliability between caregivers and the researcher. A high level of education and training experience contributes to higher levels of knowledge and higher attitude scores. This probably contributes to a higher compliance with available guidelines (Simonetti et al. 2015).

The divergent scores on the amount of feedback received by caregivers indicate a different experience by the caregivers. This might be attributable to the patients they cared for as not every caregiver used the Vendlet V5s® to reposition the same patients and the system was more appropriate for certain patients.

4.4 Strengths and difficulties of the study

4.4.1 Setting and participants

The real-world setting of the study increased the relevance of the results. The study tested the feasibility of a novel system and compared it to the current

working method. Therefore, conclusions drawn from an environment where participants as well as the environment is authentic are more likely to be reliable.

Furthermore, no demographic data of the participating caregivers was collected. The prevalence of neck or shoulder complaints might be different among caregivers concerning age, work experience or gender.

4.4.2 Training and intervention

The intervention included both the use of another bed and the Vendlet V5s®. For some caregivers, four months appeared to be relatively short to master the skills to use the system with all of its features. Furthermore, the number of residents using the Vendlet V5s® was limited. Some caregivers didn't feel confident using the new assistive devices which hampered optimal use of the Vendlet V5s®. This might have had a negative effect on the care and might subsequently have influenced the assessment of the system.

The instruments used for the assessment from caregivers and residents in the study were not validated. The questionnaires are based on pre-existing questionnaires in validation process. They were adapted consistent with scientific literature. Furthermore, an adapted version of the Nordic questionnaire was added to the questionnaires.

4.5 Future research

In future research projects, a combination of preventive measures can be tested with the target population of the Vendlet V5s® detected in this study to find a significant effect on skin integrity. For this kind of research, a RCT with a bigger sample size and control group should be used. For example, the influence on pressure ulcer development of repositioning schedules and frequencies or other types of mattresses in combination with the use of the Vendlet V5s® might affect the development of pressure ulcers and can be examined.

In this study, routine repositioning frequencies of the facilities were not actively affected or measured. However, the use of an assistive device that facilitates transfers might stimulate caregivers to perform regular repositioning. Using participant observation to examine repositioning schedules and the influence of an assistive device on compliance of caregivers would be an interesting topic for further research.

5 Conclusion

The use of the Vendlet V5s® to reposition immobile patients is feasible and beneficial for caregivers and patients if the necessary conditions are fulfilled. Although transfers in bed with the Vendlet V5s®can contribute to skin friendliness and patient comfort, in this study no causal relationship was found between the use of the Vendlet V5s® system as a single measure and the occurrence of pressure ulcers.

No significant time differences were measured when using the system. However, with the Vendlet V5s®. patients who are non-cooperative, less mobile and/or heavy, can be cared for by one caregiver instead of two. Therefore, the system can enhance the staff efficiency.

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Appendix A

Basisgegevens van participant (bewoner) bij de start van het onderzoek

Bewoner:

Naam:

…….

Unieke code:

……..

Socio-demografische kenmerken

- Geboortejaar:

  ……..
- Geslacht (omcirkel) : Man / Vrouw
- Multipathologie:

  ……..

  ……

  ……

  ……

  ……

  ……
- Relevante medicatie:

  …….

  ……

  ……

  ……

  ……

  ……

Biometrische gegevens

- Lengte (of kniehoogte): ……..
- Gewicht: …….....

Het risico op decubitus en de graad van mobiliteit aan de hand van de Braden-schaal.

Waarneming van pijn en ongemak	Vochtigheid huid	Activiteit
1. Totaal verstoord 2. Zeer verstoord 3. Licht verstoord 4. Geen stoornis	1. Altijd vochtig 2. Meestal vochtig 3. Soms vochtig 4. Zelden vochtig	1. Bedgebonden 2. Stoelgebonden 3. Loopt af en toe 4. Loopt vaak rond
Mobiliteit	**Voeding**	**Wrijving en schuiven**
1. Volledig immobiel 2. Zeer beperkt 3. Licht beperkt 4. Geen beperkingen	1. Onvoldoende 2. Waarschijnlijk ontoereikend 3. Toereikend 4. Uitstekend	1. Actueel probleem 2. Mogelijk probleem 3. Geen zichtbaar probleem

- Het risico op decubitus (som van alle items): ……
- Mobiliteitsniveau:
  - Activiteit: ……....
  - Mobiliteit: …….

