Consistent practice for pressure ulcer prevention in long-term older people care: A quasi-experimental intervention study

Abstract

Background
Consistent practice, an agreed clinical practice based on evidence, has been considered as a base for effective provision of quality and safety of care. As a result, patients have equal quality of care regardless of the organization or worker. However, despite the international guidelines, pressure ulcer prevention practices vary in long-term older people care.

Aim
To develop, implement and evaluate the impact of renewed, consistent practice for pressure ulcer prevention, in long-term older people care.

Design
A quasi-experimental intervention study.

Methods
Two long-term older people care facilities chosen with convenience sampling were randomly allocated to intervention or comparison group. Registered and practical nurses, in total 141/112, participated in the study.

The renewed consistent practice based on international guidelines for pressure ulcer prevention was developed and implemented using the Operational Model for Evidence-Based Practices (OMEBP). Frequencies and agreement of PU prevention practices in line with international guidelines in the care facilities were measured using the PUPreP-instrument.

Results
In the intervention facility, improvement in line with international guidelines was seen in the frequency of PU prevention practices in risk assessment, nutrition, pressure relieving devices and documentation. Furthermore, improvement was seen in the intervention facility in all six areas of agreement on practices.

Conclusions
The results of this study support the implementation of PU prevention guidelines in long-term older people care (LOPC) and more widely in health care settings for older people to promote consistent practice, and safety and equal quality of care.

Keywords:
Pressure ulcer Prevention, Consistent practice, Guidelines, Intervention, Long-Term Care, Older People, Quantitative study

Introduction

Consistent practice means that organizations agree on clinical practice based on evidence. By reducing variation and ensuring consistency in practice, patients in health care have equal quality of care regardless of the organization or worker[1]. The importance of evidence and consistence of practices is also pointed out by the World Health Organization[2], the European Union[3], U.S. National Institutes of Health[4] and national legislations[5]. The maintenance of consistent practice has been considered as basis for effective provision of quality and safety of care[6-7].

In this study, the interest of consistent practice is on prevention of pressure ulcers (PUs) in long-term older people care (LOPC). The risk for developing a PU is higher in LOPC facilities because of characteristics such as advanced age, low cognitive and consciousness function, chronic diseases, or low nutritional status[8]. For example, in the US the average PU prevalence in nursing homes was 5.1% in 2014, in Switzerland, 5.7% in 2015, and in Finland, 5.0% in 2016, but it varied a lot[9-11]. Effective prevention of PUs reduces health care costs[12] and individual suffering.

It is important to understand which PU prevention interventions are best suited to LOPC. Contextual features, such as the characteristics of older people or the composition of nursing staff, are important for the success or failure of the implementation of PU prevention interventions[13-15]. Existing PU prevention programs also require local customizing by the facilities[15].

In PU prevention, international evidence-based guidelines for consistent practice have been drawn up by the National Pressure Injury Advisory Panel (NPIAP), European Pressure Ulcer Advisory Panel (EPUAP), and Pan Pacific Pressure Injury Alliance (PPPIA) in 2014[16] and 2019[17]. Based on these international guidelines, many countries also have national PU prevention guidelines[18-19]. International PU prevention guidelines include several recommendations concerning such areas as risk assessment, skin assessment and care, nutrition, repositioning, support surfaces and treatment of PUs[16]. In PU prevention, consistent practice can be improved by using clinical practice guidelines[20-21].

However, despite the guidelines, PU prevention practices vary between organizations, adherence with PU prevention guidelines is low[15, 22-23], or PU preventive interventions are only partly implemented in patient[24]. In general, the implemented guidelines on PU prevention are often based on expert opinion and low-level evidence[25].

The reported barriers to the use of evidence-based guidelines in PU prevention include insufficient knowledge or skills to understand or evaluate research, limited access to information, lack of time to learn and implement new guidelines, lack of support or consistent leadership, lack of technology or competency to use it, or heavy workload[26-28].

To reduce barriers, organizational support, especially of frontline staff members for implementing evidence-based practice has been considered essential[15, 27-29]. Availability of research articles or EBP mentorship projects including education sessions for nurses on searching and evaluating research evidence have also been mentioned[27]. In nursing homes, “Quality Improvement Champions” have been used to foster changes[28,30]. In addition, implementation methods for reducing barriers have been used[31].

Investigating the implementation methods by which evidence can most successfully be distributed and integrated into practice by nursing staff has been considered fundamental[31]. Common constructs of different models that are believed to influence implementation have also been reviewed[32]. To promote systematically the development of evidence-based practices into clinical practice various methods have been used, such as the "Champions for Skin Integrity model"[31] and the Ottawa model[33].

In this study, the Operational Model for Evidence-Based Practices (OMEBP, Figure 1)[7, 34-35] was used as an implementation model for renewed consistent PU prevention practices. It was chosen because it is well known and has been used before in Finnish health care [35]. The OMEBP is a generic model developed and validated by the Finnish Nursing Research Foundation (NRF). In the model, the development and implementation of the consistent practice proceeds in four phases: 1)Development needs for current practice, where the purpose is to assess whether the current practice is in line with the best evidence, such as international PU prevention guidelines, and to recognize development needs in current practice, 2) Plan for consistent practice, where the purpose is to plan consistent practice by making changes to the current practice in line with the best evidence, 3) Consistent practice, where the purpose is to describe the renewed consistent practice and then, to disseminate the new practice which is agreed and in line with best evidence, and 4) Evaluation and follow-up of the practice, where the purpose is to evaluate and follow up the practice, ensuring that no variation in practice occurs.

After the implementation of evidence-based clinical practices, the maintenance of consistent practices requires continuous effort[36], such as using annual reviews, strengthening an evidence-based practice culture, and education[20]. In this study, the maintenance was followed for the duration of the intervention.

In LOPC facilities, the incidence and prevalence of PUs has been reduced with PU prevention bundles or programs[15, 37-38]. A review[39] concluded that one third of the PU prevention interventions used in LOPC facilities were reported as effective. However, recent studies have stated that not only PU rates should be reported as an outcome of the intervention, but also compliance of the PU prevention bundle. The implementation of care bundles has been seen as a possibility to measure that best practice is being implemented with consistent compliance[40-42].