❖ Mobiliteitsklasse:

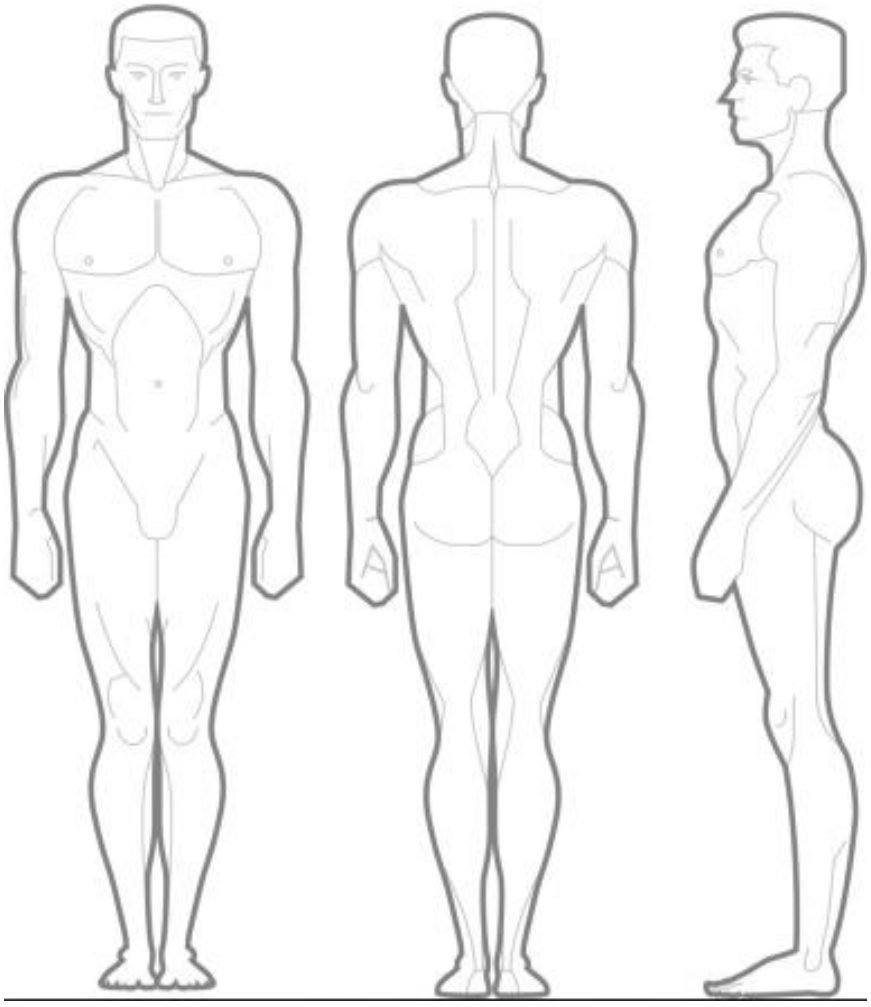
Huidtoestand bij de aanvang van de studie:

Duidt op de figuur op de volgende pagina met een pijl de regio's **aan** waar u 1 of meerdere van onderstaande symptomen waarneemt en **benoem** ze:

- Is er een **letsel** waarneembaar? O Ja O Nee
  Zoja, duidt aan op de figuur en benoem met een passende code uit deze tabel.

Code	Uitleg
0	Geen decubitusletsel
1	Niet-wegdrukbare roodheid bij een intacte *huid*
2	Blaar of open blaar
3	Oppervlakkige decubitus: verlies van volledige *huidlaag*
4	Diepe decubitus: verlies van volledige huidlaag en weefsel (spier of bot zichtbaar)
5	Niet te categoriseren letsel
6	Vermoeden van een letsel ter hoogte van diep weefsel: donker rode tot paarse verkleuring
7	Skin tear

- Heeft de bewoner **pijn**? O Ja O Nee
  Zoja, duidt aan op de figuur waar en benoem.
- Zijn er zones op het lichaam die **warmer** aanvoelen na het herpositioneren met het Vendlet systeem? O Ja O Nee
  Zoja, duidt aan op de figuur waar en benoem.
- Is er **weg-drukbare roodheid** waarneembaar? O Ja O Nee
  Zoja, duidt aan op de figuur waar en benoem.