Because of variations in clinical practice and low adherence with evidence-based PU prevention guidelines there is a need for research of consistent practice. To produce new knowledge researchers designed a consistent PU prevention practice intervention based on international PU prevention guidelines in the context of LOPC.

Aim

The aim of this study was to develop and implement renewed consistent practice for pressure ulcer (PU) prevention in long-term older people care (LOPC) and to evaluate its impact on the frequency and agreement on PU prevention practices in line with evidence-based international guidelines in care facility. The hypothesis was that after intervention, PU prevention practice in the intervention facility would be more consistent than in the comparison facility. Prior to the study, it was

hypothesized that all the PU prevention areas would improve following the intervention. The ultimate goal is to promote the quality and safety of care in LOPC facilities.

Methods

Study design and participants

A quasi-experimental intervention study was conducted between January 2016 and January 2017 in two public long-term older people care facilities (LOPC) in Finland. Facilities with more than a hundred beds and with presence of PUs were asked to participate after an extensive PU prevalence survey of the LOPC facilities in the area[11]. Two facilities as big as possible were conveniently chosen. Registered nurses (RNs) and practical nurses (PNs) were randomly allocated on facility level either to the intervention or comparison group (n=76 intervention/n=85 comparison). In total, the intervention facility included five and the comparison facility eight care units. All RNs and PNs (n=161) of the facilities were asked before as well as after the intervention to complete a questionnaire in the study. Of these, 141 (88 %, n=69/72) participated and completed a questionnaire before the intervention. After the intervention, 112 (n=61/51) RNs and PNs responded to a questionnaire. (Figure 2.) The TREND guidelines[43] were followed.

Health care system in Finland

In Finland, municipalities are responsible for organizing health care and form the basis of the health care system[44]. In 2018, municipalities provided over 50% of sheltered housing with 24-hour assistance[45]. Nursing staff in LOPC facilities in Finland consists of registered nurses and practical nurses, led by head nurses. Practical nurses have 2 to 3 years' education in social and health care in the competence area of care and rehabilitation for older people[46].

Intervention

The intervention consisted of development and implementation of a renewed consistent practice for PU prevention in a LOPC facility based on international guidelines[16]. The content of the renewed consistent practice was a bundle of six PU prevention areas: risk assessment, skin assessment and skin care, nutrition, repositioning, pressure relieving devices, and documentation. The OMEBP-model was used in four phases[34]. In the comparison care units, usual PU practice prevention was continued.

In a meeting before the intervention, head nurses and researchers confirmed consensus on the research protocol. Two wound contact persons, one RN and one PN, from all five units were also appointed by head nurses.

Development needs for current practice

The purpose of this first phase was to assess how well the current practice complied with international PU prevention guidelines. The current practice of PU prevention was assessed among the nursing staff by using the Pressure Ulcer Prevention Practice (PUPreP) instrument. In all care units, this baseline data was collected two weeks before the intervention.

"Development needs for current practice" (Table 1) included two meetings: a) orientation meeting and b) first development meeting for head nurses, RNs and PNs. In the three hour orientation meeting, participants were informed by researchers about the purpose of the research, its different phases, and the roles of different actors. Presentations of evidence-based practices and OMEBP were also given by the researchers.

In the first development meeting, the results of the measurement of the current PU prevention practice in the facility were reported to nursing staff, a presentation of international guidelines regarding PU prevention and early identification was given by an authorized wound care nurse, and the international PU classification system[16] was presented. The participants, researchers and authorized wound care nurses discussed the measured current practice and compared it with international PU prevention guidelines, with the aim of recognizing development needs in the current practice.

Insert Table 1 about here

Plan for consistent practice

In the second phase (Table 1), the purpose was to plan the renewed consistent practice by making changes to the current PU prevention practice of the facility in line with the international guidelines[16]. The phase "Plan for consistent practice" included a) the second development meeting and b) the third development meeting, attended by head nurses and two wound contact persons from each unit, and led by the researchers and two authorized wound care nurses.

In the second development meeting, six content areas from the international PU prevention guidelines were chosen. These were risk assessment, skin assessment and skin care, nutrition, repositioning, pressure relieving devices, and documentation. In these areas, planning of renewed action and documentation in the facility was now started. The national PU prevention guidelines[19], based on international guidelines[16], were used in these meetings. After the second development meeting, head nurses and wound contact persons continued the development work before the third development meeting; each unit worked with one PU prevention content area.

In the third development meeting, the head nurses and wound contact persons continued the planning of renewed consistent practice led by the researchers and authorized wound care nurses. The renewed consistent practice, the "Procedure for PU Prevention in LOPC Facility" (Appendix 1) was now completed. Written information was produced regarding the six areas of consistent practice as follows: 1) how and when to act and, 2) how and when to document. An agreement was also reached on further work including yearly PU prevention education for nursing staff and using the procedure as part of the orientation program for new nursing staff.

Consistent practice

The purpose of the third phase (Table 1) was to describe, and then, to implement the renewed consistent PU prevention practice. First, all five units in the intervention facility had a unit meeting led by the researcher and the head nurse of the unit. In the unit meetings, the researcher went through the renewed, consistent PU prevention practice with the nursing staff. All nursing staff members also received a copy of the "Procedure for PU Prevention in LOPC Facility" in their

personal e-mail. In addition, the procedure was described on the facility's internal web pages. Following this, the renewed consistent practice for PU prevention started. It was stated that in this phase, immediately after unit meetings, the whole nursing staff worked in the same way for PU prevention and in line with "Procedure for PU Prevention in LOPC Facility". In each unit, the two wound contact persons promoted the implementation of the renewed consistent practice by showing an example and mentoring others.

As a supporting structure, nursing staff were educated in PU prevention methods related to the PU prevention areas. Six 90-minute education sessions were held on topics about risk assessment, skin assessment and skin care, nutrition, pressure relieving devices and, as secondary prevention of PUs, wound care. Education was given by authorized wound care nurses, a dietician, or persons with expertize in pressure relieving devices. As written information, participants received a laminated pocket-size version of the Braden scale instructions and a pocket guide of the international PU classification system translated into Finnish. The nursing staff members were also guided to use existing web material on PU prevention. In addition, a researcher and an authorized wound care nurse were available for consultations.

Evaluation and follow-up of the practice

In the fourth phase, the purpose was to evaluate and follow up the renewed practice and to ensure that no variation in practice occurred (Table 1). To ensure the fidelity of implementation of the renewed consistent practice, the researcher visited the intervention units one to three times a week at random times. At these visits, the researcher discussed the progress of the intervention and possible problems with the head nurses and nursing staff, and observed documenting on patient records. After ten months of renewed consistent PU prevention practice, the second data were collected with the PUPreP instrument for evaluation of the nursing staff's consistent practice after the intervention. In addition, nursing staff's PU prevention knowledge and residents' PU prevalence, incidence, and PU healing time were measured. These will be reported in another paper.

Data collection and instrument

The data were collected at baseline and after the intervention, in January 2016 and January 2017, using the structured questionnaire, Pressure Ulcer Prevention Practice (PUPreP) instrument, developed for this study based on international PU prevention guidelines[16]. The instrument (PUPreP) includes nine items of background questions on characteristics and 51 items on PU prevention practices. The six subscales of PU prevention practices are: Risk assessment (11 items), Skin assessment and skin care (8 items), Nutrition (7 items), Repositioning (13 items), Pressure relieving devices (8 items), and Documentation (4 items). The scale was based on frequency of practices, a four-point Likert rating scale with the option "I don't know" (1=never, 2= sometimes, 3=often, 4=always, 5 = I don't know), and dichotomous scale for an agreed PU prevention practice in the unit (1=no, 2=yes). For example: 'We do a risk assessment for every patient when they come to our ward' / 'We have an agreement on the way of acting on this on the ward'. The six subscales of the PUPreP instrument were measured separately. This showed which PU prevention areas had improved after the intervention.

Analysis

Data were analyzed with IBM SPSS Statistics for Windows 23 (IBM Corp., Armonk, NY). Mean variables were calculated so that the values of items were summed and divided by the number of responses when at least 70% of items were answered. The total sum was not calculated because the instrument was originally designed to measure six different areas and not to calculate the total sum. Likert responses of 5 'I don't know' were interpreted as 'never' in computing the mean variables. In the study, the pre and post data were independent because to protect respondents' identity identification numbers were not used. In addition, there were changes in nursing staff during the intervention in both the intervention facility and comparison facility. Independent samples t-test for normally distributed continuous variables was used in comparison of frequency of practices, and Mann-Whitney test for non-normally distributed continuous variables was used in comparison of agreement on practices before and after the intervention. Difference in the frequency of practices within groups was measured by using the independent sample T-test and difference of agreement on the practices within groups by using Mann-Whitney test. The differences in the changes between groups in frequency of practices were compared by using two-way ANOVA. Inverse normal scores transformation (Blom's method) was used for agreement on practices to test the differences in the change between groups. The level of significance was set at $p \leq 0.05$. Effect sizes were provided to interpret the importance of results. Effect size was calculated using Cohen's d as mean difference between intervention and comparison groups by divided a pooled standard deviation. Common language effect size $f = U_1/n_1n_2$ was used as effect size for median difference. The internal consistency reliability of the sum variables of the instrument in this data was assessed by computing Cronbach alphas.

Results

Characteristics of participants

All the participants were educated healthcare professionals. In total, 141 (88%)/112 RNs and PNs from two LOPC facilities participated in the study, 69/61 in the intervention and 72/51 in the comparison group.

Participants' demographic characteristics are summarized in Tables 2 and 3 and Figure 2. No statistical differences were found between the intervention and the comparison group with respect to most characteristics. However, at baseline, the comparison group had more work experience in the current work unit than the intervention group, 8.11 years vs 4.78 years (p=0.002), while the intervention group had read more guidelines about PU prevention and early identification than the control group (p=0.034).

Insert Table 2 about here

Insert Table 3 about here

Consistent practice

Clinical outcomes of the consistent practice were frequency of practices, which measured how often the practices were in line with international evidence-based PU prevention guidelines, and agreement on the practices in care units, which measured if the practice was agreed in the care unit in line with evidence-based PU prevention guidelines.

Frequencies of practices

At baseline (Table 4), no statistical differences were found between the intervention group and the comparison group with respect to most frequencies of PU prevention practices. However, at baseline, the intervention group had a higher mean in frequency of PU prevention practice in nutrition ($p=0.032$) and pressure relieving devices ($p<0.001$).

Difference within groups before and after intervention

In the intervention group, a statistically significant difference was seen in the frequency of PU prevention practices in risk assessment (mean difference 0.53, 95% CI -0.77 – -0.29, $p<0$ .001, effect size 1.12), nutrition (mean difference 0.52, 95% CI -0.77 – -0.26, $p<0.001$, effect size 0.92), documentation (mean difference 0.29, 95% CI -0.47 – -0.10, $p=0.003$, effect size 0.46), and pressure relieving devices (mean difference 0.14, 95% CI -0.27 – -0.04, $p= 0.044$, effect size 0.56). (Table 4)

In the comparison group, a statistically significant difference was seen in pressure relieving device practices (mean difference 0.17, 95% CI -0.29 – -0.06, $p= 0.003$). At the baseline measurement, practices in both groups were already quite well in line with international PU prevention guidelines in repositioning (mean 3.46 / 3.40) and skin assessment and skin care (mean 3.42 / 3.36).

Change between the groups

The differences in changes between the groups in frequency of PU prevention practices were compared by using two-way ANOVA. It revealed that frequency of PU prevention practice in risk assessment ($p=0.005$) and nutrition ($p=0.029$) was significantly more improved in the intervention group compared to the comparison group (Table 4).

Insert Table 4 about here

Agreement on PU prevention practice in care unit

At baseline (Table 5), no statistical differences were found between the intervention and the comparison group with respect to agreement on PU prevention practices in the care units.