- Incontinentiestatus (type en graad):

  ……

- Type

  matras:……

- Score op de Katz-

  schaal:……

A. Schaal (enkel de kolom "Nieuwe score" invullen in geval van eerste evaluatie):

CRITERIUM	Oude score	Nieuwe score	1	2	3	4
ZICH WASSEN			kan zichzelf helemaal wassen zonder enige hulp	heeft gedeeltelijke hulp nodig om zich te wassen boven of onder de gordel	heeft gedeeltelijk hulp nodig om zich te wassen zowel boven als onder de gordel	moet volledig worden geholpen om zich te wassen zowel boven als onder de gordel
ZICH KLEDEN			kan zich helemaal aan- en uitkleden zonder enige hulp	heeft gedeeltelijke hulp nodig om zich te kleden boven of onder de gordel (zonder rekening te houden met de veters)	heeft gedeeltelijke hulp nodig om zich te kleden zowel boven als onder de gordel	moet volledig worden geholpen om zich te kleden zowel boven als onder de gordel
TRANSFER en VERPLAAT-SINGEN			is zelfstandig voor de transfer en kan zich volledig zelfstandig verplaatsen zonder mechanisch(e) hulpmiddel(en) of hulp van derden	is zelfstandig voor de transfer en voor zijn verplaatsingen, mits het gebruik van mechanisch(e) hulpmiddel(en) (kruk(ken), rolstoel,…)	heeft volstrekte hulp van derden nodig voor minstens één van de transfers en/of zijn verplaatsingen	is bedlegerig of zit in een rolstoel en is volledig afhankelijk van anderen om zich te verplaatsen
TOILET-BEZOEK			kan alleen naar het toilet gaan, zich kleden en zich reinigen	heeft hulp nodig voor één van de 3 items: zich verplaatsen of zich kleden of zich reinigen	heeft hulp nodig voor twee van de 3 items: zich verplaatsen en/of zich kleden en/of zich reinigen	heeft hulp nodig voor de 3 items: zich verplaatsen en zich kleden en zich reinigen
CONTINEN-TIE			is continent voor urine en faeces	is accidenteel incontinent voor urine of faeces (inclusief blaassonde of kunstaars)	is incontinent voor urine (inclusief mictietraining) of voor faeces	is incontinent voor urine en faeces
ETEN			kan alleen eten en drinken	heeft vooraf hulp nodig om te eten of te drinken	heeft gedeeltelijk hulp nodig tijdens het eten of drinken	de patiënt is volledig afhankelijk om te eten of te drinken

CRITERIUM			1	2	3	4
TIJD (2)			geen probleem	nu en dan, zelden probleem	bijna elke dag probleem	volledig gedesoriënteerd of onmogelijk te evalueren
PLAATS (2)			geen probleem	nu en dan, zelden probleem	bijna elke dag probleem	volledig gedesoriënteerd of onmogelijk te evalueren

Appendix 2

Huidobservatie

Observatie dag ……van de studie: ….. /….. / 20….

Bewoner:

…….

Unieke code:

……..

Mobiliteitsklasse (duidt aan):

Beoordelingsformulier huidtoestand

Duidt op de figuur op de volgende pagina met een pijl de regio's **aan** waar u 1 of meerdere van onderstaande symptomen waarneemt en **benoem** ze:

- Is er een **letsel** waarneembaar? O Ja O Nee
  Zoja, duidt aan op de figuur waar en benoem met een passende code uit deze tabel.