Difference within groups before and after intervention

In the intervention group, significant difference was seen in all six variables of agreement on practices in the care unit. These were agreement on practices of risk assessment ($p=0.008$, effect size 0.85), skin assessment and skin care ($p<0.001$, effect size 0.76), nutrition ($p=0.014$, effect size 0.79), repositioning ($p=0.006$, effect size 0.75), pressure relieving devices ($p=0.019$, effect size

0.76), and documentation (p=0.044, effect size 0.78). In the comparison group, no statistically significant difference was seen in any variables of agreement on practices in the care unit. (Table 5)

Change between the groups

The differences in changes between the groups in agreement on consistent practice in PU prevention in the care unit were compared using Inverse normal scores transformation (Blom's method). It revealed that in the intervention group, agreement on consistent practice in PU prevention was significantly more positively improved compared to the comparison group in all six variables: risk assessment (p=0.002), skin assessment and skin care (p=0.007), nutrition (p=0.011), repositioning (p=0.009), pressure relieving devices (p=0.014), and documentation (p<0.001). (Table 5)

Insert Table 5 about here

Reliability of the instrument

The internal consistency reliability of the instrument was assessed by computing Cronbach alphas. The internal consistency of three out of the six sum variables for frequencies of practices: risk assessment (0.88/0.88), nutrition (0.78/0.82), and repositioning (0.78/0.83) was over 0.70 before and after the intervention measurements. Internal consistency was lower in sum variable documentation (0.64/0.75), skin assessment and skin care (0.47/0.55), and pressure relieving devices (0.22/0.44).

Discussion

The aim of this study was 1) to develop and implement a renewed consistent PU prevention practice in a LOPC facility and 2) to evaluate its impact on the frequency and agreement of PU prevention practices in line with international PU prevention guidelines in care facility. Consistent practice meant that it was agreed in the care units and based on evidence. The content of the renewed consistent practice was a bundle of six PU prevention areas: risk assessment, skin assessment and skin care, nutrition, repositioning, pressure relieving devices, and documentation, and it was used to draw up the "Procedure for PU prevention in LOPC facility".

At baseline, as in previous studies reporting low or partial adherence to evidence-based PU prevention guidelines[22-24], in this study the frequencies of PU prevention practices in the six areas varied compared with evidence-based PU prevention guidelines; the frequencies of nutrition and documentation were low while those of repositioning and skin assessment and skin care were high.

As hypothesized, the nursing staff's frequency of PU prevention practice in line with PU prevention guidelines improved in more PU prevention areas in the intervention facility than in the comparison facility. In the intervention facility, the nursing staff's PU prevention practices after the intervention were significantly higher than before the intervention in risk assessment, nutrition, pressure relieving devices, and documentation. The practices of risk assessment and nutrition improved significantly more in the intervention facility than in the comparison facility. These results are in line with previous studies[42, 47] where some areas of PU prevention practice bundle improved more

than others. However, in this study, after the intervention the level of all frequencies in PU prevention practices was good, contrary to the previous studies[40,47]. Also, the results of this study showed significantly positive improvement in all six areas of agreement on the PU prevention practices in the intervention care facility.

The systematic review[41] reported that the full implementation of the elements of the care bundles was rare. In this study, fidelity to the intervention was strengthened by researchers' regular visits to the intervention care units and discussions with head nurses and nursing staff. In this study, as in the previous study[15] head nurses' support for the implementation of renewed consistent practice was essential.

The results of this study are in line with a previous study[41] showing that a multifaceted model to facilitate the implementation of EBP improved the uptake of EBP and protocol availability in a residential older people care setting. The results of this study also indicate that as in previous studies conducted in acute care[20-21], the prevention of PUs can be improved in the LOPC setting as well by using evidence-based clinical practice guidelines. The OMEBP model[34] used for the implementation of guidelines in this study seems to be useful for implementation of evidence-based PU prevention practice in LOPC facilities. The four-phase OMEBP made implementation of PU guidelines into practice systematic and foreseeable. It gave nursing staff, as local experts, the possibility to participate in the decision-making process to renew the consistent practice, which may have promoted the adoption of the new practice[48]. When the renewed consistent practice was integrated into the workflow process the practitioners turned out to be valuable experts. Additionally, the consistent practice "Procedure for PU Prevention in LOPC Facility" developed with the OMEBP model is a useful tool in the LOPC context.

Due to the increased number of residents in LOPC in many countries as a result of population aging, the PU prevention work must be of sufficient quality to achieve cost savings in PU treatment[12] and to prevent suffering for residents. The results of this study will serve the implementation of guidelines in LOPC facilities and more widely in social and health care settings. The results will also be useful for nurse managers and policy makers who make key decisions as well as contributing alongside nurse educators to disseminating information about the importance of evidence-based practice in PU prevention.

Limitations

Some limitations appeared during the implementation of the renewed consistent practice. First, nursing staff reduction was carried out both in the intervention and the comparison care facilities. The daily number of nursing staff was reduced; in addition, nursing staff who had earlier worked in a long-term locum capacity were rescheduled as one group to be used to make up sudden absences of nursing staff at several facilities. This may have increased haste and stress caused by a bigger workflow for individual persons[28]. In addition, these changes in nursing staff during the data collection may have had an impact on the results of the study. However, the intervention seemed to work also in these circumstances in the intervention care facility. Second, not all nursing staff members participated in the monthly education sessions. Some had to work in the care units or were off duty. However, these facts were known and the goal was that from each unit, as many nursing

staff members as possible would participate in these education sessions and 'carry the message' to their own units. In other parts, the intervention reached the nursing staff quite well, as planned: the orientation day, the three development days, unit meetings, personal e-mails and common web pages of the facility. The third limitation was that the reliability and validity of the instrument requires further testing. The alphas for sum variables of the instrument in the data used were calculated before and after the intervention and were partly low, under 0.70, which is an acceptable limit for new scales[49]. This reduces the reliability of the results. However, the content of the instrument was based on good level of evidence from international PU prevention guidelines and was evaluated by an expert panel. Also, a validated instrument on the topic was not available. In the study, the Likert responses 'I don't know' were interpreted as 'never' in the analysis phase. This may have impacted the results of the study. However, this interpretation was consistently used in both groups as well as before and after the intervention. Finally, clustering within units made it possible that participants' responses were not independent. Researchers could not account for clustering with accurate statistical analysis because of the small number of participants, 7 – 17, per unit. However, all intervention units participated together in consistent practice planning as well as in all education sessions at the same time. This may have reduced the effect of environment in a single unit.

At the baseline measurement, PU prevention practices in both groups were already quite well in line with international PU prevention guidelines in repositioning and skin assessment and skin care, and no difference in improvement of the practices was seen between the groups. These variables need further study. The maintenance of the renewed consistent practice in the intervention facility has not been measured. Further reliability and validity testing of the used instrument is also required. These would be important topics for further research.

Conclusions

The conducted PU prevention intervention in long-term older people care (LOPC) facilities improved consistent practice in line with PU prevention guidelines. It provided new knowledge that prevention of PUs can be improved in the LOPC by using evidence-based clinical practice guidelines. The results support the implementation of guidelines in long-term older people care and more widely in health care settings for older people. Also, this research shows the utility of the Operational Model for Developing Evidence-Based Practices (OMEBP) in the development of a renewed consistent PU prevention practice in LOPC settings. A consistent practice, "Procedure for PU Prevention in LOPC Facility", was developed for use in the LOPC context. In addition, this research shows the impact of intervention on pressure ulcer (PU) prevention practices to promote equal quality and safety of care in LOPC. Because of increasing numbers of residents in LOPC in many countries as a result of population aging, the results support the work on PU prevention of sufficient quality to achieve cost savings in PU treatment. The results will be useful for nurse managers and policy makers in making key decisions as well as contributing alongside nurse educators to disseminating information about the importance of evidence-based practice in PU prevention.

Ethical approval

The research followed good scientific practices as determined by the Finnish Advisory Board on Research Integrity[50] and conforms with the declaration of Helsinki[51] Ethical approval (43/2015) was obtained from the Ethics Committee of the University. Permissions to conduct the study and gather material were asked from the participating organizations. The nursing staff were informed and they had an opportunity to ask questions before and during the research. They were also informed about voluntariness to participate, possibility to discontinue participation, and that responding to the questionnaire was considered as consent to participate.

Author contributions

SM-T-R, HL-K, EH conceptualised and designed the study; SM-T-R, TK, EH developed consistent practice: SM-T-R collected the data: SM-T-R, TV, EH analysed the data; SM-T-R, HL-K, TK, TV, EH wrote or revised the manuscript. All authors approved the final manuscript.

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Table 1 Development and implementation of the consistent pu prevention practice according the model of the OMEBP

Time **Phase** **Purpose of the phase**	**Content**	**Participants; registered nurses (RNs) and practical nurses (PNs)** **n / %**	**Guided by**
Jan-Feb / 2016 **Phase I: Development needs for current practice** To assess whether the current practice is in line with the international PU prevention guidelines.	Baseline measuring PU prevention practice (PUPreP instrument)	RNs and PNs (n=69 / 90.8 %)	One researcher
	The orientation meeting Nursing staff were informed of the purpose and phases of the research, and the roles of different actors A presentation of evidence-based practice A presentation of The Operational Model for Evidence-Based Practices (OMEBP)	Head nurses, RNs and PNs (n= 33)	Three researchers and two authorized wound care nurses
	The 1st development meeting The results of the measured current practices A presentation of international guidelines regarding prevention of PUs (NPUAP, EPUAP, PPPIA 2014) Current practices were compared with international guidelines (NPUAP, EPUAP, PPPIA 2014)	Head nurses RNs and PNs (n= 29)	Three researchers and two authorized wound care nurses
	Development needs of current PU prevention practice were identified		
Feb / 2016 **Phase II: Plan for consistent practice** To plan consistent practice by making changes to the current PU prevention practice of the facility in line with the international guidelines.	The 2nd development meeting The planning of a renewed, context-suited, consistent PU prevention practice started in the six content areas of the international PU prevention guidelines which had been chosen: risk assessment, skin	Head nurses (n=4) and wound contact persons (n= 9) from each unit	Three researchers and two authorized wound care nurses

	assessment, nutrition, repositioning, pressure relieving devices and documentation.		
	Intermediate task for the head nurses and wound contact persons	Head nurses (n=4) and wound contact persons (n=10) from each unit	
	The 3rd development meeting: The renewed consistent PU prevention practice was completed: The Procedure for PU prevention in LOPC facility (Appendix 1) The Procedure regarding the consistent practice in the prevention of pressure ulcers: 1) how and when to act and 2) how and when to document. An agreement was also made on further work including yearly PU prevention education for nursing staff and agreement that the procedure will be part of the orientation program for new nursing staff.	Head nurses (n=3) and wound contact persons (n= 5) from each unit	Three researchers and one authorized wound care nurse
Mar-Dec/ 2016 **Phase III: Consistent practice** To describe, and then, implement the renewed consistent PU prevention practice	The Procedure for PU prevention in LOPC facility was described in: Unit meetings Personal e-mails Common webpages of the facility	RNs and PNs (n= 50) (n= 73) (n= 73)	Researcher and head nurses
	Start of the renewed consistent practice	(n= 73)	
	Supporting structure*:* Six 90-minute education sessions about Risk assessment (twice), Braden Skin assessment and skin care Nutrition, MNA Pressure relieving devices Secondary prevention of PUs, wound care	 (n=33) (n=26) (n=19) (n=13) (n=15)	Researcher and one to two authorized wound care nurses, dietician or persons with expertize in

	Material (Braden, PU classification system, MNA) Authorized wound care nurse consultations Researcher's consultations and visits		pressure relieving devices
Jan / 2017 **Phase IV: Evaluation and follow-up of the practice**			
To evaluate and follow up the renewed practice and to ensure that no variation in practice occurs	Measuring PU prevention practice (PUPreP instrument)	RNs and PNs (n= 61)	One researcher
	Observation of documentation in patient records by researcher (during phases III-IV). (These outcomes will be reported in another paper).		One researcher
	Also, evaluation was done by measuring the impact of the intervention on the nursing staff's PU prevention knowledge with a knowledge test and the effect on residents' PU prevalence, incidence and PU healing time (during phases I, III-IV). (These outcomes will be reported in another paper).		Researcher and one authorized wound care nurse
	Agreement for further work including yearly PU prevention education for nursing staff and agreement that The Procedure will be part of the orientation program for new nursing staff.		Researcher and head nurses

Abbreviations: PNs, practical nurses; RNs, registered nurses

Table 2. Education of participants at baseline and after intervention.