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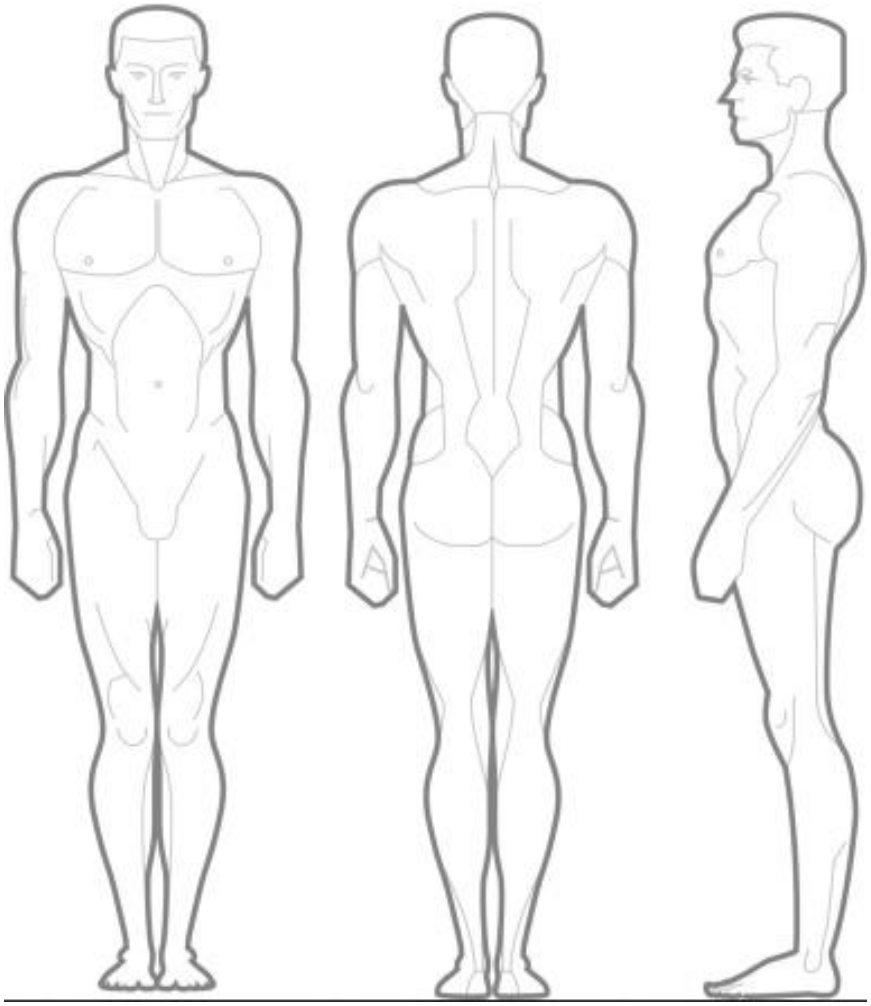
7	Skin tear

- Heeft de bewoner **pijn**? O Ja O Nee
  Zoja, duidt aan op de figuur waar en benoem.
- Zijn er zones op het lichaam die **warmer** aanvoelen na het herpositioneren met het Vendlet systeem? O Ja O Nee
  Zoja, duidt aan op de figuur waar en benoem.
- Is er **weg-drukbare roodheid** waarneembaar? O Ja O Nee
  Zoja, duidt aan op de figuur waar en benoem.



24-uurs registratie: frequentie, houding en reden voor herpositioneren met Vendlet:

Frequentie	Houding	Tijdstip	Reden
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Appendix 3

Het Vendlet herpositioneringssysteem: beoordeling door bewoners

Naam bewoner: .....

Omcirkel wat voor u van toepassing is:

- Deze vragenlijst werd ingevuld door de bewoner zelf/ de vertegenwoordiger/ de zorgverlener/ de onderzoeker

---

1. Wat vindt u van het algemeen comfort van het systeem waarmee wisselhoudingen gegeven worden?

	1	2	3	4	5	6	7	8	9	10	
Helemaal niet comfortabel	o	o	o	o	o	o	o	o	o	o	Zeer comfortabel

2. Vindt u dat het systeem geluid maakt tijdens het gebruik?

	1	2	3	4	5	6	7	8	9	10	
Zeer veel geluid	o	o	o	o	o	o	o	o	o	o	Zeer weinig geluid

3. Vindt u het geluid hinderlijk?

	1	2	3	4	5	6	7	8	9	10	
Helemaal niet hinderlijk	o	o	o	o	o	o	o	o	o	o	Zeer hinderlijk

---

4. Heeft u last van: (meerdere antwoorden mogelijk)
   - o Droge huid
   - o Roodheid
   - o Irritatie
   - o Jeuk
   - o Uitslag
   - o Pijn
   - o zweten
   - o Ontvelling
   - o Iets anders:
   - o Geen last

5. Hoe comfortabel hebt u het gevoel te liggen nadat u van houding veranderd bent door het gebruik van het Vendlet systeem?

	1	2	3	4	5	6	7	8	9	10	
Helemaal niet comfortabel	o	o	o	o	o	o	o	o	o	o	Zeer comfortabel

6. Hoe inspannend ervaart u het herpositioneren?

	1	2	3	4	5	6	7	8	9	10	
Helemaal niet inspannend	o	o	o	o	o	o	o	o	o	o	Zeer inspannend

7. Naar welke manier van herpositioneren gaat uw voorkeur uit?
    - Normaal/handmatig herpositioneren
    - Met behulp van het Vendlet systeem
    - Afhankelijk van wie of waarvoor het gebruikt wordt, namelijk (verder te specifiëren):
      .....