	Intervention baseline	Comparison baseline	p[a]	Intervention after	Comparison after	p[a]
Education, n (%)			0.090[a]			0.687[a]
RNs	6 (9.0)	13 (19.1)		11 (19.0)	8 (16.0)	
PNs	61(91.0)	55 (80.9)		47 (81.0)	42 (84.0)	
All	67 (100.0)	68 (100.0)		58 (100.0)	50 (100.0)	

[a] x2 test

Table 3. Characteristics of participants, baseline.

Characteristics	Intervention	Comparison	p-value
Education, n (%)			0.090[c]
All	67 (100.0)	68 (100.0)	
RNs	6 (9.0)	13 (19.1)	
PNs	61 (91.0)	55 (80.9)	
Work experience years, Mean (SD)			
Work experience in healthcare after completion of professional education	15.80 (10.35)	14.44 (9.58)	0.431[b]
Work experience in the current work unit	4.72 (4.95)	8.11 (7.15)	0.002[b]
Frequency of work with PU Prevention and identification, n (%)			0.210[a]
All	67 (100.0)	72 (100.0)	
Daily	61 (91.0)	57 (79.2)	
Weekly	0 (0.0)	3 (4.2)	
Monthly	3 (4.5)	4 (5.6)	
Rarely	3 (4.5)	7 (9.7)	
Frequency of treating PU patients, n (%)			0.340[c]
All	64 (100.0)	69 (100.0)	
Daily	15 (23.4)	19 (27.5)	
Weekly	6 (9.4)	10 (14.5)	
Monthly	11 (17.2)	16 (23.2)	
Rarely	32 (50.0)	24 (34.8)	
Access to information about PU (how many times during the last two years) Median [IQR]			
Participated in PU education	0.0 [1]	0.0 [0]	0.379[b]
Read research articles about PU prevention or PU care	1.0 [2]	2.0 [2]	0.373[b]
Read professional articles about PU prevention or PU care	2.0 [2]	1.5 [2]	0.786[b]
Read guidelines about PU prevention and early identification, n (%), valid			0.034[c]
All	62 (100.0)	69 (100.0)	
Yes	37 (59.7)	35 (50.7)	
No	25 (40.3)	34 (49.3)	

Abbreviations: SD, standard deviation; IQR, interquartile range.

[a]Fisher's Exact Test

[b]Mann Whitney Test

[c]x^2 test

Table 4. Frequency of PU prevention practices.

		Before (baseline)				After				Difference within groups[c]		Change between groups[d]
PU prevention Practice	**Group**	**N**	**Mean[a] (SD)**	**Effect size[b]**	**Difference between groups (p-value)**	**N**	**Mean[a] (SD)**	**Effect size[b]**	**Difference between groups (p-value)**	**Mean**	**p-value**	**(p-value)**
Risk assessment	Intervention	58	2.61 (0.72)	0.19	0.254	59	3.14 (0.56)	1.12	<0.001	0.53	<0.001	**0.005**
	Comparison	68	2.47 (0.65)			44	2.51 (0.64)			0.04	0.756	
Skin assessment and skin care	Intervention	61	3.42 (0.40)	0.14	0.380	59	3.55 (0.35)	0.46	0.024	0.13	0.058	0.279
	Comparison	69	3.36 (0.34)			48	3.39 (0.38)			0.03	0.680	
Nutrition	Intervention	59	2.40 (0.72)	0.34	0.032	56	2.91 (0.66)	0.92	<0.001	0.51	<0.001	**0.029**
	Comparison	69	2.15 (0.55)			46	2.31 (0.54)			0.16	0.148	
Repositioning	Intervention	64	3.46 (0.40)	0.17	0.282	59	3.57 (0.38)	0.24	0.187	0.11	0.130	0.784
	Comparison	68	3.40 (0.31)			50	3.48 (0.35)			0.08	0.183	
Pressure relieving devices	Intervention	61	3.32 (0.38)	0.61	<0.001	57	3.46 (0.34)	0.56	0.004	0.14	0.044	0.667
	Comparison	67	3.10 (0.29)			49	3.27 (0.32)			0.17	0.003	
Documentation	Intervention	61	2.85 (0.51)	0.12	0.463	58	3.13 (0.52)	0.46	0.015	0.28	0.003	0.171
	Comparison	70	2.78 (0.48)			49	2.89 (0.49)			0.11	0.232	

Abbreviation: SD, standard deviation

[a]1 never, 2 sometimes, 3 often, 4 always

[b]Effect size was calculated using Cohen's d as mean difference between intervention and comparison groups by divided a pooled standard deviation.

[c]Independent Sample Test, In the study the pre and post data were independent because to achieve identity protection identification numbers were not used.

[d]two-way ANOVA

Table 5. Agreement on consistent practice in PU prevention.

PU prevention Practice	Group	Before (baseline) N	Median[a] [IQR]	Difference between groups (p-value)	Effect size[b]	After N	Median[a] [IQR]	Difference between groups (p-value)	Effect size[b]	Difference within groups[d] Median difference	P-value	Change between groups[c] (P-value)
Risk assessment	Intervention	42	1.32 [1.00]	0.060	0.61	44	2.00 [0.43]	<0.001	0.85	0.68	0.008	**0.002**
	Comparison	48	1.18 [0.70]			31	1.00 [0.40]			-0.18	0.101	
Skin assessment and skin care	Intervention	37	1.71 [0.75]	0.194	0.58	45	2.00 [0.27]	<0.001	0.76	0.29	<0.001	**0.007**
	Comparison	50	1.50 [0.60]			32	1.33 [0.88]			-0.17	0.610	
Nutrition	Intervention	35	1.50 [1.00]	0.188	0.58	36	1.86 [0.43]	<0.001	0.79	0.36	0.014	**0.011**
	Comparison	48	1.29 [0.71]			30	1.14 [0.60]			-0.14	0.272	
Repositioning	Intervention	43	2.00 [0.27]	0.205	0.57	44	2.00 [0.00]	<0.001	0.75	0.00	0.006	**0.009**
	Comparison	51	1.92 [0.54]			33	1.69 [1.00]			-0.23	0.216	
Pressure relieving devices	Intervention	33	1.38 [0.78]	0.514	0.54	32	1.88 [0.72]	<0.001	0.76	1.50	0.019	**0.014**
	Comparison	47	1.25 [0.75]			28	1.13 [0.50]			-0.13	0.250	
Documentation	Intervention	39	1.67 [0.75]	0.847	0.51	36	2.00 [0.50]	<0.001	0.78	0.33	0.044	**<0.001**
	Comparison	49	1.50 [0.50]			30	1.38 [0.75]			-0.13	0.015	

Abbreviation: IQR, interquartile range

[a]1=no, 2= yes

[b]Effect size was calculated using common language effect size $f = U_1/n_1n_2$

[c]Inverse normal scores transformation (Blom's method).

[d]Mann-Whitney Test. In the study the pre and post data were independent because to achieve identity protection, identification numbers were not used.

Figure Legends

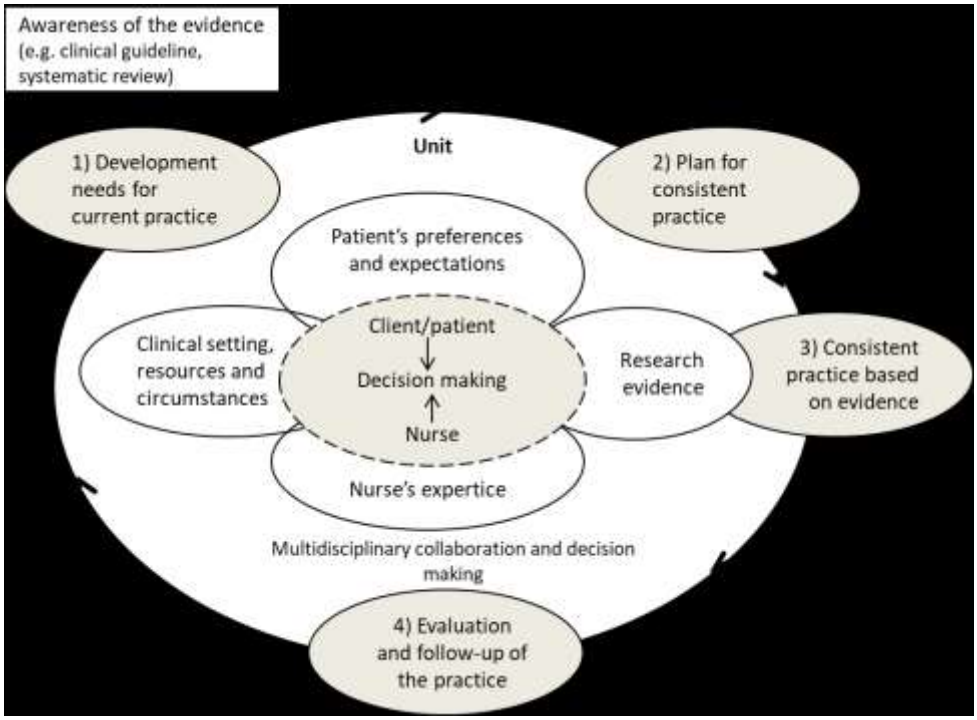

Figure 1. The operational model for evidence-based practices, OMEBP

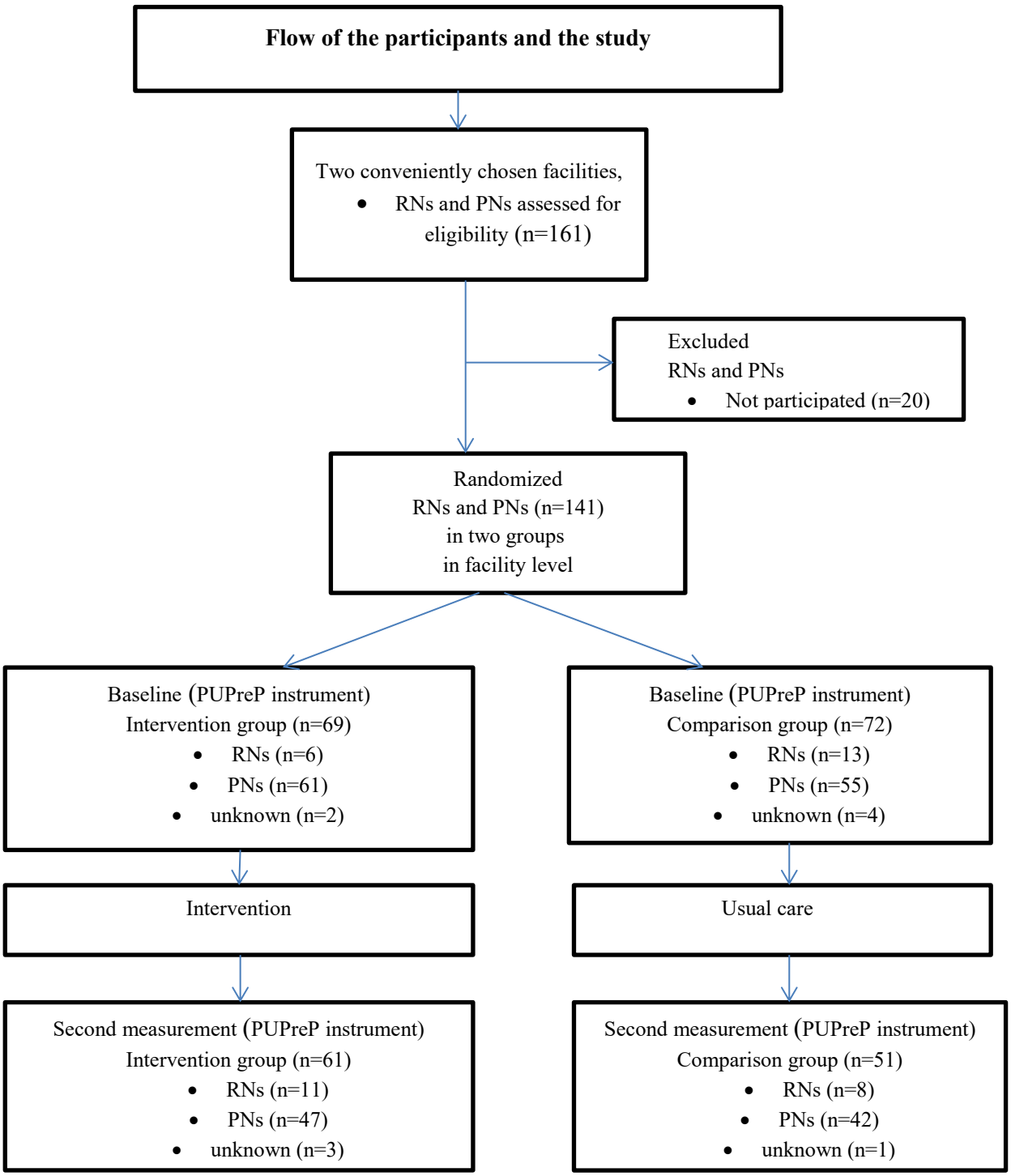

Figure 2. Flow of the participants and the study.