Verdere opmerkingen:

.....

.....

.....

.....

.....

.....

.....

.....

.....

Appendix 4

Het Vendlet herpositioneringssysteem

Beoordeling door de zorgverlener

Omcirkel wat voor u van toepassing is:

- Ik ben zorgkundige / verpleegkundige/ andere:
- Ik heb 1 keer / meerdere keren / vaak met het Vendlet systeem gewerkt

---

1. Wat is uw algemene indruk in verband met het gebruik van het hulpsysteem om wisselhoudingen te geven aan de patiënten?

	1	2	3	4	5	6	7	8	9	10	
Helemaal niet goed	o	o	o	o	o	o	o	o	o	o	Zeer goed

2. Welke bijdrage levert het Vendlet systeem volgens u aan het herpositioneren van minder mobiele personen?

	1	2	3	4	5	6	7	8	9	10	
Geen bijdrage	o	o	o	o	o	o	o	o	o	o	Zeer grote bijdrage

3. In welke mate krijgt u positieve feedback van patiënten bij het toepassen van het hulpsysteem om wisselhoudingen te kunnen geven?

	1	2	3	4	5	6	7	8	9	10	
Helemaal niet	o	o	o	o	o	o	o	o	o	o	Zeer veel

4. In welke mate krijgt u negatieve feedback van patiënten bij het toepassen van het hulpsysteem om wisselhoudingen te kunnen geven?

	1	2	3	4	5	6	7	8	9	10	
Helemaal niet	o	o	o	o	o	o	o	o	o	o	Zeer veel

5. Welke mening hebben de meeste collega's over het toepassen van het hulpsysteem om wisselhoudingen te kunnen geven volgens u?

	1	2	3	4	5	6	7	8	9	10	
Zeer negatief	o	o	o	o	o	o	o	o	o	o	Zeer positief

6. Is het herpositioneren voor u met het gebruik van het Vendlet systeem ten opzichte van handmatig herpositioneren? Duidt aan:
    - Geen verschil
    - Weinig verschil
    - Gemakkelijker
    - Moeilijker

7. In welke mate hebt u het gevoel dat het gebruik van het hulpsysteem om wisselhoudingen te kunnen geven belastend is voor uw rug?

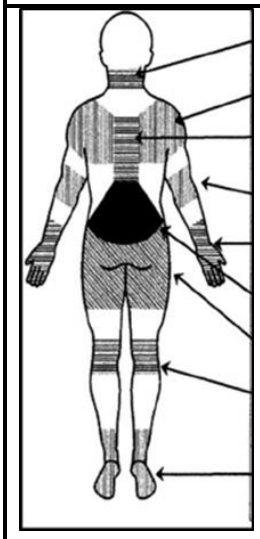
	1	2	3	4	5	6	7	8	9	10	
Helemaal niet belastend	o	o	o	o	o	o	o	o	o	o	Zeer belastend

8. Heeft U de laatste 12 maanden last van uw rug gehad ? O Ja O Nee

9. Heeft U de laatste 3 maanden last van uw rug gehad ? O Ja O Nee

10. Heeft U de laatste 12 maanden last van uw nek/schouders gehad ? O Ja O Nee

11. Heeft U de laatste 3 maanden last van uw nek/schouders gehad ? O Ja O Nee

	Regio	Heeft u vroeger last gehad in volgende regio tijdens het herpositioneren:	Hebt u tijdens het werken met het Vendlet systeem pijn in:	Ik voel tijdens het handmatig herpositioneren op deze plaats meer last dan bij het gebruik van het Vendlet systeem
	Nek	JA / NEE	JA / NEE	JA / NEE
	Schouder	JA / NEE	JA / NEE	JA / NEE
	Bovenrug	JA / NEE	JA / NEE	JA / NEE
	Elleboog	JA / NEE	JA / NEE	JA / NEE
	Pols	JA / NEE	JA / NEE	JA / NEE
	Onderrug	JA / NEE	JA / NEE	JA / NEE
	Heupen	JA / NEE	JA / NEE	JA / NEE
	Knieën	JA / NEE	JA / NEE	JA / NEE
	Enkels	JA / NEE	JA / NEE	JA / NEE