Appendices

Appendix 1. The procedure for PU prevention in long-term older people care facility.

Appendix 1. The Procedure for PU prevention in LOPC facility

Procedure for Pressure Ulcer Prevention in LOPC Facility

Risk Assessment

The nurse on duty assess verbally the resident's pressure ulcer risk within two days of admission in the unit.
The primary nurse makes a risk assessment using the Braden Scale in conjunction with drawing up a service plan within a month of admission in the unit.
The risk assessment is renewed in an interim assessment every six months, or when there are changes in the resident's health condition.
The risk assessment is conducted using the Braden Scale 6–23.
A resident with a pressure ulcer is always at high risk.

Documentation
The verbal assessment is documented in patient record under the heading "Tissue integrity".
The risk assessment Braden score is documented on the HOIpis tab.
On the HOIpis tab, the Braden score is entered in numbers, and in "additional information", the risk level is assessed verbally: very high risk, high risk, moderate risk, low risk.
In case of a resident with a pressure ulcer, the assessment "very high risk" is always entered in the "additional information" section, followed by "pressure ulcer" in brackets.

Skin Assessment and Skin Care

Skin Assessment
The condition of the resident's skin and tissue is assessed and documented in conjunction with the first shower after admission in the unit.
Following the initial assessment, the condition of the skin and tissue is assessed and documented at least once a week in conjunction with showers, with any findings documented.
If there are large amounts of excretions on the resident's skin, the condition of the skin is assessed during every diaper change and documented daily.
Skin assessment findings includes the following: warmth of the skin, blanchable redness of the skin, non-blanchable redness of the skin (pressure ulcer already present), tissue oedema, tissue hardening, broken skin.

Skin Care
Cream is always applied to the skin in conjunction with showers and otherwise when needed.
Diapers are changed according to individual needs.
The wash cream's instructions for use are checked to determine whether it should be rinsed off with water or not. When putting on diapers, the skin should not be left too wet in order to avoid maceration.
The skin must never be rubbed or massaged.
Medical equipment (e.g. catheters) must never press on the skin. It is also important to take the material and size of clothing into consideration.
Documentation
The condition and care of the skin are documented in patient record under the heading "Tissue integrity".

Nutrition

The MNA test is conducted and documented in the resident's documentation within three months of admission in the unit.
After the initial assessment, the MNA test is conducted and documented when necessary, e.g. when is the event of weight loss.
The resident is weighed once per month.
Upon resident's admission in the unit, the food portion sizes are assessed, making changes when necessary, taking into consideration the condition of the resident's mouth and possible difficulty swallowing. If necessary, meals or parts of meals may be ordered in puréed form.
If problems arise, a nutritional therapist is consulted.
The need for extra energy or protein is assessed based on weight, appetite, pressure ulcer risk, condition of the skin, and possible wounds.
Primary sources of extra energy are oil, butter, and cream.
If problems arise, the situation is discussed in a multiprofessional team (nurse, next of kin, physician, nutritional therapist), also considering the option to use nutritional supplements, e.g. Nutridrink, Cubitan.
Adequate fluid intake is ensured at every meal. The resident is assisted in drinking, and the intake of fluids is monitored using a fluid list, if necessary.

Documentation
The MNA test score is documented on the HOIpis tab.
Weight is documented on the RR tab.
Observations related to nutrition are documented in patient record under the heading "Nutrition".

Repositioning

Bed-bound resident
During the daytime, repositioning is implemented in conjunction with mealtimes.
Pressure-relieving positions/repositioning methods are used.
The 30-degree tilt, with the resident on side-lying position, is favoured.
Particular attention is paid to keeping heels elevated off the surface.
If the resident moves his/her legs, friction-reducing wound care products may be helpful.
Direct contact of bony prominences with one another (e.g. knees together) is prevented
Monitoring of sleep and wakefulness (Vivago monitoring) is used as a supplementary tool to determine a suitable time for changing the resident's position during the night time.
During the night time, duration of repositioning is assessed on an individual basis based on pressure ulcer risk, need for sleep, and the surface used. The resident's sleep should also be ensured.
The resident's position is changed in pairs in order to prevent pressure and share of his/her skin and tissue.

Seated resident
The resident's autonomy and movement is supported in all daily activities.
The resident's ability to change position is monitored. If he/she cannot do it independently, he/she is assisted in changing position. The resident is seated for a maximum of 3 hours.
The resident's seating position is fixed if he/she has slid down in the chair.

Documentation
Repositioning is documented in patient record under the heading "Daily activities".

Pressure-Relieving Devices

Pressure-Relieving Devices

The nurse, physiotherapist and representative of the assistive device loan centre make a common decision regarding the resident's mattress based on risk assessment.
The nurse makes a decision regarding the resident's seat cushions and heel protectors and makes sure they are ordered.
The nurse monitors possible complications arising from mattress (e.g. occurence of pressure ulcer).
The resident's repositioning is continued regardless of the use of a pressure-distributing mattress (including "motorised" mattress).
Unnecessary layers of bed linen are avoided in order to ensure that the mattress works.
Transfer sheets must not be left under the resident.
The minimum height for the surface of the mattress and the upper edge of the bed railing is 22 cm.

Documentation

The need for assistive devices is documented in patient record under the heading "Tissue integrity".
Assistive device orders are documented under the heading "Planning of care and further care".
Assistive devices received by the resident are documented under the heading "Tissue integrity".
Complications arising from mattresses are documented under the heading "Tissue integrity".

Other Procedures

The "Prevention and early detection of pressure ulcers" theme is part of the acquaintance programme.
The staff is provided with training on the prevention and early detection of pressure ulcers at least once per year.
The Braden and MNA scales are found in electronic form on the website of the facility.